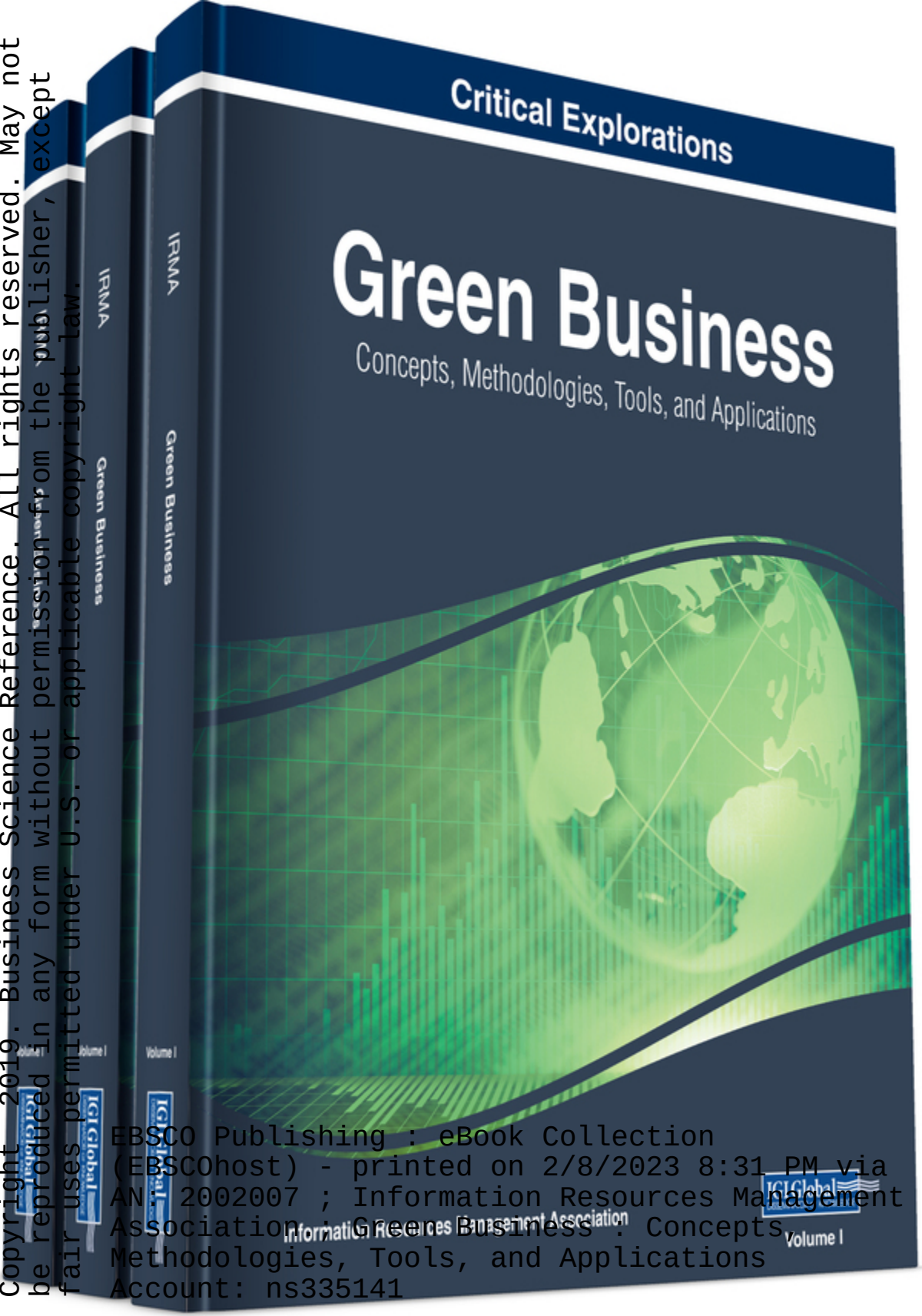


Copyright, 2019. Business Science Reference. All rights reserved. May not be reproduced in any form without permission from the publisher, except fair uses permitted under U.S. or applicable copyright law.

EBSCO Publishing : eBook Collection (EBSCOhost) - printed on 2/8/2023 8:31 PM via AN : 2002007 ; Information Resources Management Association : Green Business : Concepts, Methodologies, Tools, and Applications
Account: ns335141

Green Business:

Concepts, Methodologies, Tools, and Applications

Information Resources Management Association
USA

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Published in the United States of America by
IGI Global
Business Science Reference (an imprint of IGI Global)
701 E. Chocolate Avenue
Hershey PA, USA 17033
Tel: 717-533-8845
Fax: 717-533-8661
E-mail: cust@igi-global.com
Web site: http://www.igi-global.com

Copyright © 2019 by IGI Global. All rights reserved. No part of this publication may be reproduced, stored or distributed in any form or by any means, electronic or mechanical, including photocopying, without written permission from the publisher. Product or company names used in this set are for identification purposes only. Inclusion of the names of the products or companies does not indicate a claim of ownership by IGI Global of the trademark or registered trademark.

Library of Congress Cataloging-in-Publication Data

Names: Information Resources Management Association, editor.
Title: Green business : concepts, methodologies, tools, and applications / Information Resources Management Association, editor.
Description: Hershey, PA : Business Science Reference, [2019]
Identifiers: LCCN 2018038764| ISBN 9781522579151 (hardcover) | ISBN 9781522579168 (ebook)
Subjects: LCSH: Business enterprises--Environmental aspects. | Management--Environmental aspects. | Green products. | Green technology.
Classification: LCC HD30.255 .G7344 2019 | DDC 658.4/08--dc23 LC record available at https://lccn.loc.gov/2018038764

British Cataloguing in Publication Data
A Cataloguing in Publication record for this book is available from the British Library.

The views expressed in this book are those of the authors, but not necessarily of the publisher.

For electronic access to this publication, please contact: eresources@igi-global.com.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Editor-in-Chief

Mehdi Khosrow-Pour, DBA
Information Resources Management Association, USA

Associate Editors

Steve Clarke, *University of Hull, UK*
Murray E. Jennex, *San Diego State University, USA*
Annie Becker, *Florida Institute of Technology, USA*
Ari-Veikko Anttiroiko, *University of Tampere, Finland*

Editorial Advisory Board

Sherif Kamel, *American University in Cairo, Egypt*
In Lee, *Western Illinois University, USA*
Jerzy Kisielnicki, *Warsaw University, Poland*
Amar Gupta, *Arizona University, USA*
Craig van Slyke, *University of Central Florida, USA*
John Wang, *Montclair State University, USA*
Vishanth Weerakkody, *Brunel University, UK*

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

List of Contributors

Abbas, Sheik Adullah / *Thiagarajar College of Engineering, India* 395
Acharya, Anitha / *ICFAI Foundation for Higher Education (IFHE), India* 950
Adhikari, Arnab / *Indian Institute of Management Calcutta, India* 1489
Agarwal, Srishti / *IIS University, India* 512
Ahmad, Fauziah Sh. / *University Technology of Malaysia, Malaysia* 1510
Ahuja, Sanjay P. / *University of North Florida, USA* 1360
Aiello, Lucia / *Sapienza University of Rome, Italy* 310
Akop, Mohd Zaid / *Universiti Teknikal Malaysia Melaka, Malaysia* 643
Alnassar, Fatma M. / *Arabian Gulf University, Bahrain* 1091, 1233
Alsultanny, Yas A. / *Arabian Gulf University, Bahrain* 1091, 1233
Anand, Neeraj / *University of Petroleum and Energy Studies, India* 125, 884
Aryanto, Vincent Didiek Wiet / *Dian Nuswantoro University, Indonesia* 731
Atiku, Sulaiman Olusegun / *University of KwaZulu-Natal, South Africa* 415
Atkinson, Colin / *University of Mannheim, Germany* 683
Avittathur, Balram / *Indian Institute of Management Calcutta, India* 1489
Bag, Surajit / *Tega Industries South Africa Pty Ltd, South Africa* 125, 346, 530, 884, 1464
Balasubramanian, Sreejith / *University of Wollongong – Dubai, UAE* 1306
Bhadra, Somasree / *University of Calcutta, India* 707
Biswas, Indranil / *Indian Institute of Management Lucknow, India* 1489
Blanco-Fernandez, Julio / *Universidad de la Rioja, Spain* 859
Bozaykut-Buk, Tuba / *Istanbul Medipol University, Turkey* 1328
Cebeci, Halil İbrahim / *Sakarya University, Turkey* 1545
Chakraborty, Kamalika / *Indian Institute of Management Calcutta, India* 964
Chandan, Harish C. / *Argosy University, USA* 274
Chang, Vanessa / *Curtin University, Australia* 1591
Chaturvedi, Prachi / *Madhav Institute of Technology and Science, India* 664
Chaudhury, Saswata / *The Energy and Resources Institute (TERI), India* 328
Chawla, Deepak / *International Management Institute, India* 1048
Chekima, Brahim / *Universiti Malaysia Sabah, Malaysia* 206
Chen, Rui-Yang / *Aletheia University, Taiwan* 602
Chinnaiah, Priyanka / *Thiagarajar College of Engineering, India* 395
Chu, Kuo Ming / *Cheng Shiu University, Taiwan* 291
Dahiya, Richa / *SRM University-Delhi NCR, India* 1032
Di Carlo, Emiliano / *University of Rome "Tor Vergata", Italy* 925
Dinçer, Hasan / *İstanbul Medipol University, Turkey* 1328

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Dominic, P.D.D. / *Universiti Teknologi PETRONAS, Malaysia* 752
Dueñas, María del Pilar Muñoz / *University of Vigo, Spain* 310
El Barky, Sahar Sobhy / *Arab Academy for Science, Technology, and Maritime Transport, Egypt* 1244
Ellis, Debbie / *University of KwaZulu-Natal, South Africa* 17
Ene, Corina / *Petroleum and Gas University of Ploiesti, Romania* 1630
Ersoy, Pervin / *Yaşar University, Turkey* 1420
Esakki, Thangasamy / *Poompuhar College (Autonomous), India* 192
Esen, Selin Kucukkancabas / *Trakya University, Turkey* 1244
Esfahani, Mohammad Dalvi / *Universiti Teknologi Malaysia, Malaysia* 1386
Fernando, Yudi / *Universiti Sains Malaysia, Malaysia* 379
Fields, Ziska / *University of KwaZulu-Natal, South Africa* 415
Florea, Nicoleta Valentina / *Valahia University of Targoviste, Romania* 463
Fong, Jose Roberto Mendoza / *Universidad Autónoma de Ciudad Juárez, Mexico* 1216
Gan, P. L. / *Universiti Sains Malaysia, Malaysia* 255
Gao, Yang / *Dalian University of Technology, China* 1136
García-Alcaraz, Jorge Luis / *Universidad Autónoma de Ciudad Juárez, Mexico* 1216
Ghapanchi, Amir Hossein / *Griffith University, Australia* 1386
Gheorghe, Ileana Georgiana / *Petroleum-Gas University of Ploiesti, Romania* 153, 1161, 1195, 1660
Ghodeswar, Bhimrao / *National Institute of Industrial Engineering (NITIE), India* 1611
Goswami, Anandajit / *The Energy and Resources Institute (TERI), India* 328
Gotham, Kevin Fox / *Tulane University, USA* 1572
Gulseven, Osman / *American University of the Middle East, Kuwait* 35
Güner, Samet / *Sakarya University, Turkey* 1545
Gupta, Manish / *ICFAI Foundation for Higher Education (IFHE), India* 950
Hernandez, Alexander A. / *De La Salle University, Philippines & Technological Institute of the Philippines, Philippines* 88, 1285
Honnutagi, Abdul Razak / *Indian Institute of Technology Bombay, India* 365
Huang, Leelien Ken / *Feng Chia University, Taiwan* 232
Idemudia, Efosa Carroll / *Arkansas Tech University, USA* 565
Iqbal, Mehree / *North South University, Bangladesh* 49, 1071
Issa, Theodora / *Curtin University, Australia* 1591
Issa, Tomayess / *Curtin University, Australia* 1591
Ivanovic, Olja Munitlak / *Institute of Economic Sciences, Serbia* 1
Jimenez-Macias, Emilio / *Universidad de la Rioja, Spain* 859
Joshi, Gauri / *Symbiosis Centre for Management and Human Resource Development (SCMHRD), India* 1370
Kasliwal, Neeti / *Banasthali University, India* 512
Khan, Mohammed Shahid Ahamed / *CSH Co. LTD., Saudi Arabia* 365
Khan, Sania / *GITAM University, India* 365
Khatua, Sunirmal / *University of Calcutta, India* 707
Kılıç, Serkan / *Uludağ University, Turkey* 1444
Kirezli, Özge / *Istanbul Bilgi University, Turkey* 797
Kittilaksanawong, Wiboon / *Saitama University, Japan* 1009
Kohda, Youji / *Japan Advanced Institute of Science and Technology, Japan* 1272

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Kortelainen, Samuli / *Lappeenranta University of Technology, Finland* 907
Krischke, André / *Munich University of Applied Sciences, Germany* 580
Kuitunen, Aino / *Lappeenranta University of Technology, Finland* 907
Kumar, Prashant / *National Institute of Industrial Engineering (NITIE), India* 1611
Kundu, Anirban / *Netaji Subhash Engineering College, India* 707
Kushwaha, Gyaneshwar Singh / *Maulana Azad National Institute of Technology, India* 821
Lättilä, Lauri / *SimAnalytics, Finland* 907
Lee, Larry Jung-Hsing / *National Central University, Taiwan* 580
Leu, Jun-Der / *National Central University, Taiwan & Munich University of Applied Sciences, Germany* 580
Lewis, Joshua A. / *Tulane University, USA* 1572
Li, Guodong / *Civil Aviation University of China, China* 1136
Loya, Valeria Martínez / *Universidad Autónoma de Ciudad Juárez, Mexico* 1216
Lumbanbatu, Kardison / *University of Diponegoro, Indonesia* 731
Luthra, Sunil / *Government Engineering College, India* 884
Mahmud, Imran / *Daffodil International University, Bangladesh* 255
Maldonado, Aidé Aracely / *Universidad Autónoma de Ciudad Juárez, Mexico* 1216
Mansor, Muhd Ridzuan / *Universiti Teknikal Malaysia Melaka, Malaysia* 643
McGroarty, Frank / *University of Southampton, UK* 440
Migdadi, Yazan / *Yarmouk University, Jordan* 1020
Mkhize, Njabulo / *University of kwaZulu-Natal, South Africa* 17
Mostert, Jacques / *American University of the Middle East, Kuwait* 35
Musthafah, M. T. / *Universiti Teknikal Malaysia Melaka, Malaysia* 643
Muthiah, Karthika / *University of North Florida, USA* 1360
Nilashi, Mehrbakhsh / *Universiti Teknologi Malaysia, Malaysia* 1386
Nisha, Nabila / *North South University, Bangladesh* 49, 781, 1071
Nulkar, Gurudas / *HRD, India* 989, 1370
Obayelu, Abiodun Elijah / *Federal University of Agriculture, Abeokuta, Nigeria* 1523
Odia, James / *University of Benin, Nigeria* 1105
Ona, Sherwin E. / *De La Salle University, Philippines* 88
Özdemir, Erkan / *Uludag University, Turkey* 1444
Panait, Mirela / *Petroleum and Gas University of Ploiesti, Romania* 1630
Panda, Pradiptarathi / *National Institute of Securities Markets, India* 49
Pandey, Krishan Kumar / *O.P. Jindal Global University, India* 125
Pandey, Shweta / *International Management Institute, India* 1048
Radu, Laura-Diana / *Alexandru Ioan Cuza University of Iasi, Romania* 624
Rahman, Azizah Abdul / *Universiti Teknologi Malaysia, Malaysia* 1386
Raisinghani, Mahesh S. / *TWU School of Management, USA* 565
Ramayah, T. / *Universiti Sains Malaysia, Malaysia* 255, 752
Ramchurjee, Esther P. / *Independent Researcher, India* 838
Ramchurjee, Nichola A. / *University of Mysore, India* 838
Ramírez, Cuauhtémoc Sánchez / *Instituto Tecnológico de Orizaba, Mexico* 1216
Ravi, Parkavi / *Thiagarajar College of Engineering, India* 395
Raza, Syed Ali / *IQRA University, Pakistan* 1071
Richardson, Michael D. / *Columbus State University, USA* 71
Rifat, Afrin / *North South University, Bangladesh* 49

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Rosli, Trianna / *University Technology of Malaysia, Malaysia* 1510
Saha, Raiswa / *SRM University-Delhi NCR, India* 1032
Salim, Mohd Azli / *Universiti Teknikal Malaysia Melaka, Malaysia* 643
Sapuan, S. M. / *University Putra Malaysia, Malaysia* 643
Savita, K.S. / *Universiti Teknologi PETRONAS, Malaysia* 752
Schulze, Thomas / *University of Mannheim, Germany* 683
Sertyesilisik, Begum / *Istanbul Technical University, Turkey* 490
Shaharudin, Muhammad Shabir / *Universiti Sains Malaysia, Malaysia* 379
Shaharuzaman, M. A. / *Universiti Teknikal Malaysia Melaka, Malaysia* 643
Sharma, Nagendra Kumar / *Maulana Azad National Institute of Technology, India* 821
Shook, Maggie / *Thomaston-Upson Schools, USA* 71
Shukla, Ajit Kumar / *Mahatma Gandhi Kashi Vidyapith, India* 181
Sima, Violeta / *Petroleum-Gas University of Ploiesti, Romania* 153, 1161, 1195, 1660
Sinthupundaja, Janthorn / *Japan Advanced Institute of Science and Technology, Japan* 1272
Sundarakani, Balan / *University of Wollongong – Dubai, UAE* 1306
Tolani, Girish / *Curtin University, Australia* 1591
Tsai, Sang-Bing / *Foshan University, China & Dalian University of Technology, China* 1136
Tullani, Harsh / *SRM University-Delhi NCR, India* 1032
Tura, Nina / *Lappeenranta University of Technology, Finland* 907
Venkatesh, V. G. / *University of Waikato, New Zealand* 884
Verma, Nishant K. / *Indian Institute of Management Bangalore, India* 964
Villanueva, Rodrigo / *Universidad Autonoma de Ciudad Juarez, Mexico* 859
Voica, Marian Cătălin / *Petroleum and Gas University of Ploiesti, Romania* 1630
Xin, Wah Wen / *Universiti Sains Malaysia, Malaysia* 379
Yiğit, Melis Kaytaz / *University of Marmara, Turkey* 797
Yuksel, Serhat / *Istanbul Medipol University, Turkey* 1328
Zakaria, Nor Hidayati / *Universiti Teknologi Malaysia, Malaysia* 1386
Zhang, Shuo / *Dalian University of Technology, China* 1136
Ziouvelou, Xenia / *University of Southampton, UK* 440
Zuhora, Fatema Tuz / *Daffodil International University, Bangladesh* 255

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table of Contents

Preface xix

Volume I

Section 1
Fundamental Concepts and Theories

Chapter 1
Ecological Responsibility and Sustainable Development as Preconditions for Development of the Concept of Circular Economy 1
Olja Munitlak Ivanovic, Institute of Economic Sciences, Serbia

Chapter 2
Consumer Cooperation in Sustainability: The Green Gap in an Emerging Market 17
Njabulo Mkhize, University of kwaZulu-Natal, South Africa
Debbie Ellis, University of KwaZulu-Natal, South Africa

Chapter 3
Application of Circular Economy for Sustainable Resource Management in Kuwait 35
Osman Gulseven, American University of the Middle East, Kuwait
Jacques Mostert, American University of the Middle East, Kuwait

Chapter 4
Exploring Client Perceptions and Intentions in Emerging Economies: The Case of Green Banking Technology 49
Mehree Iqbal, North South University, Bangladesh
Nabila Nisha, North South University, Bangladesh
Afrin Rifat, North South University, Bangladesh
Pradiptarathi Panda, National Institute of Securities Markets, India

Chapter 5
The Green School: A Superintendent's Perspective 71
Maggie Shook, Thomaston-Upson Schools, USA
Michael D. Richardson, Columbus State University, USA

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 6
Green IT Adoption: Lessons From the Philippines Business Process Outsourcing Industry 88
Alexander A. Hernandez, De La Salle University, Philippines & Technological Institute of the Philippines, Philippines
Sherwin E. Ona, De La Salle University, Philippines

Chapter 7
Green Supply Chain Management Model for Sustainable Manufacturing Practices 125
Surajit Bag, Tega Industries South Africa Pty Ltd, South Africa
Neeraj Anand, University of Petroleum and Energy Studies, India
Krishan Kumar Pandey, O.P. Jindal Global University, India

Chapter 8
Green Customer Satisfaction 153
Violeta Sima, Petroleum-Gas University of Ploiesti, Romania
Ileana Georgiana Gheorghe, Petroleum-Gas University of Ploiesti, Romania

Chapter 9
Green Marketing in India: A Theoretical Perspective 181
Ajit Kumar Shukla, Mahatma Gandhi Kashi Vidyapith, India

Chapter 10
Eco-Friendly Culpabilities of Modern Corporates on Ecological Marketing: An Overview 192
Thangasamy Esakki, Poompuhar College (Autonomous), India

Section 2
Development and Design Methodologies

Chapter 11
Consumer Values and Green Products Consumption in Malaysia: A Structural Equation Modelling Approach 206
Brahim Chekima, Universiti Malaysia Sabah, Malaysia

Chapter 12
Constructing Green IT Alignment Framework: Car Manufacturer Case 232
Leelien Ken Huang, Feng Chia University, Taiwan

Chapter 13
Understanding Attitude Towards Green IT Among Professionals in IT Service SMEs in Bangladesh 255
P. L. Gan, Universiti Sains Malaysia, Malaysia
Imran Mahmud, Daffodil International University, Bangladesh
T. Ramayah, Universiti Sains Malaysia, Malaysia
Fatema Tuz Zuhora, Daffodil International University, Bangladesh

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 14
Implementation of Green Supply Chain Management in a Globalized Economy 274
Harish C. Chandan, Argosy University, USA

Chapter 15
The Role of a Strategic and Sustainable Orientation in Green Supply Chain Management 291
Kuo Ming Chu, Cheng Shiu University, Taiwan

Chapter 16
CSR in Cultural Organizations: A Valorization Model 310
Lucia Aiello, Sapienza University of Rome, Italy
María del Pilar Muñoz Dueñas, University of Vigo, Spain

Chapter 17
Green Growth Intervention on Employment Generation in India: Dynamic CGE Model Approach 328
Anandajit Goswami, The Energy and Resources Institute (TERI), India
Saswata Chaudhury, The Energy and Resources Institute (TERI), India

Chapter 18
Contextual Relationship Among 3 C's and Innovative Green Procurement Practices Using ISM and Its Validation Using MICMAC Analysis 346
Surajit Bag, Tega Industries South Africy Pty. Ltd., South Africa

Chapter 19
Development of a Research Framework for Green IT Enablers Using Interpretive Structural Modelling 365
Sania Khan, GITAM University, India
Abdul Razak Honnutagi, Indian Institute of Technology Bombay, India
Mohammed Shahid Ahamed Khan, CSH Co. LTD., Saudi Arabia

Chapter 20
Eco-Innovation Enablers and Typology in Green Furniture Manufacturing 379
Yudi Fernando, Universiti Sains Malaysia, Malaysia
Muhammad Shabir Shaharudin, Universiti Sains Malaysia, Malaysia
Wah Wen Xin, Universiti Sains Malaysia, Malaysia

Chapter 21
Cloud Computing Technologies for Green Enterprises: Fundamentals of Cloud Computing for Green Enterprises 395
Parkavi Ravi, Thiagarajar College of Engineering, India
Priyanka Chinnaiah, Thiagarajar College of Engineering, India
Sheik Adullah Abbas, Thiagarajar College of Engineering, India

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 22
Collective Green Creativity and Eco-Innovation as Key Drivers of Sustainable Business Solutions in Organizations 415
Ziska Fields, University of KwaZulu-Natal, South Africa
Sulaiman Olusegun Atiku, University of KwaZulu-Natal, South Africa

Chapter 23
A Business Model Framework for Crowd-Driven IoT Ecosystems 440
Xenia Ziouvelou, University of Southampton, UK
Frank McGroarty, University of Southampton, UK

Section 3
Tools and Technologies

Chapter 24
Green Attitudes and Thinking in The New Green Market: Using Mathematical Modeling to Satisfy Green Customers' Needs 463
Nicoleta Valentina Florea, Valahia University of Targoviste, Romania

Chapter 25
Green Marketing as a Tool for Reducing Environmental Footprint of the Construction Industry 490
Begum Sertyesilisik, Istanbul Technical University, Turkey

Chapter 26
Green Marketing Initiatives and Sustainable Issues in Hotel Industry 512
Neeti Kasliwal, Banasthali University, India
Srishti Agarwal, IIS University, India

Chapter 27
Building Theory of Green Procurement Using Fuzzy TISM and Fuzzy DEMATEL Methods 530
Surajit Bag, Tega Industries South Africa Pty. Ltd., South Africa

Volume II

Chapter 28
Green Information Systems for Sustainability 565
Mahesh S. Raisinghani, TWU School of Management, USA
Efosa Carroll Idemudia, Arkansas Tech University, USA

Chapter 29
Value Engineering-Based Method for Implementing the ISO14001 System in the Green Supply Chains 580
Jun-Der Leu, National Central University, Taiwan & Munich University of Applied Sciences, Germany
Larry Jung-Hsing Lee, National Central University, Taiwan
André Krischke, Munich University of Applied Sciences, Germany

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 30
Intelligent IoT-Enabled System in Green Supply Chain Using Integrated FCM Method 602
Rui-Yang Chen, Aletheia University, Taiwan

Chapter 31
Green Information System for a Sustainable Enterprise..... 624
Laura-Diana Radu, Alexandru Ioan Cuza University of Iasi, Romania

Chapter 32
Concurrent Design of Green Composites 643
Muhd Ridzuan Mansor, Universiti Teknikal Malaysia Melaka, Malaysia
S. M. Sapuan, University Putra Malaysia, Malaysia
Mohd Azli Salim, Universiti Teknikal Malaysia Melaka, Malaysia
Mohd Zaid Akop, Universiti Teknikal Malaysia Melaka, Malaysia
M. T. Musthafah, Universiti Teknikal Malaysia Melaka, Malaysia
M. A. Shaharuzaman, Universiti Teknikal Malaysia Melaka, Malaysia

Chapter 33
Cloud Computing Technology for Green Enterprises 664
Prachi Chaturvedi, Madhav Institute of Technology and Science, India

Chapter 34
Green Specifications: A Concrete Example..... 683
Thomas Schulze, University of Mannheim, Germany
Colin Atkinson, University of Mannheim, Germany

Chapter 35
Introducing Eco Friendly Urban Traffic Control Room: A Green Approach 707
Somasree Bhadra, University of Calcutta, India
Anirban Kundu, Netaji Subhash Engineering College, India
Sunirmal Khatua, University of Calcutta, India

Section 4
Utilization and Applications

Chapter 36
Green Practices Implementation as Prerequisite to Sustain Firm Competitive Advantages: The Empirical Study from Indonesia Large Scale Enterprises (LSEs)..... 731
Kardison Lumbanbatu, University of Diponegoro, Indonesia
Vincent Didiek Wiet Aryanto, Dian Nuswantoro University, Indonesia

Chapter 37
The Drivers, Practices and Outcomes of Green Supply Chain Management: Insights From ISO14001 Manufacturing Firms in Malaysia 752
K.S. Savita, Universiti Teknologi PETRONAS, Malaysia
P.D.D. Dominic, Universiti Teknologi PETRONAS, Malaysia
T. Ramayah, Universiti Sains Malaysia, Malaysia & Universiti Teknologi Malaysia, Malaysia

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 38
Green Investments and Returns: A Developing Country Perspective 781
Nabila Nisha, North South University, Bangladesh

Chapter 39
Why Do Companies Engage in Green Marketing? Alternative Green Marketing Strategies and the Motivations for the Green Marketing Approach 797
Özge Kirezli, Istanbul Bilgi University, Turkey
Melis Kaytaz Yiğit, University of Marmara, Turkey

Chapter 40
Educated Young Consumer Purchase Behavior Towards Green Products: An Empirical Study in India 821
Gyaneshwar Singh Kushwaha, Maulana Azad National Institute of Technology, India
Nagendra Kumar Sharma, Maulana Azad National Institute of Technology, India

Chapter 41
Tourists Becoming Increasingly Aware of Green Tourism: Tourist Intention to Choose Green Hotels in Bangalore, India 838
Nichola A. Ramchurjee, University of Mysore, India
Esther P. Ramchurjee, Independent Researcher, India

Chapter 42
Improving the Supply Chain (SC) Stream With Green Product Design (GPD) Strategy: Green Supply Chain Management (GSCM) 859
Rodrigo Villanueva, Universidad Autonoma de Ciudad Juarez, Mexico
Emilio Jimenez-Macias, Universidad de la Rioja, Spain
Julio Blanco-Fernandez, Universidad de la Rioja, Spain

Chapter 43
Ethical Practices, Buyer-Supplier Relationship, and Innovative Green Procurement Performance: Some Exploratory Results 884
Surajit Bag, Tega Industries South Africa Pty Ltd., South Africa
V. G. Venkatesh, University of Waikato, New Zealand
Sunil Luthra, Government Engineering College, India
Neeraj Anand, University of Petroleum and Energy Studies, India

Chapter 44
Increased Value Through Sharing in Multi-Sided Markets: Sustainability With Ridesharing 907
Nina Tura, Lappeenranta University of Technology, Finland
Aino Kuitunen, Lappeenranta University of Technology, Finland
Lauri Lättilä, SimAnalytics, Finland
Samuli Kortelainen, Lappeenranta University of Technology, Finland

Chapter 45
The Italian Doctrine *Economia Aziendale* and the Primary Interest of the Organizations 925
Emiliano Di Carlo, University of Rome "Tor Vergata", Italy

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 46
Green Brand Personality: Its Relevance to the Green Marketing Practices 950
Anitha Acharya, ICFAI Foundation for Higher Education (IFHE), India
Manish Gupta, ICFAI Foundation for Higher Education (IFHE), India

Chapter 47
A Temporal Case Study of Green Business Initiatives of a Leading Firm in the Indian Hydrocarbon Industry 964
Kamalika Chakraborty, Indian Institute of Management Calcutta, India
Nishant K. Verma, Indian Institute of Management Bangalore, India

Chapter 48
Environmental Sustainability Practices for SMEs 989
Gurudas Nulkar, HRD, India

Chapter 49
Institutional Perspective on the Drivers of Green Innovations in Firms 1009
Wiboon Kittilaksanawong, Saitama University, Japan

Chapter 50
The Leading Practices of Green Mobile Telecommunication Base Station Design 1020
Yazan Migdadi, Yarmouk University, Jordan

Section 5
Organizational and Social Implications

Chapter 51
Green Innovation and Ethical Responsibility: Do They Improve Customer's Green Purchase Intentions? 1032
Harsh Tullani, SRM University-Delhi NCR, India
Raiswa Saha, SRM University-Delhi NCR, India
Richa Dahiya, SRM University-Delhi NCR, India

Chapter 52
Driving Green Marketing in a Developing Country: Reducing the Attitude-Behaviour Gap 1048
Shweta Pandey, International Management Institute, India
Deepak Chawla, International Management Institute, India

Chapter 53
Customers' Perceptions of Green Banking: Examining Service Quality Dimensions in Bangladesh 1071
Mehree Iqbal, North South University, Bangladesh
Nabila Nisha, North South University, Bangladesh
Syed Ali Raza, IQRA University, Pakistan

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 54
Evaluating Factors Affect Green IT Readiness (Part 1) 1091
Yas A. Alsultanny, Arabian Gulf University, Bahrain
Fatma M. Alnassar, Arabian Gulf University, Bahrain

Chapter 55
Created Shared Value and Sustainable, Inclusive Development of Developing Countries 1105
James Odia, University of Benin, Nigeria

Volume III

Chapter 56
Green Entrepreneurship in Transitional Economies: Breaking Through the Constraints of Legitimacy 1136
Yang Gao, Dalian University of Technology, China
Sang-Bing Tsai, Foshan University, China & Dalian University of Technology, China
Shuo Zhang, Dalian University of Technology, China
Guodong Li, Civil Aviation University of China, China

Chapter 57
Customer Satisfaction in the Consumption of Green Products 1161
Violeta Sima, Petroleum-Gas University of Ploieşti, Romania
Ileana Georgiana Gheorghe, Petroleum-Gas University of Ploieşti, Romania

Chapter 58
Perception of Romanian Consumers on Ecological Products 1195
Violeta Sima, Petroleum-Gas University of Ploieşti, Romania
Ileana Georgiana Gheorghe, Petroleum-Gas University of Ploieşti, Romania

Chapter 59
The Impact of Green Attributes From Suppliers on Supply Chain Performance 1216
Jose Roberto Mendoza Fong, Universidad Autónoma de Ciudad Juárez, Mexico
Jorge Luis García-Alcaraz, Universidad Autónoma de Ciudad Juárez, Mexico
Aidé Aracely Maldonado, Universidad Autónoma de Ciudad Juárez, Mexico
Cuauhtémoc Sánchez Ramírez, Instituto Tecnológico de Orizaba, Mexico
Valeria Martínez Loya, Universidad Autónoma de Ciudad Juárez, Mexico

Chapter 60
Evaluating Factors Motivate Users on Green IT Readiness (Part 2) 1233
Yas A. Alsultanny, Arabian Gulf University, Bahrain
Fatma M. Alnassar, Arabian Gulf University, Bahrain

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 61
Drivers and Barriers to Green Supply Chain Management Practices: The Views of Turkish and Egyptian Companies Operating in Egypt 1244
Selin Kucukkancabas Esen, Trakya University, Turkey
Sahar Sobhy El Barky, Arab Academy for Science, Technology, and Maritime Transport, Egypt

Chapter 62
Effects of Corporate Social Responsibility and Creating Shared Value on Sustainability 1272
Janthorn Sinthupundaja, Japan Advanced Institute of Science and Technology, Japan
Youji Kohda, Japan Advanced Institute of Science and Technology, Japan

Chapter 63
Assessing the Maturity of Green IT Adoption Within the Philippine Manufacturing Industry 1285
Alexander A. Hernandez, Technological Institute of the Philippines Manila, Philippines

Chapter 64
Assessing the Green Supply Chain Management for the United Arab Emirates Construction Industry 1306
Sreejith Balasubramanian, University of Wollongong – Dubai, UAE
Balan Sundarakani, University of Wollongong – Dubai, UAE

Chapter 65
Evaluation of Financial and Economic Effects on Green Supply Chain Management With Multi-Criteria Decision-Making Approach: Evidence From Companies Listed in BIST 1328
Hasan Dinçer, İstanbul Medipol University, Turkey
Serhat Yuksel, Istanbul Medipol University, Turkey
Tuba Bozaykut-Buk, Istanbul Medipol University, Turkey

Chapter 66
Survey of State-of-Art in Green Cloud Computing 1360
Sanjay P. Ahuja, University of North Florida, USA
Karthika Muthiah, University of North Florida, USA

Chapter 67
Looking Good and Thinking Green: Can Green Personal Care Products Be Promoted?..... 1370
Gauri Joshi, Symbiosis Centre for Management and Human Resource Development (SCMHRD), India
Gurudas Nulkar, Symbiosis Centre for Management and Human Resource Development (SCMHRD), India

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Section 6
Managerial Impact

Chapter 68
Psychological Factors Influencing the Managers' Intention to Adopt Green IS: A Review-Based Comprehensive Framework and Ranking the Factors 1386
Mohammad Dalvi Esfahani, Universiti Teknologi Malaysia, Malaysia
Mehrbakhsh Nilashi, Universiti Teknologi Malaysia, Malaysia
Azizah Abdul Rahman, Universiti Teknologi Malaysia, Malaysia
Amir Hossein Ghapanchi, Griffith University, Australia
Nor Hidayati Zakaria, Universiti Teknologi Malaysia, Malaysia

Chapter 69
Meaning of Green for 3PL Companies 1420
Pervin Ersoy, Yaşar University, Turkey

Chapter 70
Green Marketing Strategies and Marketing Performance: The Case of Turkey 1444
Serkan Kılıç, Uludağ University, Turkey
Erkan Özdemir, Uludag University, Turkey

Chapter 71
Identification of Contextual Relationship Among Collaboration, Cooperation, Coordination, and Innovative Green Procurement Practices 1464
Surajit Bag, Tega Industries South Africa Pty Ltd, South Africa

Chapter 72
Green Retailing: A New Paradigm in Supply Chain Management 1489
Arnab Adhikari, Indian Institute of Management Calcutta, India
Indranil Biswas, Indian Institute of Management Lucknow, India
Balram Avittathur, Indian Institute of Management Calcutta, India

Section 7
Critical Issues and Challenges

Chapter 73
A Review on Green Trust and Environmental Quality Awareness Affect Towards Environmental Attitude 1510
Trianna Rosli, University Technology of Malaysia, Malaysia
Fauziah Sh. Ahmad, University Technology of Malaysia, Malaysia

Chapter 74
Sustainable Consumption and Green Marketing in Developing Countries: Contemporary Perspective Using Nigeria and Kenya as Case Studies 1523
Abiodun Elijah Obayelu, Federal University of Agriculture, Abeokuta, Nigeria

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 75
Multi-Criteria Decision Making Techniques for Green Supply Chain Management: A Literature Review 1545
Samet Güner, Sakarya University, Turkey
Halil İbrahim Cebeci, Sakarya University, Turkey

Chapter 76
Green Tourism and the Ambiguities of Sustainability Discourse: The Case of New Orleans's Lower Ninth Ward 1572
Kevin Fox Gotham, Tulane University, USA
Joshua A. Lewis, Tulane University, USA

Chapter 77
Awareness of Sustainability, Green IT, and Cloud Computing in Indian Organisations 1591
Tomayess Issa, Curtin University, Australia
Girish Tolani, Curtin University, Australia
Vanessa Chang, Curtin University, Australia
Theodora Issa, Curtin University, Australia

Section 8
Emerging Trends

Chapter 78
Green Marketing Mix: A Review of Literature and Direction for Future Research 1611
Prashant Kumar, National Institute of Industrial Engineering (NITIE), India
Bhimrao Ghodeswar, National Institute of Industrial Engineering (NITIE), India

Chapter 79
Green Investments and Food Security: Opportunities and Future Directions in the Context of Sustainable Development 1630
Corina Ene, Petroleum and Gas University of Ploiesti, Romania
Marian Cătălin Voica, Petroleum and Gas University of Ploiesti, Romania
Mirela Panait, Petroleum and Gas University of Ploiesti, Romania

Chapter 80
Green Performance Strategies in Romanian Economy in the View of EU 2020 Strategy 1660
Violeta Sima, Petroleum-Gas University of Ploiesti, Romania
Ileana Georgiana Gheorghe, Petroleum-Gas University of Ploiesti, Romania

Index xxii

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Preface

The constantly changing landscape of Green Business makes it challenging for experts and practitioners to stay informed of the field's most up-to-date research. That is why Business Science Reference is pleased to offer this three-volume reference collection that will empower students, researchers, and academicians with a strong understanding of critical issues within Green Business by providing both broad and detailed perspectives on cutting-edge theories and developments. This reference is designed to act as a single reference source on conceptual, methodological, technical, and managerial issues, as well as to provide insight into emerging trends and future opportunities within the discipline.

Green Business: Concepts, Methodologies, Tools, and Applications is organized into eight distinct sections that provide comprehensive coverage of important topics. The sections are:

1. Fundamental Concepts and Theories;
2. Development and Design Methodologies;
3. Tools and Technologies;
4. Utilization and Applications;
5. Organizational and Social Implications;
6. Managerial Impact;
7. Critical Issues and Challenges; and
8. Emerging Trends.

The following paragraphs provide a summary of what to expect from this invaluable reference tool.

Section 1, "Fundamental Concepts and Theories," serves as a foundation for this extensive reference tool by addressing crucial theories essential to the understanding of Green Business. Introducing the book is "Ecological Responsibility and Sustainable Development as Preconditions for Development of the Concept of Circular Economy" by Olja Munitlak Ivanovic: a great foundation laying the groundwork for the basic concepts and theories that will be discussed throughout the rest of the book. Section 1 concludes and leads into the following portion of the book with a nice segue chapter, "Eco-Friendly Culpabilities of Modern Corporates on Ecological Marketing: An Overview" by Thangasamy Esakki.

Section 2, "Development and Design Methodologies," presents in-depth coverage of the conceptual design and architecture of Green Business. Opening the section is "Consumer Values and Green Products Consumption in Malaysia: A Structural Equation Modelling Approach" by Brahim Chekima. Through case studies, this section lays excellent groundwork for later sections that will get into present and future applications for Green Business. The section concludes with an excellent work by Xenia Ziouvelou and Frank McGroarty, "A Business Model Framework for Crowd-Driven IoT Ecosystems."

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Section 3, "Tools and Technologies," presents extensive coverage of the various tools and technologies used in the implementation of Green Business. The first chapter, "Green Attitudes and Thinking in the New Green Market: Using Mathematical Modeling to Satisfy Green Customers' Needs" by Nicoleta Valentina Florea, lays a framework for the types of works that can be found in this section. The section concludes with "Introducing Eco Friendly Urban Traffic Control Room: A Green Approach" by Somasree Bhadra, Anirban Kundu, and Sunirmal Khatua. Where Section 3 described specific tools and technologies at the disposal of practitioners, Section 4 describes the use and applications of the tools and frameworks discussed in previous sections.

Section 4, "Utilization and Applications," describes how the broad range of Green Business efforts has been utilized and offers insight on and important lessons for their applications and impact. The first chapter in the section is "Green Practices Implementation as Prerequisite to Sustain Firm Competitive Advantages: The Empirical Study from Indonesia Large Scale Enterprises (LSEs)" written by Kardison Lumbanbatu and Vincent Didiek Wiet Aryanto. This section includes the widest range of topics because it describes case studies, research, methodologies, frameworks, architectures, theory, analysis, and guides for implementation. The breadth of topics covered in the section is also reflected in the diversity of its authors, from countries all over the globe. The section concludes with "The Leading Practices of Green Mobile Telecommunication Base Station Design" by Yazan Migdadi, a great transition chapter into the next section.

Section 5, "Organizational and Social Implications," includes chapters discussing the organizational and social impact of Green Business. The section opens with "Green Innovation and Ethical Responsibility" by Harsh Tullani, Raiswa Saha, and Richa Dahiya. This section focuses exclusively on how these technologies affect human lives, either through the way they interact with each other or through how they affect behavioral/workplace situations. The section concludes with "Looking Good and Thinking Green: Can Green Personal Care Products Be Promoted?" by Gauri Joshi and Gurudas Nulkar.

Section 6, "Managerial Impact," presents focused coverage of Green Business in a managerial perspective. The section begins with "Psychological Factors Influencing the Managers' Intention to Adopt Green IS: A Review-Based Comprehensive Framework and Ranking the Factors" by Mohammad Dalvi Esfahani, Mehrbakhsh Nilashi, Azizah Abdul Rahman, Amir Hossein Ghapanchi, and Nor Hidayati Zakaria. This section serves as a vital resource for developers who want to utilize the latest research to bolster the capabilities and functionalities of their processes. The chapters in this section offer unmistakable value to managers looking to implement new strategies that work at larger bureaucratic levels. The section concludes with "Green Retailing: A New Paradigm in Supply Chain Management" by Arnab Adhikari, Indranil Biswas, and Balram Avittathur.

Section 7, "Critical Issues and Challenges," presents coverage of academic and research perspectives on Green Business tools and applications. The section begins with "A Review on Green Trust and Environmental Quality Awareness Affect Towards Environmental Attitude" by Trianna Rosli and Fauziah Sh. Ahmad. Chapters in this section will look into theoretical approaches and offer alternatives to crucial questions on the subject of Green Business. The section concludes with "Awareness of Sustainability, Green IT, and Cloud Computing in Indian Organisations" by Tomayess Issa, Girish Tolani, Vanessa Chang, and Theodora Issa.

Section 8, "Emerging Trends," highlights areas for future research within the field of Green Business, opening with "Green Investments and Food Security: Opportunities and Future Directions in the Context of Sustainable Development" by Corina Ene, Marian Cătălin Voica, and Mirela Panait. This

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

section contains chapters that look at what might happen in the coming years that can extend the already staggering amount of applications for Green Business. The final chapter of the book looks at an emerging field within Green Business, in the excellent contribution "Green Performance Strategies in Romanian Economy in the View of EU 2020 Strategy" by Violeta Sima and Ileana Georgiana Gheorghe.

Although the primary organization of the contents in this multivolume work is based on its eight sections, offering a progression of coverage of the important concepts, methodologies, technologies, applications, social issues, and emerging trends, the reader can also identify specific contents by utilizing the extensive indexing system listed at the end of each volume. As a comprehensive collection of research on the latest findings related to using technology to providing various services, *Green Business: Concepts, Methodologies, Tools, and Applications* provides researchers, administrators, and all audiences with a complete understanding of the development of applications and concepts in Green Business. Given the vast number of issues concerning usage, failure, success, policies, strategies, and applications of Green Business in countries around the world, *Green Business: Concepts, Methodologies, Tools, and Applications* addresses the demand for a resource that encompasses the most pertinent research in technologies being employed to globally bolster the knowledge and applications of Green Business.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Section 1

Fundamental Concepts and Theories

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 1
Ecological Responsibility and Sustainable Development as Preconditions for Development of the Concept of Circular Economy

Olja Munitlak Ivanovic
Institute of Economic Sciences, Serbia

ABSTRACT

Ethical and ecological responsibility represent the root of sustainable development taking into account intergenerational justice. Mass production and consumption have left negative effects on the environment. Disregarding ecological responsibility, production processes were mainly based on uncontrollable use of raw materials and non-renewable energy sources. Taking into account limitation of raw materials, economic and ecological disasters, a concept of resilience has been developed to make all elements of society flexible in terms of unwanted shocks. This chapter describes two conceptual economic models: linear and circular. The linear model is based on the principle "take, produce, consume, and throw," meaning that usability of waste is reduced and that waste is simply thrown out after consumption. Circular economic model takes into account environmental responsibility, but it also makes companies more competitive. Waste is treated and processed adequately and used as raw material in production, thus increasing competitiveness. Waste that cannot be processed is disposed permanently.

INTRODUCTION

Sustainable development, in the essence of numerous definitions, has a common denominator – intra-generational and intergenerational justice. The most popular definition of sustainable development from report Our Common Future points out that development should satisfy the needs of present generation without questioning the possibility of future generations to satisfy their needs (World Commission on Environment and Development, 1987). Such perception of the concept of sustainable development im-

DOI: 10.4018/978-1-5225-7915-1.ch001

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

poses ethics review, especially ecological ethics review (Cifric, 2000). Cifric defines ecological ethics as needs for different pragmatical approach to development and environment. Ecological ethics became a part of the concept of sustainable development as a result of long-term inadequate treatment of the environment in the post-industrial society.

The issue of ecological ethics or ethical responsibility on micro and macro level refers to facing dilemmas on socially responsible behaviour and therefore, ecological responsibility (Krivokapic, Vujovic & Jovanovic, 2014). The issue of social responsibility and socially responsible behaviour shifted over time from the domain of voluntary philanthropic activities to conscious ethical behaviour and ethical responsibility or ecological legal frame that affect ecological behavior.

Disrupted relationship between people and natural resources resulting from mass production and consumption affects a modern man's behavior. Not only does he exploit nature, but he also destroys it. Nobel laureate Bertrand Russel thought that raising human consciousness about the necessity of changing the relationship towards nature is important for their existence (Russel, 2009). Mass production and consumption logics resulted in ecological crises, energetic crises, unsustainable treatment of natural resources and the value of the product itself. Modern issues of environmental protection are the consequence of the so-called linear economic model. The essence of such economy is exploitation of resources for production of products/services that is followed by consumption and throwing of unused parts representing the waste in this model.

Intensification of production and consumption in consumer society resulted in economic, ecological and social crisis. The response to these challenges was development of a new, essentially different economic model – circular economic model. Simply speaking, circular economy follows circular movement of production and brings it to a higher level. The essence of this model is reuse of waste and remaining byproducts in production. In this way, greater energetic efficiency is achieved, and consumption remains are brought back in the reproduction process. Therefore, unwanted waste coming from production and consumption becomes raw material and production is continued with less externalities (Lacy & Rutqvist, 2015) directly increasing GDP, especially in transition economies (Mitic, Munitlak Ivanovic & Zdravkovic, 2017).

BACKGROUND ON ECOLOGICAL RESPONSIBILITY

Ethical or ecological responsibility is not a new discipline, but the approach to interpreting of producer and consumer's behavior towards nature and environment has changed. A new ethical approach emphasizes the significance of components making the concept of ecological ethics itself. Many of these components are the result of high industrialization of society: economic and social justice, value pluralism, modern moral standards with regard to the environment, new forms of multiculturalism etc. (Cifric, 2000).

The question up to what level it is ecologically justified to use natural resources is an ethical question relating to intragenerational and intergenerational justice of sustainable development (Munitlak Ivanovic, 2017). This question is a basis for formulating of an adequate economic model (circular economy) that respects the concept of resilience as well (with a special emphasis to ecological and economic resilience) (Munitlak Ivanovic, & Zubovic, 2017). Speaking of ethical and ecological considerations, two conceptual bases are predominant in literature (Jost, 1996), namely (1) Perception of the concept of sustainable development based on science and (2) Perception of the concept of sustainable development based on human will.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The concept of sustainability that is based on science starts from scientific researches and thus obtained results relating to natural capacities of the Earth. This concept formulates political and technical conditions and indicators needed for implementation of thus understood concept of sustainable development. There are two models of sustainability that are based on this concept and they are related to the possibility of substitution of the natural and physical capital. Two extreme attitudes are determined within this model: "pessimistic" (neoclassical) approach to sustainability and "optimistic" approach to perspective of sustainability (Jost, 1996). Natural capital implies stocks of natural renewable and non-renewable resources and usability stocks result from work and represent physical capital.

The essence of pessimistic theory of sustainability refers to possibilities of substitution of the most important resources and ecological capacities. In this way, the attitude that selective and restrictive approach to exploitation of natural resources is needed for implementation of the concept of sustainable development is emphasized. This enables "natural" survival of resources over a longer period of time (Munitlak Ivanovic, 2007). The arguments the theoreticians of pessimistic variant of sustainable development refer to are reflected in the fact that there is no optimal way for solving of majority of ecological problems caused by accelerated economic development. Pollution problem is solved mainly by transferring of pollution from one medium to another (Munitlak Ivanovic, 2009). The activity of paper industry can be taken as an example. In order to solve the problem of water pollution, factories use water filters. However, large amounts of toxic sludge are produced during filtration. This residual has to be burnt in special furnaces or disposed in specially protected areas. In this way, the problem of water pollution as the first medium is transformed in the problem of air pollution or soil pollution as the second, i.e. third medium (Golusin et al., 2011). The need for abandoning of linear economic model and accepting circular economic model is perceived already in this perception of the concept of sustainable development.

Theoreticians of an optimistic approach start from an undefined time horizon for realization of economic activities. The essence of optimistic theory is that majority of natural functions that are important for performing of economic activities (receiver of externality and supplier of natural resources) can be replaced (substituted) with physical capital. Theoreticians who advocate this approach refer to previous historical experience. Namely, optimists advocate the attitude that each developed society always finds an adequate substitute in case of a lack of resources (Munitlak Ivanovic, Mitic, & Popovic, 2015). A lack of wood as raw material in England in the 18th century, which resulted in substitution of the insufficient forest resource with available coal, is usually taken as an example. Such activities caused positive subsequent reactions resulting in new discoveries and innovations. In the first place, this refers to construction of the steam engine that marked first revolution, i.e, had an effect on many other discoveries and innovations and led to general technical progress (Landes, 1999).

Both theories are of extreme character, but it is still possible to find elements which can be implemented adequately in practice. What is common for both theories is that sustainable development, among other things, can also be defined as a responsibility for (Sachs, 2015):

1. Nature and environment.
2. Future generations (intergenerational justice).
3. Intensity of satisfaction of needs.

Pessimistic theory of sustainable development advocates proper perception with regard to ecological capacities for absorption of waste and waste materials, in cases when substitution is not possible at

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

all. Optimistic theory of sustainable development advocates proper perception with regard to renewable natural resources.

Ethical responsibility and all forms of ethical considerations are the essence of different perception of the concept of sustainable development. Market mechanism cannot implement the concept of sustainability without the help of the state and its institutions and this developed a real need for identification of ethical responsibility and new ethical basis for perception of sustainable development. Perception of the market as an automatic instrument for timely adjustment to pollution and exploitation of natural resources has failed. This raised the issue of organization of economy in a new – sustainable way. Therefore, the analysis of ethical and ecological responsibility for realization of the concept of sustainable development stems from the theory and practice at the same time (Stiglitz, 2004). In order to realize the concept of sustainability that is understood in this way, it is necessary to change human standards and activities thus enabling undisturbed long-term life functioning. However, a basic condition for such changes is a clear and conscious will to change behaviour and this will have to be articulated (Viscuci, 1983).

Basic ethical question is whether selfish attitude should be used to raise the present generation's standard of living if this reduces any form of richness of the future generations. This is the essence of intergenerational justice which is integrated in the definition of sustainable development from Brundtland Report. In addition to intergenerational justice, the report "Our Common Future" also insists on intergenerational justice, i.e. on as fair distribution of natural wealth during one, present generation as possible. The question that arises from this is if the present generation should have and if it has rights to satisfy all its needs, even luxurious ones, or only some of them. The issue "our present needs - needs of future generations" distinguishes two basic ethical approaches: anthropocentric and biocentric ethical approach (Max-Neef, Elizalde, & Hopenhayn, 1989).

The possibility of future generations to satisfy all their needs or the level of satisfying of the needs of present generations is an ethical issue that has become the issue of ecological responsibility over time. This results in various relationships and perception of the purpose of the nature. Is the nature only an "inexhaustible" resource or a condition of the survival of mankind (Jost, 1996)?

According to Human Development Theory, basic human needs have to be satisfied. These needs include:

- Need for socialization.
- Need for education.
- Need for culture, expression, information and other social needs that are not of existential nature. As a role of economic science is to help people live better and easier, human development theoreticians advocate an intensive economic development that is sustainable. Such development is a human development at the same time.

Traditional perception of needs depending on the culture, environment, historical period, economic and technical and technological development denies the existence of difference between the needs that have to be satisfied and those that don't have to be satisfied. In effect, the main question is: does the existence of a need expresses the right to satisfy that need? This issue was not essential before the period of mass production and consumption. There were enough raw materials and fuels and waste disposal was not problematic as it is today. In the post-industrial society, this is not only ethical and ecological issue, but also the issue of survival and quality life both of this generation and of future ones.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The subject of the following chapters is representation and comparison of two concepts of economy: linear and circular model. Transition from linear to circular model in the European Union is growing faster as a result of development of new business models and new technologies. Ellen MacArthur Foundation was established in 2010 with the aim of making the transition to circular economy faster by its reports (Ellen MacArthur Foundation, 2012; Ellen MacArthur Foundation, 2013; Ellen MacArthur Foundation, 2014; Ellen MacArthur Foundation, 2015; Ellen MacArthur Foundation, 2016; Ellen MacArthur Foundation, 2017). The report from 2015 indicates that the value chain changes and that households in the European Union spend 60% of the average budget for rents and food, as well as that 80% of the total resources is exhausted in this way. This opens the space for more intensive application of circular economic model, which would result in the improvement of economic performance of the European Union.

THE CONCEPT OF LINEAR ECONOMY

So far, economy developed based on the simple principle: "take, produce, consume and throw". This is a basis of the so-called "linear" model implying unlimited and easy access to resources. This way of functioning of economy is characteristic from previous accumulation of capital to the present form of neoliberalism.

The perception that natural resources, especially ores and petroleum, are inexhaustible have been abandoned recently. At the end of the eighteenth century, in his "Essay on the principle of population", Thomas Robert Malthus questions an uncontrollable population growth rate from the point of view of survival funds (Malthus, 1798). Malthus states that population grows by geometric progression and funds needed for life, especially food, grow by arithmetic progression. Furthermore, the capacity of the Earth as a planet is limited, not only with regard to resources, but also to acceptance of industrial waste. Uncontrollable growth of world population and industrial growth are not possible as such processes require even bigger consumption of material resources.

Some other authors also pointed out to unsustainability of such growth. The Report of the Club of Rome from 1972, named "The limits of growth" was not accepted well by economists and therefore it did not have an influence on economic and ecological policy (Donella, Meadows, Randers, & Behrens III, 1974). According to critics of this report, an emphasis was on the significance of redistribution.

The Three Limitations Representing Real Limits of Growth

1. Soil as a source of non-renewable natural resources and food.
2. Ability of the environment to accept waste and other negative externalities of production and consumption processes.
3. Life in cities that incites consumption as a way of life and one of its values.

It is interesting that Brundtland's commission started from the similar postulates in the report as in "The limits of growth". While the report of the Club of Rome was sharply criticized, the report "Our Common Nature" was accepted well and understood as a desirable continuation of economic growth and a condition for sustainable growth and development.

The principle of linear economy "take, produce, consume and throw" treats waste as a residual of production that finishes its life cycle as a trash in the environment. Waste is a material or an object which

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

is not usable and which its owner plans to dispose permanently. According to Stevanovic (2003) waste is divided into solid and hazardous waste. According to the same source, solid waste is further classified into:

- **Municipal Waste:** It occurs in populated, mainly urban areas and it consists of residential and commercial waste.
- **Industrial Waste:** It occurs during production. Speaking of impacts on the environment, it can be hazardous and non-hazardous.
- **Internal Industrial Waste:** It occurs during production, but it is not dangerous for people's health and the environment according to its characteristics.
- **Medical Waste:** It occurs in health institutions. It can be hazardous and non-hazardous.

In linear economy, all waste will be permanently disposed after consumption, regardless which group of waste it belongs to, whether it is hazardous or not, whether it can be recycled or not. Such attitude towards the nature and production is unsustainable and it has to be abandoned. Figure 1 shows a linear economic model indicating that waste is the end of the life cycle of that production process.

Current period is characterized by the concept of linear economy, as ecological crises are not understood seriously enough. Due to advanced technology, raw materials are more available and cheaper and therefore, the concept of linear economy is accepted as an optimal model of growth as it is reflected in the growth of production and employment, profit and standard of living, but also in the growth of cities and demand for all kinds of products and services. Hyper production and consumerism are the bases of such perception of production.

However, the question is when linear economic model is not adequate, i.e. when it can and should be replaced by a new, circular model. Linear model of production was acceptable in the twentieth century. The advent of the next century has brought different demographic motions, from densely populated industrial centers to new growing markets and economies, and therefore the existing methods of production have to adjust to these changes. Growing consumerism requires bigger and bigger quantity of raw materials in order to satisfy growing demand and puts pressure on the prices of raw materials and energy products. Therefore, the model of reuse of waste could be a solution in terms of a new input. The future shifts to a new economic model – circular economy. This is confirmed by the numerical datum published by the Sustainable Europe Research Institute (SERI, n.d.), that 21 billion tons of materials, which were used in production, were not installed in the end products (losses incurred in production as unsuitable, inefficiency, storage problems, unnecessary loss of energy etc.). Although the transition in a wider sense implies processes through which states and people try to achieve economic growth and

Figure 1. Production process in linear economic model
Source: Authors own design.



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

development as well as social welfare of developed countries, namely North America and Western Europe (Jovanovic, & Eskinja, 2008), this concept can be perceived differently. Transition can be perceived as a process of overall improvement of economy, i.e. abandoning the previous concept of linear economy and accepting another concept that has more modern perception of social responsibility, especially with regard to concretization of the concept of sustainable development.

Exploitation of natural resources in production during which a new usability is created and the remaining resources (waste) are not processed, i.e. are thrown out, is unsustainable in the long run due to limitation of resources. The economic crisis in 2008 and a sequence of frequent ecological crises caused by climate changes intensified the need for application of the existing concept of circular economy. In circular economy, products have longer expiration date and they are upgraded, repaired or recycled at the end of their life cycle, i.e. they are used again. In this way, less waste is disposed in large water areas, less food is thrown, and biodegradable waste is used more intensely, for example, for compost or energy production. All this has positive effects on opening of new jobs locally (Drljaca, 2015).

MODERN ECONOMIC MODEL: CIRCULAR ECONOMY

Based on all above mentioned, it could be said that the concept of circular economy follows circular motion of substance in the nature. The approach to relationship between production and consumption is different, as byproducts of production and consumption are used again in the new production process. The use of non-hazardous waste as an output of one production cycle and as an input for another production cycle results in distinguishing trash and waste. Waste no longer has the role of trash that pollutes the environment, but it becomes a raw material and material resource that reduces the price of the end product (Milanovic, Radovic, & Vucic, 2002). Therefore, circular economy can have an effect on competitiveness on the market. In circular economy, value-added product is used longer before it becomes waste meaning that material resources are used longer and more rationally.

Circular economic model is needed not only for environmental protection, but also for cost savings. The benefits of circular economy can be felt both on micro and macro level. Reduction of needs for new raw materials can save millions or billions of dollars depending on the size and intensity of economy. According to the assessments of the Ellen MacArthur Foundation, the European Union could save 400-600 billion dollars per year, primarily in automated and machine industry (Sariatli, 2017). Apart from the limitations listed below, this model should be used wherever production and technical requirements enable it (e.g. when the waste is toxic or dangerous, this model cannot be applied). However, likewise in all fields of business, managers and policy makers must have (in addition to developed ecological conscience), excellent knowledge on production processes in order to know when and how linear model can be replaced by a circular model. This is especially important if we take into account the lack of standardization in this field of business and that the decisions of this type depend on good knowledge of technology and processes. These exact data indicate the need of transition from one economic model to another only when and if it is possible.

As a new concept, circular economy is one of the reactions to economic crisis from 2008, as it represents a new concept of waste management. Waste is collected and processed, it does not have a negative impact on the environment and it is used again as a raw material in the production process. Each process enabling recycling, regeneration, using of valuable properties of waste as an input or energy source, direct reuse, reduction of quantity and volume of waste before permanent disposal is considered

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

as waste processing. This means that recycling and processing are not the same terms, i.e. that recycling is a method of processing of waste (Stevanovic, 2003). The part of waste that cannot be processed is disposed permanently and safely. This process is shown in the scheme below.

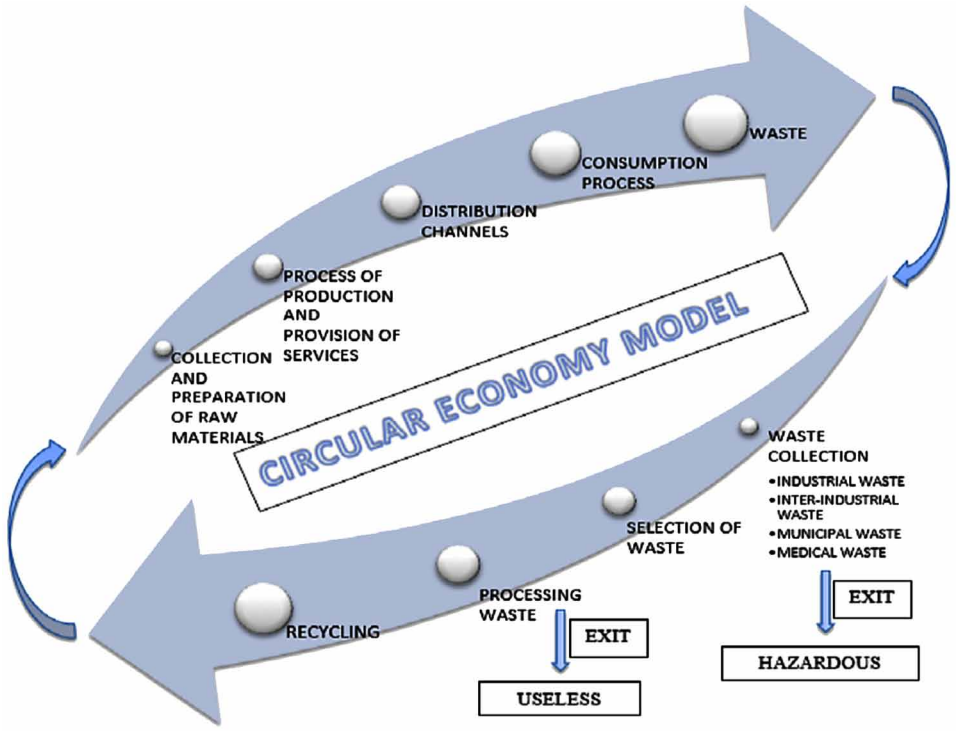
Circular economy keeps some elements of the concept of linear economy. The path of the raw material from a resource through production, distribution, consumption and occurrence of waste is identical in both concepts. If the expiry date of a product is not only considered through the lifetime but also through the further life cycle (following motion of waste occurring from the product), the concept of circular economy is perceived completely. Phases of circular economic model are shown in Figure 2. Basic premise of circular economy is that there is a feedback bringing collected, processed and recycled waste back in production as a raw material.

In order for this system to function it is necessary to establish an integrated system of waste management. The idea of creating of such system is minimizing of unusable waste. In this respect, we can arrange phases in the following order (Figure 3):

1. Minimizing of solid waste at the place of its occurrence (end of production or consumption).
2. Recycling.
3. Transformation of solid waste.
4. Sanitary disposal.

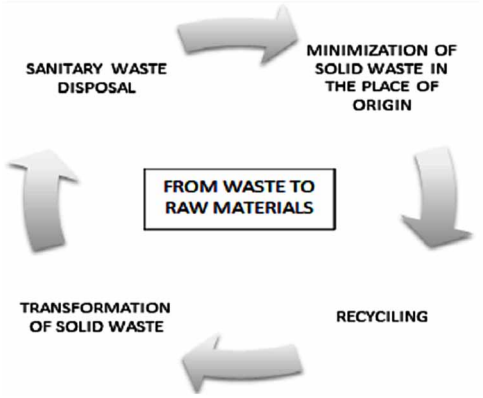
Recycling is considered only when all possibilities of minimizing waste at the place of its occurrence are exhausted. Transformation is applied after achieving a maximum recycling level. Recycling is most

Figure 2. Production process in circular economic model
Source: Authors own design.



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 3. Phases of minimizing unusable waste
Source: Authors own design.



important in the process of waste processing, as these activities reduce consumption of new raw materials and quantity of waste that has to be disposed permanently. The same waste material or some its parts can be used once or more than once as a substitute for a new raw material or commercial products. In effect, the process of recycling is done in two ways: 1. Separating useful and usable parts from the integral solid waste and processing them or 2. Removing components that pollute the environment from waste and enabling their reuse. All above mentioned phases and processes being a part of water management system are necessary as they are a condition for transition to circular economic model.

On a global scale, transition to circular model should be intensified. Some highly developed countries, such as Japan, achieved great results in this area. Until 2020, Japan plans to organize such production in the city of Kamikatsu that will leave no waste, i.e. Kamikatsu will become the first zero waste city (Medlock, 2017). In its report from 2013, Ellen MacArthur Foundation (Ellen MacArthur Foundation, 2013) points out that only 35% of waste, 75% of which is municipal waste, is used as material inputs in the economy.

Likewise, any other concept, there are certain disadvantages and challenges with which circular economy faces. These disadvantages indicate that there are production processes, technology and/or situations that should function according to linear economic model. Essentially, all disadvantages can be classified in three groups (Circular Academy, 2017): (1) Achievability and desirability; (2) Social dimension and (3) Lack of standardization and strategic guidelines.

Achievability and desirability refer to certain production processes (such as paper recycling), materials and technological processes in which there are limits to which waste can be processed into raw material. As it is shown in Scheme 2, there are materials, such as dangerous waste, that cannot be processed further and therefore they cannot be covered by circular economic model. If dangerous waste remains after a production process, circular economic model cannot be applied, but only linear economic model. Insisting on recycling of waste in terms of production of new raw material at the level of 100% does not make sense if costs of waste recycling are higher than the value of the raw material obtained. Also in this case, economic logic suggests that in such cases linear economy is a better choice than circular economy.

Being focused on recycling the remains from production, circular economy pays less attention to social dimension. Work of employees is harder to standardize and recycling and re-processing require more work. This can have negative impacts on the employees' creativity, as well as on the loss of local

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

jobs if recycling is not done locally, but it is centralized and shifted to areas where labour is cheaper. (Ellen MacArthur Foundation, 2013). This jeopardizes human rights in the developed countries and indirectly supports poor economies.

Lack of standardization and strategic guidelines indicates the disadvantage of circular economy in terms of non-existence of accurately identified criteria, activities or guidelines for implementation of this concept in all situations (such as ISO). The application of circular economic model varies greatly depending on the market and products and therefore any generalization and standardization is imprecise. Although there are no guidelines covering these issues (Ellen MacArthur Foundation, 2014), it still cannot be said that there is an internationally recognized standardization referring to recycling and circular economy for all products and processes.

As researchers from the Republic of Serbia deal with this issue as well, although on a limited scale, we will mention the results of present application of circular economic model, which is still in the initial phase in Serbia. It mainly refers to industrial production. The examples of good practice mainly refer to recycling of: Tetra Pak, water proof eco boards, plastics, multy-layer packaging for beverages and liquid food, waste tires, used antifreeze, then ash processing and heating by means of briquettes made of coffee beans. Development of circular economy strategy in the Republic of Serbia, together with the action plan for tools for full application is planned for 2017.

Over 70 companies with more than 40.000 employees in total participated in cleaner production and chemical leasing projects in Serbia in the last nine years. Average savings amount to cca. 100.000 € per year together with (Circular economy as a chance for development of Serbia, 2016):

- **Average Reduction of Water Consumption:** 50.000 m3/year.
- **Average Reduction of Electricity Consumption:** 500 MWh/year.
- **Average Reduction of CO2 Emissions:** 500t/year.

It is estimated that 30.000 new jobs can be opened and competitiveness of the economy increased by introduction of the circular economy in Serbia. The Republic of Serbia follows the processes of adoption and introduction of the circular economy in the European Union and it reacted promptly by accepting the recommendations of the European Union on the circular economy. The Ministry of Agriculture and environmental protection has recognized the needs for amendment of the law and suggested amendments to the law on environmental protection in cooperation with the Chamber of Commerce and Industry of Serbia and other relevant institutions. The amendments from February 2016 created legal basis for introduction of circular economy.

CONCLUSION

Development of consciousness, ethical and ecological responsibility resulted in creation of various concepts: sustainable development, resilience, linear and circular economy. Ethical issues and issues relating to ecological responsibility and sustainable development are observed from various aspects in this paper: Human development theory, perception of the concept of sustainable development based on science (“pessimistic attitude”) and perception of the concept of sustainable development based on human will (“optimistic attitude”).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Sustainable development is based on three pillars: economic, ecological and social. The essence of this concept is in the attempt to distribute natural wealth to all generations, minimize pollution, minimize global warming and solve other issues that are important for environmental protection.

Resilience is a step further to creation of an optimal model of functioning of global society in unstable and unpredictable conditions. It is based on the idea of as much flexibility of four pillars – economic, social, environmental and institutional – as possible. Speaking of this concept, flexibility implies readiness of each pillar to adjust to unwanted situation (shock) and returning of all pillars in the state before shock as soon as possible. In this respect, various strategies (scenario models) are developed in advance within strategic management.

Linear economy, being based on the principle "take, produce, consume and throw", does not treat waste adequately. Due to application of modern technologies, the price of raw materials falls resulting in the attitude that linear economy is an optimal model of growth which is characterized by: employment growth, production growth, profit growth and growth of a standard of living, i.e. hyperproduction and mass consumerism. However, such attitude towards the environment is not sustainable in the long run due to limitation of resources.

In addition to the above-mentioned disadvantages: achievability and desirability, social dimension and lack of standardization and strategic guidelines, circular economic model is the economic model of the future. In order to make a transition from linear to circular economy, it is necessary to define guidelines for each production sector on how to implement a circular economic model and establish an internationally recognized institution for standardization of the circular economic model that would define regulations, standards and necessary activities for each field of business. Unlike linear economic model, audience and consumers are still not familiar enough with the circular economic model. In this respect, social marketing campaigns should be intensified in order to familiarize general public with the advantages of circular economic model. All above mentioned points to the need for larger investments in order to make circular economic model a dominant production model. Manager and policy makers need to know production processes, i.e. characteristics of production sectors very well, so that they could standardize the steps for implementation of circular economy first, and then raise it to the national and international level by forming an official organization for standards related to this model. This means that general theoretical knowledge in economics is not enough and that continuous specialization and collection of new information and knowledge is needed. Lifelong learning and continuous education on higher levels of top management is a precondition for application of circular economy.

Circular economy is a new global response to ecological crisis and climate changes on one hand and economic crisis on the other hand. This new concept of economy of the twenty-first century has a different approach to all economic processes, not only from the aspect of sustainable development, but also from the aspect of social responsibility and therefore ethical and ecological responsibility. In this economic model, waste that occurs after consumption is used again after processing. There is a feedback bringing selected and processed waste back in the new production cycle as a raw material. Speaking of the described characteristics of different concepts, i.e. economic models, it can be perceived that circular economic model is sustainable in the long run. This model is economically justified as it has a positive effect on competitiveness and takes care that economic development is humane at the same time. It is economically justified as it reduces the use of raw materials and quantity of waste. Circular economic model, i.e. its elaboration on micro and macro level, is close to the concept of sustainable development. This model is also a response to ethical and ecological responsibility which each generation and society should implement in practice as intensely as possible.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

REFERENCES

Cifric, I., (2000). Bioetika i ekologija. *Socijalna ekologija: casopis za ekolosku misao i sociologijska istrazivanja okoline, 9*(1-2), 143-146.

Circular Academy. (2017). *How can we bridge the circularity gap?* Retrieved from http://www.circular.academy/circular-economy-critics-and-challenges/

Cirkularna ekonomija kao šansa za razvoj Srbije. (2017). Retrieved from http://aarhusns.rs/aarhus/wp-content/uploads/2016/12/Cirkularna-ekonomija-Web.pdf

Donella, C., H., Meadows, D.L., Randers, J., & Behrens III, V.W. (1974). *Granice rasta*. Zagreb: Stvarnost.

Drljaca, M. (2015). Koncept kruzne ekonomije. *Kvalitet & izvrsnost, 4*(9-10), 18-22.

Ellen MacArthur Foundation. (2012). *Towards the Circular Economy: Vol. 1. An economic and business rationale for an accelerated transition*. Retrieved from https://www.ellenmacarthurfoundation.org/publications/towards-the-circular-economy-vol-1-an-economic-and-business-rationale-for-an-accelerated-transition

Ellen MacArthur Foundation. (2013). *Towards the Circular Economy: Vol. 2. Opportunities for the consumer goods sector.* Retrieved from https://www.ellenmacarthurfoundation.org/publications/towards-the-circular-economy-vol-2-opportunities-for-the-consumer-goods-sector

Ellen MacArthur Foundation. (2014). *Towards the Circular Economy: Vol. 3. Accelerating the scale-up across global supply chains.* Retrieved from https://www.ellenmacarthurfoundation.org/publications/towards-the-circular-economy-vol-3-accelerating-the-scale-up-across-global-supply-chains

Ellen MacArthur Foundation. (2015). *Growth Within: a circular economy vision for a competitive Europe.* Retrieved from https://www.ellenmacarthurfoundation.org/publications/growth-within-a-circular-economy-vision-for-a-competitive-europe

Ellen MacArthur Foundation. (2016). *Intelligent Assets: Unlocking the circular economy potential.* Retrieved from https://www.ellenmacarthurfoundation.org/publications/intelligent-assets

Ellen MacArthur Foundation. (2017*). Achieving "Growth Within".* Retrieved from https://www.ellenmacarthurfoundation.org/assets/downloads/publications/Achieving-Growth-Within-20-01-17.pdf

Golusin, M., MunitlakIvanovic, O., Domazet, S., Dodic, S., & Vucurovic, D. (2011). Assessment of the effectiveness of policy implementation for sustainable energy development in South East Europe. *Journal of Renewable and Sustainable Energy, 3*.

Jost, F. A. (1996). *Sustainable Development: The Roles of Science and Ethics*. London, UK: Edvard Elgar.

Jovanovic, M., & Eskinja, I. (2008). Neki aspekti neoliberalizma u svetskom gospodarstvu. *Zbornik Pravnog Fakulteta Sveucilista u Rijeci*, *29*(2), 941–985.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Krivokapic, Z., Vujovic, A., & Jovanovic, J. (2014*). Ekoloska inovativnost u funkcji drustvene odgovornosit.* Paper presented at the 41. Nacionalna konferencija o kvalitetu, 9. Nacionalna konferencija o kvalitetu zivota, 5. Konferencija studenata industrijskog inzenjerstva i menadzmenta, Fakultet inzenjerskih nauka, Kragujevac.

Lacy, P., & Rutqvist, J. (2015). *Waste to Wealth, The Circular Economy Advantage*. Palgrave Macmillan.

Landes, D. (1999). *The Wealth and Poverty of Nations: Why Some Are So Rich and Some So Poor*. New York: W.W. Norton & Company.

Malthus, T. J. (n.d.). *An Essay on the Principle of Population*. Available from http://www.esp.org/books/malthus/population/malthus.pdf

Max-Neef, M., Elizalde, A., & Hopenhayn, M. (1989). Human Scale Development: An Option for Future Development. *Dialogue*, 5–80.

Medlock, K. (2017, January 1). This Japanese town will produce absolutely zero waste by 2020 [Web log comment]. Retrieved from http://inhabitat.com/this-japanese-town-will-produce-absolutely-zero-waste-by-2020/

Milanovic, C.Z., Radovic, S., & Vucic, V. (2002). *Otpad nije smece*. Zagreb, Republika Hrvatska: Gospodarstvo i okolis.

Mitic, P., Munitlak Ivanovic, O., & Zdravkovic, A. (2017). A Cointegration Analysis of Real GDP and CO2 Emissions in Transitional Countries. *Sustainability*, *9*(4), 1–18. doi:10.3390u9040568

Munitlak Ivanovic, O. (2007). Uloga drzave u primeni ekonomskih instrumenata u funkciji realizacije koncepta odrzivog razvoja. *Poslovna ekonomija*, *1*(1), 135-149.

Munitlak Ivanovic, O. (2009). Ekoloski menadzment kao model upravljanja rizikom. *Poslovna ekonomija, 3*(4), 155-160.

Munitlak Ivanovic O., Mitic, P., & Popovic, S. (2015). Globalizacija i tehnicko-tehnoloske promene – savremenije drustvo i/ili globalna ekoloska propast. *Poslovna ekonomija*, *16*(9), 263-276.

MunitlakIvanovic, O. (2017, April). *Pokusaji redukcije emisija CO2 analizom Kuznetzovekrive i medjunarodnih protokola –instrumenti za realizaciju odrzivog razvoja*. Paper presented on Medjunarodna naucna konferencija: Ciljevi odrzivog razvoja u III milenijumu, knjiga apstrakata, Beograd, Srbija.

MunitlakIvanovic, O., & Zubovic, J. (2017). From the Millennium Development Goals to the Resilience Concept – Theoretical Similarities and Differences. In The State and the Market in Economic Development: In Pursuit of Milennium Development Goals (pp. 7-29). The IIDS Australia Inc.

Russell, B. A. (2009). *The Basic Writings of Bertrand Russell*. London, UK: Routledge.

Sachs, J. A. (2015). *The Age of Sustainable Development*. New York: Columbia University Press. doi:10.7312ach17314

Sariatli, F. (2017). Linear economy versus Circular economy: A comparative and analyzer study for optimization of Economy for Sustainability. *Visegrad Journal of Bioeconomy and Sustainable Development*, *1*, 31–34.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

SERI. (n.d.). Retrieved from http://www.seri.de/home/themes/resource-efficiency-and-dematerialisation/

Stevanovic, B. (2003). Cvrsti i opasni otpad. In EnciklopedijaZivotnasredina i odrzivirazvoj (pp. 239-249). Beograd, RepublikaSrbija: Ecolibri.

Stiglitz, J. (2004). *Ekonomija javnog sektora*. Beograd, Republika Srbija: Ekonomski fakultet u Beogradu.

Viscusi, K. A. (1983). *Risk by Choice: Regulating Gealth and Safety in Workplace*. Harvard University Press. doi:10.4159/harvard.9780674186217

World Commission on Environment and Development. (1987). *Our common future*. New York: Oxford University Press.

ADDITIONAL READING

Bazilian, M., Rogner, H., Howells, M., Hermann, S., Arent, D., Gielen, D., ... Yumkella, K. K. (2011). Considering the energy, water and food nexus: Toward an integrated modeling approach. *Energy Policy*, *39*(12), 7896–7906. doi:10.1016/j.enpol.2011.09.039

Drljaca, M. (2015).Tranzicija linearne u kruznu ekonomiju, Association for Quality and Standardization of Serbia, 35-44.

Gabriela-Cornelia, P., Indith, I., & Alexandru, B. (2015). New Theoretical and Practical Approaches of Implementing the Circular Economy for Preservation of Natural Resources. *Procedia Economics and Finance*, *22*, 124–130. doi:10.1016/S2212-5671(15)00235-X

Gamon, A.R. (2016). Emplotting Virtue: A Narrative Approach to Environmental Virtue Ethics. *Environmental Ethics*, 38(3), United States: Environmental Philosophy.

George, A. R. D., Lin, B. Ch., & Chen, Y. (2015). A circular economy model of economic growth. *Environmental Modelling & Software*, *73*, 60–63. doi:10.1016/j.envsoft.2015.06.014

Ghisellini, P., Cialani, C., & Ulgiati, S. (2016). A review on circular economy: The extended transition to a balanced interplay of environmental and economic systems. *Journal of Cleaner Production*, *114*, 11–32. doi:10.1016/j.jclepro.2015.09.007

Hartwick, J. (1977). Intergenerational Equity and the Investing of Rents from Exhaustible Resources. *The American Economic Review*, *66*, 972–974.

Hartwick, J. (1990). Natural Resources, National Accounting and Economic Depreciation. *Journal of Public Economics*, *43*(3), 291–304. doi:10.1016/0047-2727(90)90002-Y

Jiao, W., & Boons, F. (2017). Policy durability of Circular Economy in China: A process analysis of policy translation. *Resources, Conservation and Recycling*, *117*, 12–24. doi:10.1016/j.resconrec.2015.10.010

Kates, R. W., Parris, T. M., & Leiservitz, A. A. (2005). What is Sustainable development? Goals, Indicators, Values, and Practice. *Environment*, *47*(3), 8–21. doi:10.1080/00139157.2005.10524444

Klein, N. A. (2014). *This Changes Every Thing*. New York, USA: Simon & Shuster.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Kristo, M. (1984). Kruzna ekonomija za brzi razvoj. *Gospodarstvo i okolis, Hrvatski poslovni savjet za odrzivi razvoj.* 11(41), 9-19.

Lieder, M., & Rashid, A. (2016). Towards circular economy implementation: A comprehensive review in context of manufacturing industry. *Journal of Cleaner Production*, *115*, 36–51. doi:10.1016/j.jclepro.2015.12.042

Munitlak Ivanovic, O. (2007). *Odrzivi razvoj kao redefinisan pristup ekonomskom razvoju*. Beograd: Zaduzbina Andrejevic.

Norton, B. (1984). Environmental Ethics and Weak Anthropocentrism. *Environmental Ethics*, *6*(5), 131–148. doi:10.5840/enviroethics19846233

Prekajac, Z. & Josifidis, K. (1999). Ekonomija i ekologija-ekoloska ekonomija i/ili koncep todrzivog razvoja, *Privrednaizgradnja*, 125-139.

Repetto, R., McGrath, W., Wells, M., Beer, C., & Rossini, F. Authors. (1989). Wasting Assets: Natural Resources in the National Income Accounts, Washington D.C., USA: World Resources Institute.

Sachs, J. (1982). The Current Account in the Macroeconomic Adjustment Process. *The Scandinavian Journal of Economics*, *84*(2), 147–159. doi:10.2307/3439631

Sauve, S., Bernard, S., & Sloan, P. (2016). Environmental sciences, sustainable development and circular economy: Alternative concepts for trans-disciplinary research. *Environmental Development*, *17*, 48–55. doi:10.1016/j.envdev.2015.09.002

Singh, J., & Ordonez, I. (2016). Resource recovery from post-consumer waste: Important lessons for the upcoming circular economy. *Journal of Cleaner Production*, *134*, 342–353. doi:10.1016/j.jclepro.2015.12.020

Solow, R. (1974). Intergenerational Equity and Exhaustible Resources. *The Review of Economic Studies*, *41*, 29–45. doi:10.2307/2296370

Solow, R. (1986). On the Intergenerational Allocation of Natural Resources. *The Scandinavian Journal of Economics*, *88*(1), 141–149. doi:10.2307/3440280

Szabo, A., & Durkop, C. (Eds.). (2016). *SMEs and Green Economy*. Ankara, Turkey: Konrad-Adenauer-Stiftung.

Weitzman, M. (1976). On the Welfare Significance of National Product in a Dynamic Economy. *The Quarterly Journal of Economics*, *90*(1), 156–162. doi:10.2307/1886092

Williams, E. F. A. (2015). *Green Giants: How Smart Companies Turn Sustainability into Billion-Dollar Businesses*. USA: Amacom.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

KEY TERMS AND DEFINITIONS

Circular Economy: A desirable concept of the economic model, as non-hazardous waste is processed in various ways and returned in production. Raw materials are used less which increases competitiveness of the company over competition as usability of waste is prolonged.

Ecological Responsibility: A concept which implies socially responsible behavior towards nature. It is an ethical attitude to natural resources during their exploitation and during waste disposal.

Environment: A precondition for the existence of all (economic and other) processes and creatures. It is divided into non-living nature (water, air, soil, minerals, and similar) and living nature (plants, animals, bacteria in ecosystems). Briefly, no system could survive without the environment.

Intergenerational Justice: One of the principles on which the concept of sustainable development is based. The essence of this justice is in intra-generational and intergenerational justice. This means that, within the same generation (i.e., among generations), the principle of equal right to similar quantities of natural resources is respected.

Linear Economy: Still, a predominant form of production that treats waste after product consumption as the end of the life cycle of production and consumption, disposing of it permanently.

Raw Materials: Various natural resources that are used as an input in production. Production of goods or services would be impossible without raw materials.

Resilience: A concept representing the "upgraded" concept of sustainable development. It is based on four pillars, three of which are the same as in the concept of sustainable development and the fourth pillar being institutions. The concept of resilience insists on flexibility of all four pillars in case of an unwanted situation (shock), fast adjustment of pillars to new situation (i.e., returning the whole system in the state before shock).

Sustainable Development: A concept that is based on three pillars: economic, ecological, and social. The main idea of this concept is that economic processes take place on an optimal level, satisfying social needs without prejudice to environmental protection.

Waste: A residual of production (i.e., consumption). It is a material or an object that is not suitable for further use and therefore, it is permanently disposed or thrown. Depending on the category or determined class which it belongs to, waste is treated in the process of waste processing (in circular economy) or rejected immediately as unusable without previous processing (in linear economy).

This research was previously published in Organizational Culture and Behavioral Shifts in the Green Economy edited by Violeta Sima, pages 1-20, copyright year 2018 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 2
Consumer Cooperation in Sustainability:
The Green Gap in an Emerging Market

Njabulo Mkhize
University of kwaZulu-Natal, South Africa

Debbie Ellis
University of KwaZulu-Natal, South Africa

ABSTRACT

The planet is under threat. Unless all stakeholders, that is governments, businesses, and consumers, become more environmentally friendly, some predict dire consequences for the earth and all those who inhabit it. While governments and businesses have a role to play, green consumer behavior is vital to the sustainability of the environment. Consumers have been shown to express increasing concern for the environment, but in many studies this concern has been found not to be matched by actions, a phenomenon labelled the green gap. This chapter describes a study that investigated the existence and extent of the green gap amongst a sample of South African adult consumers and sought to determine possible reasons for a lack of green behavior. Recommendations are made to marketers and policy makers to encourage consumer cooperation in environmental sustainability.

INTRODUCTION

António Guterres, the United Nations Secretary General, warns that climate change and competition for scarce natural resources threaten peace and sustainable development globally and that protecting the environment and having an emphasis on environment prevention methods is imperative (United Nations, 2016). There are two main drivers of the human impact on the environment, namely population and consumption (de Sherbinin, Carr, Cassels, & Jiang, 2007). The last century has seen an increase in the global population, which has resulted in an increase in the food consumption and a deterioration of the environment caused by over consumption and an increase in the use of natural resources (Chen & Chai,

DOI: 10.4018/978-1-5225-7915-1.ch002

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

2010). The global population has more than tripled in the last century from an estimated 1.5 living on earth in 2003 to 6.3 billion people and there is a prediction that the population will reach 9.7 billion by 2050 (United Nations, 2015). Most of this growth will come from emerging markets.

From a marketing perceptive an increase in the number of people and their consumption levels may be seen as advantageous since products are being consumed. However thirty to forty percent of the environmental issues are caused by the consumption patterns of human beings (Chan, 2001) thus the decisions and behaviours of consumers have a significant impact on the environment (Tobler, Visschers, & Siegrist, 2012). Climate change, global warming, deforestation, pollution and depletion of the ozone layer are just some of the global environmental crises facing the world (Juwaheer, 2005). These environmental issues give rise to environmental concern amongst governments, activist groups, some businesses and some consumers, which has led to the emergence of the green economy consisting of green or pro-environment governments, companies, marketers and consumers. Global consumers' cooperation in achieving global sustainability is arguably more important than government or business actions as consumers have the greatest impact on sustainability or the lack thereof.

In most studies on environmental concern, it has been found that people are concerned with their impact on the environment and the deterioration thereof (Takács-Sánta, 2007) and these levels of concern have been increasing especially in the last three decades (Kim & Choi, 2005; Synodinos & Bevan-Dye, 2014). This increase in environment concern should translate into green consumer behaviour, i.e. the purchase and use of products and services which are environmental friendly. While some prior research studies indicate a significant positive relationship between environmental concern and green consumer behaviours (Davari & Strutton, 2014; Kim & Choi, 2005) with some even finding environmental concern to be a predictor of green consumer behaviours (Sinnappan & Rahman, 2011), this is not always the case. Other researchers have found that more consumers in the modern society are concerned about the environment than has translated into environmentally friendly behaviours and the purchase of green products (Fisher, Bachman, & Bashyal, 2012; Flynn, Bellaby, & Ricci, 2009; Young, Hwang, McDonald, & Oates, 2010). This gap between green concern and green behaviour is known as the 'green gap' (Kennedy, Beckley, McFarlane, & Nadeau, 2009; Nielsen, 2011).

The efforts made by green consumers to purchase green products and support green initiatives have been hindered by several constraints to adopting green lifestyles. Addressing these constraints will assist in decreasing the green gap globally. This research investigates the extent of the green gap in an emerging market and surfaces some of the perceptions respondents have regarding green behaviour which might indicate reasons these consumers give for not adopting green lifestyles. de Barcellos, Krystallis, de Melo Saab, Kügler, and Grunert (2011) indicate that research on the green gap has been scarce in developing countries, such as South Africa. Without the cooperation of emerging market consumers in achieving sustainability, the efforts of developed nations' governments, business and consumers is unlikely to be enough to save the planet. It will ultimately be vital to garner the support and cooperation of the emerging market consumers as they represent 80% of the world's population (European Central Bank, 2017).

The mission of this chapter is to expose the reader to research conducted on emerging market consumers to determine the existence of, and reasons given for, the green gap among these consumers. After reading this chapter, the reader will understand a key sustainability concern which is understanding of the challenges to getting emerging market consumer cooperation in achieving global sustainability goals. The reader will also be exposed to recommended solutions to enhance green behaviour among these consumers so as to ultimately better achieve global sustainability.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

THEORETICAL FRAMEWORK

Various social-psychological theories have been used by researchers of green behaviour to understand this behaviour (Stern, 2000). However, the Knowledge Attitude-Behaviour model has been used widely to describe behaviour change (Derzon & Lipsey, 2002). In the context of green behaviour it represents a linear model which explains that environmental awareness (knowledge) influences environmental concern (attitude) which in turn influences pro-environmental behaviour (Kamate et al., 2009). This study focuses specifically on the concern-behaviour link in the model by investigating the existence of a gap between concern and behaviour and possible reasons for this gap.

Green Consumer Behaviour

There are several terms which have been used in past studies to describe green consumer behaviour such as 'ecological conscious consumer behaviour (ECCB)' (Straughan & Roberts, 1999), 'pro-environmental consumer behaviour' (Kaufmann, Panni, & Orphanidou, 2012), 'environmentally conscious consumer behaviour' (Gan, Wee, Ozanne, & Kao, 2008), 'environmentally friendly consumer behaviour' (Thøgersen & Ölander, 2003) and 'green consumer behaviour' (Jansson, Marell, & Nordlund, 2010). This section uses these names interchangeably.

Green consumers are understood to be people who have a particular interest in, and awareness of 'green' issues and make an ongoing attempt to change their behaviours to protect the environment (Chen & Chai, 2010). Moisander (2007) states that green consumers are characterised by the willingness to use their purchasing power to cause a social change. With the purpose of reducing the negative effect on the environment they engage in behaviours of recycling materials, buying green products, being aware of and supporting companies which are green, checking labels and packaging to see if they are environmentally friendly and adopting behaviours which lessen or reduce green issues (Albayrak, Caber, Moutinho, & Herstein, 2011; Laroche, Bergeron, & Barbaro-Forleo, 2001) such as conserving energy and water and supporting conservation campaigns such as 'Save the Rhino'.

Environmental Concern

Environmental concern or concern for the natural environment (Hartmann & Apaolaza-Ibáñez, 2012) can be defined "as a global attitude with indirect effects on behaviour through behavioural intention" (Kaufmann et al., 2012, p. 53). Environmental concern is an important attitude in the struggle for the sustainability of the environment. According to Pagiaslis and Krontalis (2014), ecological or environmental concern is a concept of general belief that is an antecedent of more specific concepts such as green knowledge and environmental beliefs associated with green products. The levels of environmental concern across the globe have been increasing steadily. In America for example, studies show that there was an increase in environmental concern from 62% to 77% between 2004 and 2006 (Ryan, 2006) and in a recent study by van Riper and Kyle (2014) high levels of environmental concern amongst US respondents were found. Environmental concern has also become important for the international community too. In a study in Hong Kong, 80% of respondents expressed dissatisfaction with the city's environmental quality (Lee, 2008) indicating concern for the environment. In the United Kingdom, approximately 47% of consumers have favourable attitudes towards organic foods (Albayrak et al., 2011). Studies of various aspects of environmental concern in several populations in South Africa have found environmental

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

concern for pollution, waste (Rousseau & Venter, 2001), air and water (Berndt & Petzer, 2011; Davari & Strutton, 2014; Kim & Choi, 2005; Straughan & Roberts, 1999) however levels of environmental concern have generally been found to be lower in developing nations than in developed nations (Paul, Modi & Patel, 2016).

In some cases a positive correlation has been found between the environmental concern and environmentally friendly behavior, and environmental concern has been found to predict green behavior (Kaufmann et al., 2012; Lee, 2008; Sinnappan & Rahman, 2011). However this concern does not always match behaviour and a green gap has been found between concern and behaviour.

The Green Gap

Generally individuals consider themselves as eco-friendly or sensitive to the environment but their behaviour often contradicts their confessed sensitiveness (Albayrak et al., 2011; Fisher et al., 2012). This gap has been called the value-action gap (Honabarger, 2011), the environmental values-behaviour (EVB) gap (Kennedy et al., 2009), and the 'green gap' (Honabarger, 2011).The 'green gap' can also be defined as "the observed disparity between people's reported concerns about key environmental, social, economic or ethical concerns and the lifestyle or purchasing decisions that they make in practice" (Flynn et al., 2009, p. 158).

Evidence of the green gap: There is compelling evidence supporting the existence of the green gap at least in developed nations. For example, in a Canadian study done in 2004, it was shown that 72.3% of the respondents stated they were concerned about the environment but their actions did not support their concern as only 10.8% stated their lifestyles were supportive of the environment (Kennedy et al., 2009, p. 156). Similarly, a global survey done by McKinsey & Company indicated that 87% of the participants were concerned about the environmental and social impact caused by their purchase behaviour but only 33% admitted to have bought products that assist in sustaining the environment (Bonini & Oppenheim, 2008). More recently in a study by Nielsen, it was shown that 83% of consumers in the world are aware of the need to implement programmes to assist with environmental recovery yet less than 20% are willing to pay more for their green products (Nielsen, 2011).

The above studies mostly reflect research done in developed countries. Few studies have been conducted in developing nations. A study conducted in Turkey which looked at consumer skepticism towards green products found a disparity between green consumer behaviour and environmental concern (Albayrak et al., 2011). Another study conducted in India explored the green concern and behaviour in the lodging industry and found that respondents were conscious of environmental issues but they still did not adopt green lifestyles, because they were not willing to pay a premium price (Manaktola & Jauhari, 2007). Pantelic, Sakal, and Zehetner (2016) found that their Serbian sample also exhibited positive attitudes towards sustainability but lacked the corresponding actions. In South Africa, some studies have been done on environmental perceptions, awareness and behaviour (e.g. Anderson, Romani, Phillips, Wentzel, & Tlabela, 2007). A study conducted in the Durban Municipality researched making laws at local government level to adapt to climate change (Roberts, 2008). However, no studies could be found that specifically investigate the green gap in South Africa. This study aims to fill this research gap.

Reasons for the Gap: Understanding green behaviour is far more complicated than previously thought (Gifford & Nilsson, 2014) and determining the reasons or the barriers for consumers to adopt green lifestyles has been said to be a complex issue (Kaufmann et al., 2012). While individuals can state that

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

they value the environment, in some instances other issues take precedence over their concern for the environment e.g. financial security and safety (Kennedy et al., 2009). Han, Hsu, and Lee (2009) state that monetary and non-monetary costs are reasons for the small numbers of eco-friendly consumers who are in the market. Several reasons have been proposed for why consumers do not adopt ecologically conscious consumer behaviour:

- **Green Products Are Perceived to be Expensive:** Green products are, and are perceived to be, more expensive yet provide the same functions (Bennet & Williams, 2011). Although long-term cost savings may come from using energy efficient products like hybrid cars and light bulbs, initial costs are usually higher (Stephenson & Rodriquez, 2014). Majláth (2010) states that price is the biggest reason that consumers do not buy green products. A study conducted in India found high prices as a major barrier to organic food consumption as Indian customers are price sensitive compared to developed nations (Yadav & Pathak, 2016, p. 123).
- **Green Product Availability:** Takács-Sánta (2007) argues that it is not the weakness of environmental concern but the lack of alternatives, which jeopardises adoption of ecologically conscious behavior. Tilikidou (2007) found that some green products, such as organic wine, toiletries, pasta and clothing, are difficult to find. GrailResearch (2011) reports that 34% of their US respondents indicated low availability of green products as a reason for not buying these products. In India, also a developing market, green choices were perceived to be low (Paul et al., 2016).
- **Perception of Inferiority of Green Products in Terms of Quality and Efficiency:** Sharma (2011) states that one of the biggest obstacles to consumers' adopting a green lifestyle or purchasing eco-friendly products is the lack of trust in green products. Consumers' scepticism, or distrust of green products, reduces their ability to make a pro-environmental decision (Albayrak et al., 2011).
- **Perceived Consumer Effectiveness:** Perceived Consumer Effectiveness (PCE) is defined as the extent to which consumers believe that their individual efforts can have a positive impact on the environment (Chang, 2011; Kim & Choi, 2005). PCE is seen to be a significant predictor of a variety of ecologically conscious and pro-environmental consumer behaviours (Chang, 2011; Majláth, 2010; Rex & Baumann, 2007; Straughan & Roberts, 1999; Vicente-Molina, Fernández-Sáinz, & Izagirre-Olaizola, 2013). Roberts (1996) argues that PCE is the single strongest predictor of green consumer behaviour, surpassing both psychological and demographic factors.
- **Lack of Information About the Availability of Green Products:** Lack of information is one factor affecting the practicality of adopting a green lifestyle (Kollmuss & Agyeman, 2002).

These reasons are investigated in this study of South African consumers. Soyez (2012) states that in terms of environmental research, researchers ought to concentrate more on examining emerging economies that have an effect on the environment such as South Africa in order to understand the actions of consumers better.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

A STUDY OF EMERGING MARKET CONSUMERS

Research Methods

A descriptive research design using quantitative data was used to describe participants concern for the environment and green behaviour so as to determine the existence and extent of the green gap, as well as the reasons for a lack of green behaviour. The questionnaire was developed to measure the constructs of this study. Ethical clearance was obtained from the university's Research Office before the commencement of the study. All respondents were assured of their anonymity and confidentiality.

Measures

The questionnaire included the environmental behaviour questions from the ECCB scale developed by Roberts (1996) and used by Straughan and Roberts (1999) and more recently by several authors (e.g. Datta, 2011; McEachern & Carrigan, 2012). To measure environmental concern the Environmental Concern scale, also called the New Ecological Paradigm (NEP) scale developed by Dunlap, Kent, Angela, and Robert (2000) was used. This scale has also been used in many other studies (e.g. Amburgey & Thoman, 2012; Vikan, Camino, Biaggio, & Nordvik, 2007). The Perceived Consumer Effectiveness scale items were taken from the Straughan and Roberts (1999) questionnaire. The other questions on reasons for the lack of ECCB, were developed from the literature review. Previous use of the main measures indicated that these scales exhibit internal consistency and can thus be deemed reliable. For example, the Cronbach's alpha for the ECCB scale was 0.96, Environmental Concern scale 0.84 and the Perceived Consumer Effectiveness had an alpha scale of 0.72 (Roberts, 1996, p.223-224). Hair, Bush, and Ortinau (2009) state that a co-efficient alpha of less than 0.6 indicates a low to marginal (unsatisfactory) internal consistency. Therefore, looking at the Table 1, the constructs exhibited acceptable internal consistency reliability in this study.

Pilot studies are used to identify weaknesses or limitations of the questionnaire (Hair et al., 2009; Muijs, 2010). The pilot study sample was chosen to represent the research sample. A sample of 30 was selected to represent all the demographic variables relevant to the study in relation to race, gender and age. The sample was conveniently selected and this was seen as reasonable since the study was also using convenience sampling. The pilot study ensured that different types of respondents would be able to understand the research instrument. The pilot study was conducted at the same study location as the main survey. The length of the questionnaire was particularly taken into consideration while conducting the pilot test as it was seen as a critical factor to receiving unbiased data. The longest time it took a respondent to complete the questionnaire was 10 minutes but some respondents were able to complete it in 5 minutes. It was decided that this was an acceptable time for respondents to complete the questionnaire

Table 1. Cronbach alpha scores for the current research instrument

Scale	Cronbach Alpha
Ecologically conscious consumer behavior (ECCB)	0.88
Perceived Consumer Effectiveness (PCE)	0.67
Environmental Concern (EC)	0.76

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

without negatively affecting response rate. Therefore, there were no changes in terms of the length of the questionnaire. Pilot study respondents were also asked to give feedback on the questionnaire. They experienced no difficulty in answering the questions therefore no changes were made to the research instrument. The original Likert scale format was used where 1=*strongly agree* and 5= strongly *disagree.*

The Sample

Since the research investigated the 'green gap', which is the difference between the levels of concern and the purchasing behaviour of consumers, an adult population was seen as an appropriate population since they possess purchasing power. In the South African constitution any person older than 18 is considered to be an adult, and thus has the capacity to make their own decisions (Strode, Slack, & Essack, 2010). The study took place in a municipality in South Africa with approximately 423 000 people who are over the age of 15 with 53% female and 47% male. The race distribution of residents is approximately 81% African, 10% Indians, 6% White and 3% Coloured (StatisticsSA, 2011).

Since the questionnaire included a large number of constructs each with multiple measures, it was fairly lengthy, thus, needed to be distributed to respondents where it would be convenient for them to complete. The study site chosen was the Mkondeni Test Driving Centre (MTDC) Licensing Department. This study site was chosen because it is the place where all residents have to go to book their learners and driving tests, to be tested for their learner and driving licenses, and to renew their licenses every 5 years, and thus, it provided access to a large number of relevant members of the target population. There are also usually fairly long queues thus providing people who may be more likely to have time to answer the questionnaire, thereby improving the response rate. The MTDC is ideal for data collection as it is the only testing centre in the city and the people who go there are over the age of 18 years, due to legal age restriction for driving. It is acknowledged that any study site is likely to have some limitations. In this case the site may exclude certain elements of the population, for example, those who do not drive. Overall it was believed that the benefits of the site outweighed the limitations, as the site provided a good cross-section of respondents from all race groups, genders and ages above 18. Other study sites such as shopping malls were considered to be inferior as they have been over-used in consumer behaviour studies in the past and are also unsuitable for lengthy questionnaires. Data was collected over a period of a month, 3 days per week, chosen to ensure all days were eventually covered during the month.

At the confidence level of 95% and with a 5% confidence interval, a sample of 378 was desired. Using non-probability, convenience sampling 378 questionnaires were distributed and 330 questionnaires returned of which 317 were usable. This gave an effective response rate of 84%. The demographic profile of the sample is presented in Table 2.

As illustrated in Table 2, the gender and race profile is not too dissimilar to that of the municipality's population, although the sample is somewhat skewed in terms of age with the majority of respondents being in the age groups 18 to 30. In terms of the level of education of this sample, it indicated a highly literate group as the majority (98.4%) of respondents hold a National Senior Certificate (NSC) qualification and above. The NSC qualification is the national school leaving certificate after 12 years of schooling. This is in contrast to the municipality statistic indicating that only approximately 24% of the municipality's population hold a NSC or higher (StatisticsSA, 2011). It should be kept in mind however that the study was restricted to adults while the city statistics reflect all ages. Thus, overall it is felt that this sample bears close resemblance on demographics, to the city's adult population.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 2. Demographic profile of the sample

Demographics	Frequency (Percentage)						Missing
Gender	**Male**	**Female**					
	160(50.5)	144(45.4)					13 (4.1)
Education	**Below matric**	**NCS**	**Diploma/ degree**	**Postgrad**			
	5 (1.6)	122(38.5)	144(36)	60(18.9)			16(5)
Place of residence	**Rural**	**Township**	**CBD**	**Suburban**			
	41(12.9)	61(19.2)	41(12.9)	182(47.9)			22 (6.9)
Race	**African**	**White**	**Indian**	**Coloured**	**others**		
	233 (73.5)	16 (5)	37 (11.7)	13(4.1)	2(0.6)		16(5)
Age	**18-20**	**21-30**	**31-40**	**41-50**	**50 &above**		
	109 (34.4)	160 (50.5)	12 (3.8)	12 (3.8)	6 (1.9)		18(5.7)
Household income	**Under 40k**	**40001-80k**	**80001-160k**	**160001-320k**	**320001-640k**	**1.2million & above**	
	99(31.2)	39(12.3)	46(14.5)	21(8.5)	46(14.5)	8 (2.5)	52 (16.5)

Results

After reversing negatively worded item scores, composite scores were created for each construct representing the mean score for the construct i.e. for Environmental Concern (EC), Ecologically conscious consumer behaviour (ECCB) and Perceived Consumer Effectiveness (PCE).

The Green Gap

As with other studies on the green gap (e.g. Nielsen, 2011), the difference between ecologically conscious consumer behaviour (ECCB) and environmental concern (EC), was calculated. In terms of an equation, the Green Gap = ECCB - EC (Nielsen, 2011). If the mean of the ECCB construct is greater (i.e. showing more green behaviour) than the mean for the EC construct, then a positive gap exists (there is no 'green gap') and there is more action towards a sustainable environment than there is concern. The green gap occurs when the ECCB mean is less than the EC mean. The results of this study indicate a green gap of -.661. Thus concern is greater than behaviour. This difference in composite scores is significant $t(58) = -6.671$, $p < .000$(2-tailed) and the eta squared statistic (.43) indicates a large effect size. This suggests that the respondents of this study have higher levels of concern than behaviour. This is consistent with a global study conducted by Nielsen which found that 87% of the participants were found to be concerned about the environment but only 33% converted their concern into action when they bought products. In the current study 73% of respondents were concerned but only 22% converted their environmental concern into green consumer behaviour. Possible reasons for the lower levels of behaviour were then explored.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Reasons for the Green Gap

This section is divided into two parts, firstly a discussion of Perceived Consumer Effectiveness as a possible reason for lack of ECCB, and secondly other reasons for the lack of ECCB.

Perceived Consumer Effectiveness (PCE) is defined as the extent to which consumers believe that their individual efforts can make a positive impact on the environment (Chang, 2011; Kim & Choi, 2005). Thus consumers may not behave in an environmentally-friendly manner because they do not believe their actions will make a difference (Straughan & Roberts, 1999). In this study the composite mean score for PCE was 2.17 (STD = .691) where 1 represents a highest PCE and 5 the lowest PCE. Fifty eight percent of the respondents, as well as the relatively low mean (2.17) indicates that respondents believe that their individual actions can make a difference towards the sustaining of the environment. Thus it seems that a lack of perceived effectiveness should not be the reason for the low levels of ECCB. Other reasons are investigated below.

Table 3 indicates that the reasons for the lack of green consumer behaviour in this sample were predominantly the perceptions of a lack of promotion of green products (M=2.34), the lack of availability of green products (M=2.66), that green products are not clearly labelled (M=3.14) and the lack of mechanisms to support a green lifestyle (2.77) where 1 = strongly agree and 5 = strongly disagree.

BUSINESS AND POLICY IMPLCATIONS AND RECOMMENDATIONS

Lee (2008) argues that environmental concern is the second top predictor of green purchasing behaviour. In an application to the eco-hospitality industry, Han et al. (2009) found that there is a significant relationship between level of environmental concern and the number of people who intend to stay at an Eco-hotel. Similarly Laroche et al. (2001) state that there is positive relationship between the willingness of consumers to pay a premium price and the extent of environmental concern. Thus it seems environmental concern may be a necessary prerequisite to environmental behaviour. Similar to other studies

Table 3. Other reasons for the green gap

Reasons for the 'Green Gap'	Frequency (Percentage)					
Statement	**ATSE**	**N**	**DTSE**	**Missing**	**Mean**	**Std dev.**
Product quality of green products is inferior	84 (26.5)	98 (30.9)	125 (39.5)	10 (3.1)	3.22	1.21
Promotion of eco-friendly products is lacking	197 (62.1)	56 (17.7)	58 (18.3)	6 (1.9)	2.34	1.09
Unable to distinguish between green and conventional products	104 (32.8)	94 (29.7)	109 (34.4)	10 (3.1)	3.03	1.14
Green products are not easily available	152 (38)	81 (25.6)	78 (24.8)	6 (1.9)	2.66	1.09
I am not aware of any green products	64 (20.2)	60 (18.9)	188 (59.3)	4 (1.3)	3.55	1.14
I don't trust green branded products	45 (14.2)	77 (24.3)	191 (60.2)	4 (1.3)	3.65	1.01
Green products are clearly labelled	102 (32.1)	88 (27.8)	121 (58.2)	6 (1.9)	3.14	1.11
There are no or limited mechanisms available to practice a green lifestyle	130 (41)	99 (31.2)	82 (25.9)	6 (1.9)	2.77	1.11

ATSE= Agree to some extent; N= neutral; DTSE= Disagree to some extent

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

(e.g. Lee, 2008; Nielsen, 2011) the current study found that respondents showed high levels of concern about the environment. However it is behaving in an environmentally friendly way that is the required consumer cooperation essential in the fight against the depletion of the environment. Concern may be necessary but studies have found that it is not always sufficient to ensure behaviour and a green gap has often been found between concern and behaviour (Laroche et al., 2001; Nielsen, 2011). In this study, ECCB item scores indicate that respondents have participated in some actions that are pro-environmental e.g. reducing electricity consumption but on the whole, green behaviour lags behind concern. Only 13% of respondents can be said to frequently act in a green manner. Although very low, this figure is not totally dissimilar to a similar global study where the percentage was 22% (Nielsen, 2011). Thus like many other countries, this study of South African consumers also indicates a significant gap between environmental concern and behaviour.

The second objective of this research was to try to understand why green behaviour may be lacking in developing nations such as South Africa. Barriers to adopting of the green lifestyle are evident in prior studies (e.g. Kollmuss & Agyeman, 2002; Nielsen, 2011). The participants of this study also indicated that these barriers impede their green behaviour. The main reason for not behaving in a green manner appears to be a perception of a lack of promotion of green products. If consumers are not made aware of the existence of green products or of the benefits of these products to consumers and the environment, then consumers cannot be expected to cooperate in achieving global sustainability by purchasing green products. Promotion is a fundamental aspect of the marketing mix and necessary for the adoption of these products. Better information by organisations that are promoting the adoption of green products and services is vital to gaining the trust of consumers in the market (Ozaki, 2011). Producers of green products need to address this problem by actively promoting their products so that consumers recognise green products as strong alternatives to traditional products which are more harmful to the environment. Money is needed to aggressively promote green products in all forms of media. An integrated marketing communication plan needs to be designed and implemented.

Eco-labels are also a good way to notify consumers that products are environmentally friendly. According to Rashid (2009, p.134) eco-labels are eye-catching tools that notify consumers. The Global Ecolabelling Network states that an eco-label is a label which "identifies overall environmental preference of a product or service within a specific product/service category based on life cycle considerations" (Global Ecolabelling Network, 2011, para4). To be of use in steering consumers towards green products, these labels have to be credible, meaningful and recognisable to consumers (D'Souza, Lamb & Taghian, 2006). Third party environmental labelling has superior reliability as they involve a 3rd party evaluation of a company's environmental principles (D'Souza et al., 2006). Once a manufacturer passes the certification process the product is awarded a seal or symbol which is a sign that the producer's product has been deemed environmentally safe (Engels, Hansmann & Scholza, 2010). As independent verification is used to determine if a manufacturer meets the criteria, the consumers trust these labels more in comparison to the manufacturers' self-installed labels (Grankvist, Dahlstrand & Biel, 2004). Consumers' assessment of environmental performance of brands is usually affected completely by environmental symbols (Roe, Teisl & Rong, 2001). Unfortunately there is no independent third party to officially certify environmentally friendly products in South Africa (Scott & Vigar-Ellis, 2014) however these authors recommend organisations apply to use international symbols or alternatively use terms such as non-harmful, biodegradable or recyclable on packaging as these were found in their South African study, to be associated with environmentally friendly packaging.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The government also has a role to play here. Firstly, the development of a national environmental certification process and symbol would ensure that environmental claims made by companies are legitimate. Secondly, having one symbol that consumers can look out for and trust will assist them in identifying truly green products. This is important as Brennan and Binney (2008) state that green washing (the false claims made by companies about the greenness of their products) has resulted in consumer skepticism. Scott and Vigar-Ellis (2014) also state that where there is no national symbol and certification is industry specific, consumers are likely to become confused by what constitutes environmentally friendly products. Thus to alleviate green washing, consumer skepticism and consumer confusion, and national certification system and symbol is required.

A similar potential reason for the lack of green behaviour is the perceived lack of availability of green products in the marketplace. While the above discussion assumes green products exist but are not effectively promoted, here the respondents indicate a perception that there are not many green products available. While the number of green alternatives is likely to be less than in developed countries, green products certainly do exist and the challenge to the producers of these products is to increase consumer awareness of these and to make them more readily available to consumers. This may include more aggressive advertising of these products as mentioned above but distribution of green products also plays an important role in giving a competitive advantage (Smith & Perks, 2010). Improved availability of green products means that consumers need to find green products whenever they need them. Green products have to be in close proximity to consumers. This can be done by each store having a green product shelf easily visible in the supermarket. Green product manufacturers can also investigate joint awareness-building campaigns undertaken with leading retailers or distributers of these products and more intensive distribution. Certain retailers, such as Woolworths have positioned themselves as supporting the green initiative and thus green products assisting them to achieve this position while maintaining product quality standards may be well received. Of course organisations that have not produced green alternatives can look at greening their processes and products to make more green products available.

A major aspect of green behaviour is green activities as opposed to the purchasing of green products which only represents one aspect of green behaviour. Green activities are part of a broader green lifestyle and include reducing the use of non-renewable or scarce resources e.g. electricity, fuel and water; recycling and reusing; and supporting animal and plant conservation campaigns. The second most likely reason for a lack of green behaviour amongst this sample of South African consumers was the perceived lack of mechanisms to practice a green lifestyle. A lack of the necessary infrastructure or a civic movement promoting and supporting green behaviour may well cause the green gap (Pantelic et al., 2016). While businesses may support these initiatives, these mechanisms often need to be supplied, or initiated by government or non-profit organisations. Thus all parties in society need to share the responsibility of conserving the planet. However, specifically in terms of mechanisms to support a green lifestyle, a basic example of such mechanisms is the provision of recycling stations. In comparison to most developed countries, these are sorely lacking in South Africa. Social marketing campaigns can also be a critical marketing activity required here. Eskom, South Africa's only supplier of electricity, ran a media campaign aimed at convincing the general public to reduce their electricity consumption during the peak demand hours of 18h00 to 21h00. The Power Alert campaign was successful in reducing peak time load between 100 and 900 megawatts, depending on the level of criticality (Etzinger, 2011). Eskom's provision of energy efficient light bulbs to replace traditional bulbs was also successful. This initiative has seen the rollout of 54 million compact fluorescent lamps saved more than 1000 megawatts (Eskom, 2015). Thus more needs to be done by government at national and local level to make it an easy option for consumers to adopt the green lifestyle.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

As with most study sites, the chosen site had some limitations in that the sample appeared to be skewed towards a slightly younger and more educated sample than perhaps other sites would have. Older and less educated respondents may have had different concerns, behaviours and perceptions. The highly literate sample however did have the advantage of minimising language problems with using an English questionnaire with a predominantly African sample for whom English would have been a second language. The NCS qualification which the majority of respondents had attained includes English so translation problems were not believed to hinder the quality of the data. As the combined effort of all consumers is required to achieve global sustainability, future studies should investigate the perceptions, concerns and behaviours of the less literate emerging market consumers. Although this is acknowledged to be a more difficult task, qualitative studies conducted in mother tongues could provide valuable insights into this important, and relatively large, component of emerging markets. The study was focused in one city, in one, relatively small, emerging market and it is possible that other regions may have yielded different results. With the number of studies beginning to be done in emerging markets such as China and India, a comparative study would be useful. Finally, neutral or indecisive scores were recorded for a few of the concern statements. This may need more in-depth investigation. Why were respondents indecisive? Was it because they didn't understand the statement or because there were mediating factors? Environmental concern and behaviours are complex constructs which may be productively investigated using more in-depth qualitative methods. Could for example, relatively higher concerns for poverty, health and safety make green behaviour impractical for emerging market consumers?

CONCLUSION

As in many other countries a green gap exists between the environmental concern and behaviours of this sample of South Africa consumers. Consumer cooperation is arguably more important in sustaining the global environment than the actions of businesses and governments, thus understanding the reasons for this lack of green behaviour is vital in achieving consumer cooperation. In this chapter, a study of emerging market consumers green gap and possible reasons therefore was undertaken. Barriers or inhibitors of environmental behaviour in this emerging market were found to be the perceived lack of green products and promotion of those that do exist, as well as a lack of mechanisms to assist in the adoption of green activities such as recycling, reuse and support of conservation initiatives. These emerging market consumers are concerned about the environment but these barriers prevent the behaviours required to sustain the planet. To assist consumers to do their bit for global sustainability, businesses and governments must play their respective parts as indicated in the recommendations of this chapter. Ultimately a great deal of cooperation between the major stakeholders: governments, businesses and consumers is necessary to have a positive impact on the sustainability of the environment.

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors. Permission for the study was granted by the KZN Road Traffic Inspectorate.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

REFERENCES

Albayrak, T., Caber, M., Moutinho, L., & Herstein, R. (2011). The influence of skepticism on green purchase behavior. *International Journal of Business and Social Science*, *2*(13), 189–197.

Amburgey, J. W., & Thoman, D. B. (2012). Dimensionality of the New Ecological Paradigm Issues of Factor Structure and Measurement. *Environment and Behavior*, *44*(2), 235–256. doi:10.1177/0013916511402064

Anderson, B. A., Romani, J. H., Phillips, H., Wentzel, M., & Tlabela, K. (2007). Exploring environmental perceptions, behaviors and awareness: Water and water pollution in South Africa. *Population and Environment*, *28*(3), 133–161. doi:10.100711111-007-0038-5

Bennet, G., & Williams, F. (2011). *Mainstream Green: Moving sustainability from niche to normal*. Chicago: Ogilvy & Mather.

Berndt, A., & Petzer, D. (2011). Environmental concern of South African cohorts: An exploratory study. *African Journal of Business Management*, *5*(19), 7899–7910.

Bonini, S., & Oppenheim, J. (2008). Cultivating the green consumer. *Stanford Social Innovation Review*, *6*(4), 56–61.

Brennan, L., & Binney, W. (2008). Is it green marketing, greenwash or hogwash? We need to know if we want to change things. In *Proceedings of Partnerships, proof and practice: International nonprofit and social marketing conference*. University of Wollongong.

Chan, R. (2001). Determinants of Chinese consumers' green purchase behavior. *Psychology and Marketing*, *18*(4), 389–413. doi:10.1002/mar.1013

Chang, C. (2011). Feeling ambivalent about going green. *Journal of Advertising*, *40*(4), 19–32. doi:10.2753/JOA0091-3367400402

Chen, T. B., & Chai, L. T. (2010). Attitude towards the environment and green products: Consumers' perspective. *Management Science and Engineering*, *4*(2), 27.

D'Souza, C., Taghian, M., & Lamb, P. (2006). An empirical study on the influence of environmental labels on consumers. *Corporate Communication: An International Journal*, *11*(2), 162–173. doi:10.1108/13563280610661697

Datta, S. K. (2011). Pro-environmental concern influencing green buying: A study on Indian consumers. *International Journal of Business and Management*, *6*(6), 124.

Davari, A., & Strutton, D. (2014). Marketing mix strategies for closing the gap between green consumers' pro-environmental beliefs and behaviors. *Journal of Strategic Marketing*, *22*(7), 563–586. doi:10.1080/0965254X.2014.914059

de Barcellos, M. D., Krystallis, A., de Melo Saab, M. S., Kügler, J. O., & Grunert, K. G. (2011). Investigating the gap between citizens' sustainability attitudes and food purchasing behaviour: Empirical evidence from Brazilian pork consumers. *International Journal of Consumer Studies*, *35*(4), 391–402. doi:10.1111/j.1470-6431.2010.00978.x

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

De Sherbinin, A., Carr, D., Cassels, S., & Jiang, L. (2007). Population and environment. *Annual Review of Environment and Resources*, *32*(1), 345–373. doi:10.1146/annurev.energy.32.041306.100243 PMID:20011237

Derzon, J. H., & Lipsey, M. W. (2002). *A meta-analysis of the effectiveness of mass communication for changing substance use knowledge, attitudes and behavior. In Mass media and drug prevention: Classic and contemporary theories and research* (pp. 231–258). Mahwah, NJ: Erlbaum.

Dunlap, R., Kent, D., Angela, G., & Robert, E. (2000). Measuring Endorsement of the New Ecological Paradigm: A revised NEP Scale. *The Journal of Social Issues*, *56*(3), 425–442. doi:10.1111/0022-4537.00176

Engels, S. V., Hansmann, R., & Scholz, R. W. (2010). Toward a sustainability label for food products: An analysis of experts' and consumers' acceptance. *Ecology of Food and Nutrition*, *49*(1), 30–60. doi:10.1080/03670240903433154 PMID:21883088

Eskom. (2015). *Eskom IDM Programme: Focus on Housing Sector of South Africa*. Retrieved 13 May 2017 from http://www.ieadsm.org/wp/files/Ncayiyana_CapeTown.pdf

Etzinger, A. (2011). *Eskom Intergrated demand Management*. Association of Municipal Electrical Utilities (AMEU) Convention. Retrieved 13 May 2017 from http://www.ameu.co.za/Portals/16/Conventions/Convention%202011/Papers/Eskom%20Integrated%20Demand%20Management%20-%20A%20Etzinger.pdf

European Central Bank. (2017). *Growing Importance of Emerging Markets*. Retrieved 13 May 2017 from https://www.ecb.europa.eu/ecb/tasks/international/emerging/html/index.en.html

Fisher, C., Bachman, B., & Bashyal, S. (2012). Demographic impacts on environmentally friendly purchase behaviors. *Journal of Targeting*, *Measurement and Analysis for Marketing*, *20*(3), 172–184. doi:10.1057/jt.2012.13

Flynn, R., Bellaby, P., & Ricci, M. (2009). The 'value-action gap' in public attitudes towards sustainable energy: The case of hydrogen energy. *The Sociological Review*, *57*(2_suppl), 159–180. doi:10.1111/j.1467-954X.2010.01891.x

Gan, C., Wee, H. Y., Ozanne, L., & Kao, T.-H. (2008). Consumers' purchasing behavior towards green products in New Zealand. *Innovative Marketing*, *4*(1), 93–102.

Gifford, R., & Nilsson, A. (2014). Personal and social factors that influence pro-environmental concern and behaviour: A review. *International Journal of Psychology*, *49*(3), 141–157. PMID:24821503

Global Ecolabelling Network. (2011). *What Is Ecolabelling?* Retrieved 13 May 2017 from http://www.globalecolabelling.net/what_is_ecolabelling

GrailResearch. (2011). *The Green Evolution*. Retrieved 13 May 2017 from http://www.grailresearch.com/pdf/Blog/Grail-Research-Green-Evolution-Study_240.pdf

Grankvist, G., Dahlstrand, U., & Biel, A. (2004). The impact of environmental labelling on consumer preference: Negative vs. positive labels. *Journal of Consumer Policy*, *27*(2), 213–230. doi:10.1023/B:COPO.0000028167.54739.94

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Hair, J., Bush, R., & Ortinau, D. (2009). *Marketing Research: In a digital information environment* (4th ed.). Boston: McGraw-Hill.

Han, H., Hsu, L.-T. J., & Lee, J.-S. (2009). Empirical investigation of the roles of attitudes toward green behaviors, overall image, gender, and age in hotel customers' eco-friendly decision-making process. *International Journal of Hospitality Management*, *28*(4), 519–528. doi:10.1016/j.ijhm.2009.02.004

Hartmann, P., & Apaolaza-Ibáñez, V. (2012). Consumer attitude and purchase intention toward green energy brands: The roles of psychological benefits and environmental concern. *Journal of Business Research*, *65*(9), 1254–1263. doi:10.1016/j.jbusres.2011.11.001

Honabarger, D. (2011). *Bridging the Gap: The Connection Between Environmental Awareness, Past Environmental Behavior, and Green Purchasing* (Masters thesis). American University, Washington, DC. Retrieved 13 May 2017 from http://www.american.edu/soc/communication/upload/Darcie-Honabarger.pdf

Jansson, J., Marell, A., & Nordlund, A. (2010). Green consumer behavior: Determinants of curtailment and eco-innovation adoption. *Journal of Consumer Marketing*, *27*(4), 358–370. doi:10.1108/07363761011052396

Juwaheer, T. D. (2005). An emerging environmental market in Mauritius: Myth or reality? *World Review of Entrepreneurship, Management and Sustainable Development*, *1*(1), 57–76. doi:10.1504/WREMSD.2005.007753

Kamate, S. K., Agrawal, A., Chaudhary, H., Singh, K., Mishra, P., & Asawa, K. (2009). Public knowledge, attitude and behavioural changes in an Indian population during the Influenza A (H1N1) outbreak. *The Journal of Infection in Developing Countries, 4*(1), 7-14.

Kaufmann, H. R., Panni, M., & Orphanidou, Y. (2012). Factors affecting consumers' green purchasing behavior: An integrated conceptual framework. *Amfiteatru Economic*, *14*(31), 50–69.

Kennedy, E. H., Beckley, T. M., McFarlane, B. L., & Nadeau, S. (2009). Why we don't" walk the talk": Understanding the environmental values/behaviour gap in Canada. *Human Ecology Review*, *16*(2), 151.

Kim, Y., & Choi, S. M. (2005). Antecedents of green purchase behavior: An examination of collectivism, environmental concern, and PCE. *Advances in Consumer Research. Association for Consumer Research (U. S.)*, *32*, 592.

Kollmuss, A., & Agyeman, J. (2002). Mind the gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research*, *8*(3), 239–260. doi:10.1080/13504620220145401

Laroche, M., Bergeron, J., & Barbaro-Forleo, G. (2001). Targeting consumers who are willing to pay more for environmentally friendly products. *Journal of Consumer Marketing*, *18*(6), 503–520. doi:10.1108/EUM0000000006155

Lee, K. (2008). Opportunities for green marketing: Young consumers. *Marketing Intelligence & Planning*, *26*(6), 573–586. doi:10.1108/02634500810902839

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Majláth, M. (2010). *Can Individuals do anything for the Environment? - The Role of Perceived Consumer Effectiveness.* Paper presented at the FIKUSZ '10 Symposium for Young Researchers, Budapest, Hungary.

Manaktola, K., & Jauhari, V. (2007). Exploring consumer attitude and behaviour towards green practices in the lodging industry in India. *International Journal of Contemporary Hospitality Management*, *19*(5), 364–377. doi:10.1108/09596110710757534

McEachern, M. G., & Carrigan, M. (2012). Revisiting contemporary issues in green/ethical marketing: An introduction to the special issue. *Journal of Marketing Management*, *28*(3-4), 189–194. doi:10.1080/0267257X.2012.666877

Moisander, J. (2007). Motivational complexity of green consumerism. *International Journal of Consumer Studies*, *31*(4), 404–409. doi:10.1111/j.1470-6431.2007.00586.x

Muijs, D. (2010). *Doing quantitative research in education with SPSS*. Thousand Oaks, CA: Sage Publications.

Nielsen. (2011). *The 'Green' gap between environmental concerns and the cash register*. Retrieved 13 May 2017 from http://www.nielsen.com/us/en/insights/news/2011/the-green-gap-between-environmental-concerns-and-the-cash-register.html

Ozaki, R. (2011). Adopting sustainable innovation: What makes consumers sign up to green electricity? *Business Strategy and the Environment*, *20*(1), 1–17. doi:10.1002/bse.650

Pagiaslis, A., & Krontalis, A. K. (2014). Green Consumption Behavior Antecedents: Environmental Concern, Knowledge, and Beliefs. *Psychology and Marketing*, *31*(5), 335–348. doi:10.1002/mar.20698

Pantelic, D., Sakal, M., & Zehetner, A. (2016). Marketing and sustainability from the perspective of future decision makers. *South African Journal of Business Management*, *47*(1), 37–47.

Paul, J., Modi, A., & Patel, J. (2016). Predicting green product consumption using theory of planned behavior and reasoned action. *Journal of Retailing and Consumer Services*, *29*, 123–134. doi:10.1016/j.jretconser.2015.11.006

Rashid, N. R. (2009). Awareness of eco-label in Malaysia's green marketing initiative. *International Journal of Business and Management*, *4*(8), 132–150. doi:10.5539/ijbm.v4n8p132

Rex, E., & Baumann, H. (2007). Beyond ecolabels: What green marketing can learn from conventional marketing. *Journal of Cleaner Production*, *15*(6), 567–576. doi:10.1016/j.jclepro.2006.05.013

Roberts, D. (2008). Thinking globally, acting locally—institutionalizing climate change at the local government level in Durban, South Africa. *Environment and Urbanization*, *20*(2), 521–537. doi:10.1177/0956247808096126

Roberts, J. A. (1996). Green consumers in the 1990s: Profile and implications for advertising. *Journal of Business Research*, *36*(3), 217–231. doi:10.1016/0148-2963(95)00150-6

Roe, B., Teisl, M. F., Rong, H., & Levy, A. S. (2001). Characteristic of consumer-preferred labelling policies: Experimental evidence from price and environmental disclosure for deregulated electricity services. *The Journal of Consumer Affairs*, *35*(1), 1–26. doi:10.1111/j.1745-6606.2001.tb00100.x

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Rousseau, G., & Venter, D. (2001). A multi-cultural investigation into consumer environmental concern. *SA Journal of Industrial Psychology*, *27*(1), 1–7. doi:10.4102ajip.v27i1.768

Ryan, B. (2006). Green Consumers A Growing Market for Many Local Businesses. *UWExtension, 1*(123), 1-2.

Scott, L., & Vigar-Ellis, D. (2014). Consumer understanding, perceptions and behaviours with regard to environmentally friendly packaging in a developing nation. *International Journal of Consumer Studies*, *38*(6), 642–649. doi:10.1111/ijcs.12136

Sharma, Y. (2011). Changing consumer behaviour with respect to green marketing–a case study of consumer durables and retailing. *International Journal of Multidisciplinary Research*, *1*(4), 152–162.

Sinnappan, P., & Rahman, A. A. (2011). Antecedents of green purchasing behavior among Malaysian consumers. *International Business Management*, *5*(3), 129–139. doi:10.3923/ibm.2011.129.139

Smith, E. E., & Perks, S. (2010). A perceptual study of the impact of green practice implementation on the business functions. *Southern African Business Review*, *14*(3), 1–29.

Soyez, K. (2012). How national cultural values affect pro-environmental consumer behavior. *International Marketing Review*, *29*(6), 623–646. doi:10.1108/02651331211277973

Statistics, S. A. (2011). Msunduzi Municipanilty. *Statistics SA*. Retrieved 13 May 2017 from http://www.statssa.gov.za/?page_id=993&id=the-msunduzi-municipality

Stern, P. C. (2000). New environmental theories: Toward a coherent theory of environmentally significant behavior. *The Journal of Social Issues*, *56*(3), 407–424. doi:10.1111/0022-4537.00175

Straughan, R. D., & Roberts, J. A. (1999). Environmental segmentation alternatives: A look at green consumer behavior in the new millennium. *Journal of Consumer Marketing*, *16*(6), 558–575. doi:10.1108/07363769910297506

Strode, A., Slack, C., & Essack, Z. (2010). Child consent in South African law: Implications for researchers, service providers and policy-makers. *SAMJ: South African Medical Journal*, *100*(4), 247–249. doi:10.7196/SAMJ.3609 PMID:20459973

Synodinos, C., & Bevan-Dye, A. (2014). Determining African Generation Y Students' Likelihood of Engaging in Pro-environmental Purchasing Behaviour. *Mediterranean Journal of Social Sciences*, *5*(21), 101–110.

Takács-Sánta, A. (2007). Barriers to environmental concern. *Human Ecology Review*, *14*(1), 26.

Thøgersen, J., & Ölander, F. (2003). Spillover of environment-friendly consumer behaviour. *Journal of Environmental Psychology*, *23*(3), 225–236. doi:10.1016/S0272-4944(03)00018-5

Tilikidou, I. (2007). The effects of knowledge and attitudes upon Greeks' pro-environmental purchasing behaviour. *Corporate Social Responsibility and Environmental Management*, *14*(3), 121–134. doi:10.1002/csr.123

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Tobler, C., Visschers, V. H., & Siegrist, M. (2012). Addressing climate change: Determinants of consumers' willingness to act and to support policy measures. *Journal of Environmental Psychology*, *32*(3), 197–207. doi:10.1016/j.jenvp.2012.02.001

United Nations. (2015). *World Population Prospects: The 2015 Revision*. Retrieved 13 May 2017 from: https://populationpyramid.net/world/2020/

United Nations. (2016). *Environment Annual Report 2016*. Retrieved 13 May 2017 from: http://web.unep.org/annualreport/2016/index.php

van Riper, C. J., & Kyle, G. T. (2014). Understanding the internal processes of behavioral engagement in a national park: A latent variable path analysis of the value-belief-norm theory. *Journal of Environmental Psychology*, *38*, 288–297. doi:10.1016/j.jenvp.2014.03.002

Vicente-Molina, M. A., Fernández-Sáinz, A., & Izagirre-Olaizola, J. (2013). Environmental knowledge and other variables affecting pro-environmental behaviour: Comparison of university students from emerging and advanced countries. *Journal of Cleaner Production*, *61*, 130–138. doi:10.1016/j.jclepro.2013.05.015

Vikan, A., Camino, C., Biaggio, A., & Nordvik, H. (2007). Endorsement of the New Ecological Paradigm A Comparison of Two Brazilian Samples and One Norwegian Sample. *Environment and Behavior*, *39*(2), 217–228. doi:10.1177/0013916506286946

Yadav, R., & Pathak, G. S. (2016). Intention to purchase organic food among young consumers: Evidences from a developing nation. *Appetite*, *96*, 122–128. doi:10.1016/j.appet.2015.09.017 PMID:26386300

Young, W., Hwang, K., McDonald, S., & Oates, C. J. (2010). Sustainable consumption: Green consumer behaviour when purchasing products. *Sustainable Development*, *18*(1), 20–31.

KEY TERMS AND DEFINITIONS

Eco-Labels: Symbols indicating that a product is environmentally friendly.

Environmental Concern: Consumer concern for the environment and the sustainability thereof.

Green Consumer Behavior/Ecological Conscious Consumer Behavior (ECCB)/Pro-Environmental Consumer Behavior/Environmentally Friendly Consumer Behavior: The consumer behavior of supporting green initiatives such as energy conservation as well as buying green products which do not harm the environment.

Green Consumers: People who have a particular interest in and awareness of environmental problems and make an ongoing attempt to change their behaviors to protect the environment.

Green Gap: The gap between consumers expressed environmental concern and their actual behavior.

Green Products: Environmentally friendly products that do not negatively affect the environment.

Perceived Consumer Effectiveness (PCE): The extent to which consumers believe that their individual efforts can have a positive impact on the environment.

This research was previously published in Promoting Global Environmental Sustainability and Cooperation edited by Sofia Idris, pages 112-135, copyright year 2018 by Engineering Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 3
Application of Circular Economy for Sustainable Resource Management in Kuwait

Osman Gulseven
American University of the Middle East, Kuwait

Jacques Mostert
American University of the Middle East, Kuwait

ABSTRACT

Circular economy is an alternative to traditional industrial system based on producing and consuming as much as possible. Contrary to produce and dispose model, circular economy emphasizes resource efficiency in both consumption and production cycle. This research aims to reveal potential role of circular economy with specific applications to small and medium sized enterprises in Kuwait. It is proposed that by applying circular economy concepts, Gulf Cooperation Council countries, particularly Kuwait, can achieve a competitive edge in global economy while minimizing the impact of industrial activities to the environment. Is it also proposed that small and medium sized enterprises tend to be the least efficient enterprises. Therefore, they have the highest potential for circular economy applications that lead to innovation, sustainability and resource efficiency.

INTRODUCTION

As early as the onset of the 1990s, "the public's demand for policies that encourage environmental protection [had become] more evident with each passing year" (Granzin & Olsen, 1991). The current zeitgeist in environmental policy and practice is experiencing significant challenges with the advent of the new regime in the United States of America. At this point, with a stronger presence in the global media, the topic of climate and environmental science has the opportunity to increase proposing sustainable solutions to avert climate and environmental disaster. One solution proposed in this article is the Circular Economy and its applications.

DOI: 10.4018/978-1-5225-7915-1.ch003

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Circular economy is a challenge to the traditional "take, make, and dispose model" which relies on large quantities of resources and energy. Whereas, displacement economy is the long-term economic growth generated by the creation of the new, and the displacement of the old, in a capitalist society, a circular economy proposes that a sustainable growth generated model of use and re-use is implemented as the base of economic behaviours (Lin & Lin, 2014). This concept refers to a revolutionary economic system based on usage of renewable energy, eliminations of toxic chemicals and recycling of waste. All of this is done voluntarily through motivationally designed mechanisms which maintain a competitive edge.

Achieving a circular, resource-efficient, and resilient economy requires innovation and investment in resource-efficient technologies, and creating better market conditions for sustainable products and services. This research aims to enhance the creative and innovative potential of Gulf Council Countries, (particularly Kuwait) by introducing multidisciplinary field of circular economy in small and medium enterprises (SMEs). Circular economy is an increasingly important field as the world's resources started showing signs of depletion. SMEs are integrated into the circular economy policy framework through research and development of a variety of solutions.

There is an academic and social consensus for the need to provide an extended taxonomy of strategic sustainability behaviours in SMEs. Following the examples of some large enterprises, SMEs need to remove the barriers that impede the exploitation of circular economy benefits. For example, in energy efficiency, a sector of circular economy, Trianni and Cagno (2012) analysed the barriers to its adoption by SMEs. Following their work, the three pillars of the circular economy are addressed within the context of SMEs: Innovation, Sustainability, and Efficiency. Thus, three tier taxonomy is suggested in order to aid SMEs to develop sustainable growth and economic diversification: innovation, sustainability and efficiency. The first tier forms the foundation of the triadic structure. Enveloped in the first tier three supporting factors exist: public-private partnerships, policy development and incentive creation. The second tier proposes that sustainability through circular economies is central to strategic development initiatives and finally, the third tier depends on efficiency in execution of policy, strategy and implementation of sustainable resource management.

There have been sector wide initiatives, especially in large enterprises, to implement circular economic concepts such as automotive industry or chemical industry. However, limited research has been done on the potential to integrate SMEs into a circular economy. Specifically, none has been discussed within the context of Kuwaiti applications. This research aims to close this gap by promoting ideas for Kuwaiti SMEs to apply. Literature review discusses the past research regarding the circular economy with a focus on small and medium enterprises. Next section discusses the role of innovation in enterprise management followed by discussions regarding the roles of sustainability and resource efficiency, respectively. Challenges and opportunities for SMEs operating within the State of Kuwait are presented with concrete examples. Finally, the last section summarizes the research findings.

LITERATURE REVIEW

In some articles, circular economy is also referred to as green economy, efficient resource management, or even reutilization of resources. Therefore, in the literature review a comprehensive analysis has been performed to include all different aspects of circular economy. In the literature there exists a wide range of studies ranging from geographical location based policy taxonomies to product specific applications

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

of circular economy. Here, both the research on the theoretical economic framework as well as critics of circular economy is included.

Among the geographically identified applications, China is one of the most researched countries. As mentioned by Xinan and Yanfu (2011) there is an increasing government involvement in the process of China's economic transformation and this involvement also plays a decisive role in implementation of circular economy. In a recent article, Wu et al. (2014) discuss the effectiveness of the policy of circular economy in China. The authors find that the efficiency of the Chinese state policy on implementation of circular economy varies within each region. Therefore, the authors suggest that promoting the adaptability of the regional policies within the comprehensive state plan is a key concern for realizing sustainable development. This research is in line with Qing et al. (2011) who analyzed the circular economic efficiency in Western China. In another related article, Qiping (2011) suggests an action plan for small and medium-sized resource based cities in Zibo City of Shandong Province in China. Kun and Jian (2011) suggest that low extraction, high use and low emissions could be successfully implemented in China's oil and gas industry.

Europe is among the leading regions when it comes to utilizing circular economy concepts by means of institutional supervision and policy setting. As mentioned by Despeisse et al. (2015) the recent European Directive on end-of-life vehicle treatment will affect the policies of major car manufacturing countries such as UK and Japan where automakers will need to reconsider their initial production stage to ease the end-of-life disposal. The redesigned manufacturing systems shall consider the recycling process to recover energy and reduce material waste. A similar act is imposed by the State of Germany where the new legislation was legalized, namely the German Closed Cycle Management Act. As mentioned by Nelles et al. (2016), this act aims to turn the waste management into an integrated resource management system. This act is in line with the global emission reduction agreed in Kyoto protocol. The German State aims to increase the recycled input material use to 20% to achieve the target set by the German Kyoto agreement.

Besides China and Europe, several regional case studies are present in literature. Soo et al. (2016) perform a comparative life cycle component analysis for the car door materials for differentiated automobiles regarding their age and model. The authors claim that the vehicle designs have been improved to reduce environmental impact but more needs to be done for achieving a sustainable circular economy within the Australian auto industry. Abu-Ghunmi et al. (2016) discuss the water industry in Jordan where there is a big potential gain from the application of circular economy. The authors calculate that there is a strong economic case for transforming the Jordanian water industry into circular economic framework. Ilic and Nikolic (2016) perform a case study on the waste resource management for Serbia. The authors suggest that there is a big potential for improvement in the Serbian waste management system. However, this potential is deeply underutilized due to bottlenecks such as low levels of reuse, recycling and recovery of waste and weak economic incentives.

Industry specific applications are also widely present in the literature. Circular economy is specifically applied in the waste management systems. Applications of circular economy are mostly discussed within the sector of the waste input and output analysis. As discussed by Li (2012), sustainable development can be achieved by thoroughly implementing a circular economy principles in an enterprise setting. This can eliminate or at least minimize the waste resulted due to production. George et al. (2015) presents a theoretical model which is based on a polluting input and recyclable input. Their model suggests that environmental quality can be improved as the recycling ratio for production increases. Bhaskar et al.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

(2016) advocate circular economy in the waste biorefinery system. Mohan et al. (2016) suggest that biorefinery transforms waste into a renewable material that recovers biobased energy through sustainable mechanisms. Liguori and Faraco (2016) state that biorefineries where the lignocellulosic wastes are utilized to generate fuels, chemicals and energy are eco-friendly mechanisms that support the adaptation of circular economy.

Of course, there are also other applications in different sectors. In a case study Li and Ma (2015) discuss how energy and material efficiency can be achieved in China's paper mill industry. The authors introduce Guangdong Silver Island Lake (GSIL) Papermaking Park as an example of Circular Economy development by means the region achieved cleaner production and sustainable development. This is a very good example as the industrial region formed a unique integration of papermaking and power industries which reduced the pollutant emission of the park. Another application based research is suggested by Reuter and Schaik (2016). The authors propose that recycling of the gold, silver, and platinum in waste electric and electronic equipment is a well-known example of circular economy. However, this is better achieved by including other non-precious metals such as copper, cobalt, lead, nickel, tin, and zinc to be recycled from these equipment. Johnson et al. (2016) use the example of precious metal recycling from old cell phone handsets as an example of economic incentive for circular economy. The authors suggest that production managers should encourage longer lifetime use and increase the product return levels for initial use in order to achieve higher recycling levels.

The theoretical, economic and political framework is also explained in several articles. Martins (2016) argue that circular economy can find its theoretical framework within the classical political economic theory. As the classical theory emphasizes the sustainability and aggregate capital it best supports the circular economy as its contribution to the society is better explained compared to the neoclassical economics. Singh and Ordonez (2016) point to an interesting distinction between economic circulation and circular economy. The authors suggest that contrary to common belief, recirculating resources to make different types of products is not circular economy. Instead a circular economy requires the manufacturer to recycle their own product and use it as an input in the production system. Witjes and Lozano (2016) propose circular economy as a concept that addresses both environmental and socio-economic issues. In their article, the authors reveal a comprehensive framework that considers not only the socio-cultural specifications, but also the physical and social proximity between the involved stakeholders. Therefore the authors suggest that the procurement process between the suppliers and producers could be enhance by means of common ground to achieve sustainable resource efficiency.

Circular economy has also been criticized as well. One critic is the over recycling to the extent that products that shall not be recycled are recycled. Leslie et al. (2016) suggest that there is a delicate balance between consumer safety/cleaner production and resource efficiency. While society wants to achieve higher recycling ratio, one need to be careful not to include any harmful toxic chemicals recycled from the obsolete materials. Therefore, hazardous materials should be kept out of the recycling chain and disposed properly instead of recycling. Another critic is the notion that recycling does nothing to reduce the post-capitalist consumption-based economic models. Hobson and Lynch (2016) claim that the radical sudden transformation imposed by European Union and global business leaders may not be the best solution to the challenges of consumption society and sustainable consumption lifestyle. The authors suggest that sharing economy where resources are commonly utilized by the society might be a better alternative for world's growing resource scarcity problems.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

INNOVATION

Since the industrial revolution, the world has experienced standardized manufacturing in large enterprises. Growing as much as possible to become pre-eminent in the field was the trend of 20th century businesses. However, the fall of century old companies showed that being big may not always be the best solution. Innovation does not just come from large enterprises, SMEs started to become a prominent field in the innovation field. Incremental innovation explains the day-to-day activities that enable companies to gain small continuous advantages on their competitors. Conversely, breakthrough innovation comes from entrepreneurs developing novel ideas and large-scale research and development (Morris, 2013). As nations achieve higher levels of gross domestic product per person, the main source of this change becomes innovation. However natural resource depletion may direct the displacement economy that has served as the driving force of economic growth towards a circular economy where reconstitution of materials become the central focus of innovation and sustainable growth and development.

According to Sheth and Ram (1987) the need for innovation is driven by four features of development: technological advancement, changing customer needs, intensified competition and a changing business environment. To develop an environment within which innovation, as a key aspect of sustainable resource development, can flourish. There are three main facets that contribute to creating such an environment: public-private partnerships, policy development and risk tolerance.

Public-Private Partnership

Public-private partnerships drive innovation through both policy and financial support. In cases where large-scale research and development have succeeded the Public-Private Partnerships have been driven by clear government policies that incentivise and encourage innovation process. For example, the national governments of both Taiwan and Singapore have fast-tracked policy development aimed at underpinning their national innovation structures (Lin & Lin, 2014). In addition, the national innovation strategy for Luxembourg encourages public investment into research and development in order to enhance the government's goals to diversify the economy (OECD, 2016). Thanks to this public-private partnership strategy, the region has shown an increase of 238% increase in research and development. These examples of economic growth, in economies of parity with Kuwait, supports the notion of a strong public-private partnership in the establishment of research and development of a circular economy.

It also makes sense to support the development of circular economy from an economic point of view. As mentioned by Ferreira, Ratten, and Dana (2016) there is an underestimated spillover effect that is highly connected with the strategic management approach. Thus, an unintentional outcome of circular economy is to create additional knowledge flows which can be utilized by entities other than the original creator of this knowledge. As a result, there might be a highly beneficial multiplier effect where the initial positive outcome gets magnified through knowledge spillovers in the network. Therefore, the total benefit of supporting circular economy might get much higher than the cost of government support.

Policy Development

Government policy is often charged to provide an umbrella approach to manage the various initiatives and stakeholders in the economic playing field through a series of strategic tasks, guiding principles and recommendations. To encourage active participation of the private sector in innovation, four areas of

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

policy development are suggested to support increasing innovation in Kuwait: Establish National Areas Sustainable Innovation, Incentivizing University Research, Research Innovation Networks and Initiation of Challenge-Driven Innovation programs.

Government policy that is focused on clear areas for innovation is at the heart of developing innovation on a national level. It is important that the government looks at possibilities at hand when establishing National Areas of Sustainable Innovation (NASI). An example may be the large number or discarded rubber, plastic and metal that resulted from a growing automotive market. As mentioned by Jones (2015), the engagement of private sector is easy when it involves a large upfront investment. Therefore, policy framework is needed to promote private sector's involvement.

Government policy that incentivizes institutions of higher education to enhance research into the NASI that have been identified can become the driver of successful and continued national innovation. In addition to fiscal incentives, support through hosting national and international conferences on innovation, providing support for international research cooperation and encouraging cooperation between higher institutions within Kuwait may enhance the drive for innovation. In addition, providing scholarships for post graduate research, both at home and abroad is essential to driving innovation. It is also of interest to promote project-oriented learning as an essential learning mechanism as it supports the implementation of sustainability concepts at earlier ages. (Filho et al., 2016)

Government policy may provide an increased awareness of science and innovation by enhancing the role of research collaboration across institutions through Research Innovation Networks. Collaboration between institutions may relieve the fiscal and human resource pressure of driving innovation within a single institution. Government policy should encourage a strategy where each of the NASI are presented as a challenge to be solved in the form of a national competition. The outcomes of the competition may be supported by a financial prize as well as the opportunity to develop the winning proposal into a sustainable business.

Financial support has an equally significant role to play in encouraging innovation. A recent OECD (2015) report on research and development incentives indicates that where government support is equal to the input of the private sector, growth indicators are significantly higher. Albeit, such incentives were mostly provided in tax relief, government support, both through policy and financial backing contributes a significantly to research and development growth. However, several corporations consider developing such partnerships as a strategy beyond governmental regulations to augment their market shares. (Buysse & Verbeke, 2003)

Risk Tolerance

One of the most significant challenges of developing and implementing a sustainable circle economy is the uncertainty that goes hand-in-hand with new scientific developments. Central to any business model is the core concept of reducing or avoiding risk. However, where new frontiers in science driven manufacturing becomes the genesis of the business model, risk tolerance becomes a strengthening attribute of the SME.

Insofar as, understanding the impact of risk in the sustainability of renewable resources and the role SMEs play in developing these resources, one needs to consider that decisions in SMEs are made by individuals, each with their personal subjective estimation of risk and personal level of tolerance of risk. Therefore, it is important to consider human behaviour as a factor of risk aversion.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Environmental risk reflects what happens in the physical world within which the economic behaviours occur. The environmental risk element functions as a link between resources, ideology and geo-political initiatives. The simplest way to explain environmental risk elements is by looking at the controversial debate regarding human influence on climate change. Scientific consensus that climate change is a result of human economic activity in indisputable. Moreover, significant measures to reduce the growing impact of climate change are imperative to ensure sustainable development on the planet, yet within the context of energy affordability, the ideology of social equality (the belief that all people should have reasonably priced access to goods and services) requires that governments and corporations provide goods and services at reasonable cost. A balancing act between developing new sustainable industries and the loss of revenue is a weighty driver of corporate policy making within the boardrooms of corporations as well as SMEs.

Sources of social influence clarifies how geo-political and national corporate voices guide social opinions. A significant amount of money, airtime and lately social media time is devoted to directing social opinion on sustainable development. These sources of influence have a significant influence on a regional and local level insofar as social representation reflect systems of widespread or shared beliefs and values (Breakwell, 2014), and these representatives often hold the purse strings of the general consumer. Thus decision-makers, especially within SMEs where access to larger political players is slight, pay a significant amount of attention to the prevailing unanimity created by social influence. Consequently, the attitudes towards sustainable development and circular economy initiatives are largely driven by those who have access to the greatest sources of social influence.

Institutional standards are the parameters and guidelines instituted through policies and laws of on regional and national level. As indicated earlier, public policies that favour innovation and the expansion of sustainable resource are essential to developing risk tolerance of SMEs. Where policies are ambivalent to the impact of social influence and normative pressure, SMEs find that the pressure to continue with current methods contribute to the perceived risk of developing sustainable economic methods and behaviours.

Normative pressures illuminate the active, day-to-day communication and interactions within the environment where the economic behaviour is implemented. Initiating innovations that go against the custom model of economic behaviour may introduce a sense of alienation. Consumers tend to be habit driven, steering towards what is trusted and dependable. Thus, in a time, where geo-political trends are aimed inwards towards self-protecting localism, introduction of novel technologies that enhance a circular economy, but have no track record of efficiency or sustainability, may increase the aversion to risk of decision-makers in SMEs.

Past action reflects the former activities of the SME that are perceived to be low risk. This is particularly the case for chemical and related industries as they operate at a high environmental cost. (Sharratt and Choong, 2002). These approaches to innovation and development of sustainable economic models have a direct impact on how the SME tolerates risk. In addition to the SME itself, proximal attitudes towards innovation and sustainable resource development have an indirect impact on decision-makers in the SME. The risk tolerance of the direct competition of an SME may prove to have an impact on their economic behaviours. For instance, if a competitor that is more risk tolerant than the SME has success in implementing a new economic model or innovation, this may be encouraging to other SMEs to also engage in innovative developments.

Finally, an individual's cognitive and conative processes relate to the internal mental life that drives the individual's striving, desire and motivation. Thus the decision-makers' personal ideological approaches

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

to sustainable resource development as well as their education level have a direct impact on the risk tolerance that can be seen in the SME. If the decision-makers are educated in a tradition of innovation supported by pro-sustainable development public policy, it may be easier for such decision-makers to be open to innovation. This, in turn will benefit the entire organization.

SUSTAINABILITY

As mentioned by Geissdoerfer et al. (2017), the Circular Economy is increasingly becoming a new sustainability paradigm globally. This is also becoming a more popular term in the Arabian Gulf region. In the aftermath of the global financial crises and later depressed oil prices, it became obvious that the GCC economies need sustainable development policies to be more innovative and competitive. This can be done while reducing resource usage and lowering the environmental impact. Establishing a circular economy initiative can help GCC companies to become more resource efficient and competitive. There are some positive movements in this field, but these initiatives usually target well-established large enterprises ignoring the SMEs. In the first place, this research aims to tap the potential of SMEs by analysing their supply chains and identifying the sectors where the waste of one company can be a raw material for another. Secondly, the use by one company or sector of by-products, including energy, water, logistics and materials, from another is an example of industrial symbiosis within a circular economy. Finally, this new model is slowly transforming the way industrial production is resourced and is a challenge for individual companies to create this interactive synergy. However, by providing a knowledge base for SMEs, such challenges can be turned into opportunities.

The supply chain procurement techniques need to be readjusted in order to comply with circular economy. In some cases, this is done naturally by the laws of supply and demand. For example, in many developed and developing countries, there are specific production zones that specialize in a diversified but similar products. This is commonly observed in the automobile industry. There are many different branded automobiles but they all have some of the parts in common. That is because they are utilizing the same supplier. One hurdle in this type of efficiency is the need to geographical closeness between different producers and (usually) the only supplier. By producing in significant quantities, the supplier is able to offer cheaper prices to the final product producers.

In some cases, there needs to be an institutional involvement to redesign the supply chain. Consider the example of cell phone chargers. As soon as cell phones became widespread, all households ended up holding several different types of chargers in order to use them for each different brand of phone. But then institutions such as European Union decided to get involved and imposed that all cell phones to be sold in the EU shall be compatible with simple USB type of adaptor. This type of successful involvement of the state proves that institutional settings play a crucial rule in even supply chain management systems.

The by-product of one enterprise can sometimes be an essential input for the production of another product by the same or another company. In Kuwait there is a very good example for the useable by-product utilization. Kuwait is known for its harsh weather that is incredibly hostile for growing food. Yet, there is an entire region called Wafra which is known for its greenery scene and vast lands of vegetation. While there are underground water sources in this area, this all became possible thanks to the recycling of waste water. Water is a rare commodity in Kuwait, as such the recycling of water to be reused for vegetation was a brilliant idea. Thanks to the farms in Wafra, now one can consume locally grown fruits

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

and vegetables in Kuwait. Kuwait needs to create more examples like this in order to sustain its economic activities within the circular framework.

A synergy is created if two or more companies apply joint production systems where their productivity is increased thanks to joint operations. The synergy created between those joint operations can help to utilize the resources more efficiently. Consider the example of an auto mechanic and vehicle removal company. The vehicle removal company often witnesses automobiles that were so badly damaged and have almost no potential to be back on the road. Those companies can form a union and consequently deliver all those cars in non-useable state into a common parking ground. In turn, the auto mechanics need the spare parts for fixing the cars of their customers. It will be much more efficient for them to obtain those parts from the local car parts instead of waiting for those imported parts to arrive from the ports. It will also be a lot cheaper and the cost to the consumer will be lower. This network type of agreement can create new revenues as well as provide cost savings to those involved. The junk cars will be valued as treasures by the mechanics. It will also reduce the amount of waste and the unsightly appearance of accident-seen cars near the roads.

RESOURCE EFFICIENCY

Resource-efficiency, eco-intensification and sustainability are major issues in the energy sector and are at the heart of Circular Economy thinking. Resource efficiency is a critical component to ensure access to sufficient and nutritious food. It is a key priority that impacts all world citizens. Given the structure of this sector, SMEs play a critical role. However, general procurement problems exist in in the supply chain management. Such problems can be solved by the use of Circular Economy and symbiotic paradigms. These suggestions are based more or less on the best practices applied around the globe.

There is an increasing global trend, particularly in Europe, from energy efficiency to resource efficiency where nothing is wasted (Bundgaard, 2017). The idea of zero waste means that the resource efficiency is reached to a level that nothing goes for waste. While this is a very ideal approach which currently seems implausible, in future it may be possible. The resource efficiency can be significantly improved by imposing zero waste rule. This implies a full recycling of all waste produced by both producers as well as consumers. The EU commission emphasizes a particular role for the municipal waste. It is aimed to minimize the landfill amount by maximum 10% by 2030. That also implies recycling and repacking up to 90% of all the municipal waste by the same deadline. This is an unlikely scenario for the GCC countries where there is a natural waste due to carbon-based economy. However, still GCC countries, particularly Kuwait can benefit from imposing similar targets with solid deadlines. At least one possible action to be taken is to separately collect waste so that they can be recycled in the later stages. The separation can be based on recyclable plastic, glass, and paper. This way the recycling process will be much easier and also more profitable for the companies involved in recycling.

Another action plan is to create economic incentives to discourage landfilling and encourage greener product usage. This of course requires state involvement, but it is a necessity to save the environment for future generations. A similar incentive plan could be provided for putting greener products with high recycling rate throughout the region. Plastic bags are an increasingly common problem for the region and their usage could be discouraged by putting a price on them instead of offering them for free. Another product category that needs to be separately dealt is the electronic equipment in the region. Currently

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

there is no incentive to reutilize the old computers, cell phones, batteries, etc. There should be some sort of mechanism to promote the proper disposal of those items as they are highly dangerous as a trash and needs to be properly disposed. It is also important to emphasize that those old electronics contain valuable materials which can be reused as an inputs in the production stage.

CHALLENGES AND OPPORTUNITIES IN KUWAIT

Similar to other GCC states, Kuwait's economy is heavily dependent on oil production and revenues. In fact it would not be a mistake to consider Kuwait as a carbon-based economy. The rise in the oil prices since the last century has provided a great amount of wealth to the region. Citizens as well as expatriates living in the country has greatly benefited from the oil wealth. However, the recent decline in oil prices prompted the relevant parties that a pure oil-based economy is not the best development option. The idea of selling oil and importing almost everything else do not seem to be a feasible solution to the growing fiscal problems in the region. Therefore, one needs identify the diversification options and apply them for sustainable development in the region. Applications of circular economy can greatly benefit everyone regarding this concept. SMEs can play a significant role in the implementation of circular economy within Kuwait and the GCC region.

As a starting point one can consider the recycling of carbon-based products in Kuwait. There is no doubt that oil is cheap in Kuwait. As a result, plastic bags are also a cheap commodity available not only in the markets but also almost everywhere around. One of the reasons is that there is no recycling culture in the society. There is also no fiscal motivation for recycling plastic bags. In fact contrary to Western European stores, bags are free and offered abundantly in the supermarkets. In a scenario where plastic bags are free, it is considered as a trash after being utilized only once. However, in countries where plastic bags are sold as a commodity there is a motivation to reuse them or at least minimize the number of bags used in shopping. Of course it may not be the most profitable solution to offer bags for sale, but a small shop can recollect those bags for a small fee. This way they will not show up on the streets and the unsightly abundance of plastic waste will disappear. The proper disposition of tires is another issue. The tire graveyard in Sulaibiya, Kuwait is one of the biggest in the world. This enormous tire dump has been growing both in depth and also in size and it is very visible in Google Maps. Proper recycling of the tires can be utilized in making a diversified variety of products ranging from children's playgrounds to artificial sports pitches.

A similar case could be made for recycling card boards. While paper is not that much used compared to plastic in Kuwait, it is a rare commodity that is imported abroad. Nevertheless a significant amount of non-recycled cardboard trash appears after the purchase of material equipment, household appliances, and even furniture by consumers. Normally, in advanced countries it is the responsibility of the retailer to recollect this waste to recycle as an input. However, this is rarely the case in Kuwait and the purchaser ends up disposing the cardboards in the trash. This is another opportunity for SMEs to get involved by collecting this cardboard waste and turning it into valuable inputs for the production processes.

Recycling plastic and paper trash is not the only way SMEs can get involved in circular economy. In the automotive industry, the obsolete materials need to be disposed properly. In the best case scenario these obsolete materials are recomposed into the production of new cars. In the worst case scenario the obsolete materials keep decaying within the car while the car is unsightly standing somewhere in public. In Kuwait, where accidents are common, this unsightly sight can frequently appear almost anywhere.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Recycling this valuable material can save significant income and is also beneficial for the entire society. Another recycling opportunity exists for electronic equipment. Almost every electronic equipment carries a tiny bit of precious metal inside. The extraction of these precious materials can be a profitable business who specialize in this field. It can also help to diversify the carbon-based Kuwaiti economy.

Of course, all of those opportunities need to be incentivized by the state. This is perhaps the biggest challenge faced by those proponents of recycling and circular economy. There is an environmental legislation that aims to protect the environment. However, this falls short of imposing recycling rules similar to that of Western world. Therefore, the lack of proper legislation is the primary challenge against potential recycling companies. A new law similar to that of EU and Japan initiatives can close the gap and promote companies to engage in circular economy. Another challenge is the lack of recycling culture which is partly due to wealth brought by the oil. That hurdle can also be eliminated by means of proper environmental education starting from very early ages of education. Considering all of these facts, an active role is proposed for the state involvement in order to achieve a better circular economy within the State of Kuwait.

SUMMARY

SMEs are faced with numerous complex challenges that require a strong collaboration between industry, academia, government and private business. This collaboration can create a new ecosystem, which can promote an open innovation mechanism and lead to sustainable product systems. This open innovation offers SMEs a special avenue to better compete in the global economic marketplace.

In this article, the concept of circular economy is discussed with potential specific applications that are feasible within the Kuwaiti enterprise system. The applications are based on circular economic framework and emphasizes recycling and resource efficiency. That is a significant challenge for a welfare-supported oil-based economy where everything is imported, abundantly available and relatively affordable for the wealthy society. However, given the lower oil prices, diversification of carbon-based economic system has gained more supported within the GCC countries. As such, applications of circular economic framework has gained more momentum within the region.

There are of course several barriers particularly for small and medium sized enterprises to get involved in circular economy. It is proposed that innovation, sustainability, and efficiency are key drivers behind achieving circular economy. State shall get actively involved by means of creating the necessary institutional setting and legislations. Thus, there needs to be public-private partnership promoting policy development and supported by financial incentives. In the literature, several studies are mentioned from European Union, individual European States, as well as Japan, Australia, and China. While each region has its specific dynamics those examples can work as a benchmark for the GCC region.

In case of small and medium enterprises, the human role, particularly that of the manager or the owner is essential for application of new production techniques that reduces waste. Therefore, the role of risk tolerance in circular economy also needs to be emphasized. Thus, for SMEs, the factors such as environmental context, sources of social influence, institutional standards, normative pressures, past actions, and cognitive and conative pressures are highly valuable. This in turn implies that education is a key factor in waste reduction and resource management. Therefore, the role of state should also include public training for resource efficiency.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

This research can be extended in several directions. One line of research is to compare and contrast the legislative frameworks in the regional countries with that of globally leading economies in the Circular Economy field. The legislative frameworks in the Arabian Gulf countries are substantially different than that of Western countries. Therefore, issues such as recycling and environmental protection are not among the state priorities. By identifying the key environmental initiatives in the Western legislations, one can help establishing similar initiatives in the region. Another line of research is to determine how the social capital in the GCC countries can be enhanced in order to raise awareness regarding the resource waste. Currently, the economies of GCC countries are almost entirely dependent on carbon-based oil and gas industries. Thanks to the accumulated and flowing income from these industries, the recycling culture is almost nonexistent among households. It is of interest for researchers, industry players and policymakers to figure out how to establish an environmentally sound practices to minimize the waste at both the production and consumption stages.

REFERENCES

Abu-Ghunmi, D., Abu-Ghunmi, L., Kayal, B., & Bino, A. (2016). Circular economy and the opportunity cost of not closing the loop of water industry: The case of Jordan. *Journal of Cleaner Production*, *131*, 228–236. doi:10.1016/j.jclepro.2016.05.043

Bhaskar, T., Chang, J., Khanal, S., Lee, D., Mohan, S. V., & Rittmann, B. E. (2016). Waste Biorefinery – Advocating Circular Economy. *Bioresource Technology*, *215*, 1–2. doi:10.1016/j.biortech.2016.06.020 PMID:27297316

Breakwell, G. M. (2014). *The Psychology of Risk* (2nd ed.). Cambridge University Press. doi:10.1017/CBO9781139061933

Bundgaard, A. M., Mosgaard, M. A., & Remmen, A. (2017). From energy efficiency towards resource efficiency within the Ecodesign Directive. *Journal of Cleaner Production*, *144*, 358–374. doi:10.1016/j.jclepro.2016.12.144

Buysse, K., & Verbeke, A. (2003). Proactive Environmental Strategies: A Stakeholder management Perspective. *Strategic Management Journal*, *24*(5), 453–470. doi:10.1002mj.299

Despeisse, M., Kishita, Y., Nakano, M., & Barwood, M. (2015). Towards a Circular Economy for End-of-Life Vehicles: A Comparative Study UK – Japan. *Procedia CIRP*, *29*, 668–673. doi:10.1016/j.procir.2015.02.122

Ferreira, J., Ratten, V., Dana, L., (2016). Knowledge based spillovers. *International Entrepreneurship and Management Journal*. doi:10.100711365-016-0415-6

Filho, W. L., Shiel, C., & Paco, A. (2016). Implementing and operationalising integrative approaches to sustainability in higher education: The role of project-oriented learning. *Journal of Cleaner Production*, *133*, 126–135. doi:10.1016/j.jclepro.2016.05.079

Geissdoerfera, M., Savageta, P., Bockena, N. M. P., & Hultink, E. J. (2017). The Circular Economy – A new sustainability paradigm? *Journal of Cleaner Production*, *143*, 757–768. doi:10.1016/j.jclepro.2016.12.048

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

George, D., Lin, B. C., & Chen, Y. (2015). A circular economy model of economic growth. *Environmental Modelling & Software*, *73*, 60–63. doi:10.1016/j.envsoft.2015.06.014

Granzin, K. L., & Olsen, J. E. (1991). Characterizing Participants in Activities Protecting the Environment: A Focus on Donating, Recycling, and Conservation Behaviors. *Journal of Public Policy & Marketing*, *10*(2), 1–27.

Hobson, K., & Lynch, N. (2016). Diversifying and de-growing the circular economy: Radical social transformation in a resource-scarce world. *Futures*, *82*, 15–25. doi:10.1016/j.futures.2016.05.012

Ilić, M., & Nikolić, M. (2016). Drivers for development of circular economy – A case study of Serbia. *Habitat International*, *56*, 191–200. doi:10.1016/j.habitatint.2016.06.003

Johnson, F. E., Figge, F., & Canning, L. (2016). Resource duration as a managerial indicator for Circular Economy performance. *Journal of Cleaner Production*, *133*, 589–598. doi:10.1016/j.jclepro.2016.05.023

Jones, A. W. (2015). Perceived barriers and policy solutions in clean energy infrastructure investment. *Journal of Cleaner Production*, *104*, 297–304. doi:10.1016/j.jclepro.2015.05.072

Kun, H., & Jian, Z. (2011). Circular Economy Strategies of oil and Gas exploitation in China. *Energy Procedia*, *5*, 2189–2194. doi:10.1016/j.egypro.2011.03.378

Leslie, H. A., Leonards, P. E. G., Brandsma, S. H., Boer, J., & Jonkers, N. (2016). Propelling plastics into the circular economy — weeding out the toxics first. *Environment International*, *94*, 230–234. doi:10.1016/j.envint.2016.05.012 PMID:27262786

Li, S. (2012). The Research on Quantitative Evaluation of Circular Economy Based on Waste Input-Output Analysis. *Procedia Environmental Sciences*, *12*, 65–71. doi:10.1016/j.proenv.2012.01.248

Li, Y., & Ma, C. (2015). Circular economy of a papermaking park in China: A case study. *Journal of Cleaner Production*, *92*, 65–74. doi:10.1016/j.jclepro.2014.12.098

Liguori, R., & Faraco, V. (2016). Biological processes for advancing lignocellulosic waste biorefinery by advocating circular economy. *Bioresource Technology*, *215*, 13–20. doi:10.1016/j.biortech.2016.04.054 PMID:27131870

Lin, C. C., & Lin, G. T. (2014). Analyzing Innovation Policy Dimensions and Contexts: In the Empirical Cases of Taiwan and Singapore. *International Journal of Organizational Innovation*, *6*(4), 114–128.

Martins, N. O. (2016). Ecosystems, strong sustainability and the classical circular economy. *Ecological Economics*, *129*, 32–39. doi:10.1016/j.ecolecon.2016.06.003

Mohan, S. V., Butti, S. K., Amulya, K., Dahiya, S., & Modestra, J. A. (2016). Waste Biorefinery: A New Paradigm for a Sustainable Bioelectro Economy. *Trends in Biotechnology*, *34*(11), 852–855. doi:10.1016/j.tibtech.2016.06.006 PMID:27427264

Morris, L. (2013). Three Dimensions of Innovation. *International Management Review*, *9*(2), 5–10.

Nelles, M., Grünes, J., & Morscheck, G. (2016). Waste Management in Germany – Development to a Sustainable Circular Economy? *Procedia Environmental Sciences*, *35*, 6–14. doi:10.1016/j.proenv.2016.07.001

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

OECD. (2015). Measuring R&D Tax Incentives.

OECD. (2016). *OECD Reviews of Innovation Policy: Luxembourg 2016*. Paris: OECD Publishing. doi:10.1787/9789264232297-en

Qing, Y., Mingyue, C., & Qiongqiong, G. (2011). Research on the Circular Economy in West China. *Energy Procedia*, *5*, 1425–1432. doi:10.1016/j.egypro.2011.03.246

Qiping, R. (2011). Circular Economy Action Programs and Countermeasures for Small and Medium-sized Resource-based Cities of China-Case Study of Zibo City of Shandong Province. *Energy Procedia*, *5*, 2183–2188. doi:10.1016/j.egypro.2011.03.377

Reuter, M., & Schaik, A. (2016). Gold – A Key Enabler of a Circular Economy: Recycling of Waste Electric and Electronic Equipment. In M. D. Adams (Ed.), *Gold Ore Processing* (2nd ed., pp. 937–958). Elsevier; doi:10.1016/B978-0-444-63658-4.00053-0

Sharrat, P. N., & Choong, P. M. (2012). A life-cycle framework to analyze business risk in process industry projects. *Journal of Cleaner Production*, *10*(5), 479–493. doi:10.1016/S0959-6526(02)00003-3

Sheth, J. N., & Ram, R. (1987). *Bringing Innovation to Market: How to Break Corporate and Customer Barriers*. New York: Wiley.

Singh J., Ordoñez I. (2016). Resource recovery from post-consumer waste: important lessons for the upcoming circular economy. *Journal of Cleaner Production*, *134*, 342-353. doi:10.1016/j.jclepro.2015.12.020

Soo, V. K., Compston, P., & Doolan, M. (2016). Is the Australian Automotive Recycling Industry Heading towards a Global Circular Economy? – A Case Study on Vehicle Doors. *Procedia CIRP*, *48*, 10–15. doi:10.1016/j.procir.2016.03.099

Trianni, A., & Cagno, E. (2012). Dealing with barriers to energy efficiency and SMEs: Some empirical evidences. *Energy*, *37*(1), 494–504. doi:10.1016/j.energy.2011.11.005

Witjes, S., & Lozano, R. (2016). Towards a more Circular Economy: Proposing a framework linking sustainable public procurement and sustainable business models. *Resources, Conservation and Recycling*, *112*, 37–44. doi:10.1016/j.resconrec.2016.04.015

Wu, H., Shi, Y., Xia, Q., & Zhu, W. (2014). Effectiveness of the policy of circular economy in China: A DEA-based analysis for the period of 11th five-year-plan. *Resources, Conservation and Recycling*, *83*, 163–175. doi:10.1016/j.resconrec.2013.10.003

Xinan, L., & Yanfu, L. (2011). Driving Forces on Chinas Circular Economy: From Governments perspectives. *Energy Procedia*, *5*, 297–301. doi:10.1016/j.egypro.2011.03.051

This research was previously published in the International Journal of Social Ecology and Sustainable Development (IJSESD), 8(3); edited by Elias G. Carayannis, pages 87-99, copyright year 2017 by IGI Publishing (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 4
Exploring Client Perceptions and Intentions in Emerging Economies:
The Case of Green Banking Technology

Mehree Iqbal
North South University, Bangladesh

Nabila Nisha
North South University, Bangladesh

Afrin Rifat
North South University, Bangladesh

Pradiptarathi Panda
National Institute of Securities Markets, India

ABSTRACT

This article describes how in response to the global initiative to save the environment, many emerging economies today promote environmental-friendly practices by implementing various forms of green banking services. Beyond its usefulness for the environment, green banking also benefits the clients by offering new channels of financial services delivery. As such, there may be various factors which can shape the behavioral intentions of clients for adopting green banking, including their environmental concerns, perceived financial cost and timeliness factor attached to these services. Using UTAUT model and Structural Equation Modeling (SEM), this paper thus proposes a model to identify such adoption factors in the context of an emerging economy. The article finds that timeliness, facilitating conditions, environmental concerns, effort expectancy and performance expectancy, plays an important role in capturing clients' overall perceptions of green banking. Results therefore indicate clients may be fairly pragmatic in developing general attitudes towards the use of green banking.

DOI: 10.4018/978-1-5225-7915-1.ch004

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

INTRODUCTION

In recent years, the eminent problem of global warming has finally shifted the attention of business practices of all functional areas to climate change, resource efficiency and environmentally conscious issues. As such, initiatives related to green safety and sustainable ecological balance is growing in support. Environmental degradation has become such a pressing issue today that even the financial sectors need to address this universal concern (Goyal and Joshi, 2011). This is because financial institutions, particularly banks, play a vital role in the economic system of a country and generally affects all types of business practices through their financing activities (Bahl, 2012). Thus, banks should contribute to the saving of the environment by considering environmental aspects as part of their lending and investing principles, which would then divert industries to invest in environmental management and the use of appropriate green technologies (Masukujjaman and Aktar, 2013).

As a response to this global development and environmental degradation, financial sectors of many developed and developing countries have adopted green technologies to address the issue of sustainable business practices. As such, various eco-friendly practices and in-house operations, broadly known as green banking, are now part of most banking activities (The Daily Observer, May 26, 2015). Green banking mainly involves the environmental and social responsibility of banks in terms of the contribution they make towards ensuring sustainability of the environment and ecological system, through their in-house operations and the wide range of financial products and services that they offer (Nisha, 2016).

Green banking focuses on two aspects: green revolution of internal operations through the consumption of renewable energy, digitalization and other measures that can reduce the emission of carbon mark from the banking activities and the use of environment-friendly financing like sustainable banking, ethical banking, green mortgages, green loans, green credit cards, mobile banking, online banking, etc. (Inderst et al., 2012). Additionally, banks worldwide use energy-wise Green Machines, which source power from clean, emission-free methods such as wind power and invests hugely for local environment and wildlife projects in their community (Hossain et al., 2015).

Since the objectives of green banking provide incentives for environmental sustainability, its adoption is increasingly growing in emerging economies to promote the concept of social responsibility towards the environment (Masum, 2015). This is because most of the emerging economies tend to be prone to natural calamities which often cause huge losses to the environment, adversely affecting biodiversity, agriculture, forestry, water resources and human health (Biswas, 2011). For emerging economies like Bangladesh, this issue is all the more pressing because people in this country have very little awareness about environmental hazards, air and water pollution, industrial, medical and household wastes community, etc. (Hossain and Ahmed, 2015). Thus, the growth of green banking initiatives can be rightly justified in Bangladesh.

The Central Bank of Bangladesh has already shown keen interest in promoting environmentally-friendly and socially responsible approaches to banking, following which leading commercial banks of the country now follow various forms of green banking policies within their banking operations (Rahaman et al., 2015). However, the application of green banking chiefly requires the involvement of the bank clients as well, since they are the ones who are at the forefront of using such initiatives to conduct their banking transactions. This is where it becomes imperative to examine the thought process of the clients towards the concept and implementation of green banking in Bangladesh. In particular, since environmental concern is the focal point of green banking, clients' views related to environmental

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

sustainability, along with the relative advantages like timeliness and the financial cost attached to such initiatives needs to be examined.

To pursue this purpose, a conceptual research model has been developed on the basis of the original Unified Theory of Acceptance and Use of Technology (UTAUT) model and the method of Structural Equation Modeling (SEM) applied to investigate the underlying relationships related to the perceptions of bank clients towards green banking practices in the country. Findings of this research provide further insights into identifying the factors that can influence clients' perceptions into adopting and using green banking in Bangladesh. This study can also assist banks to understand and assess the level of social responsiveness of bank clients in context of emerging economies.

The remainder of the study is organized in the following manner. Section two presents review of literature, section three describes the research model and hypotheses, section four discusses research methods, section five presents data analysis and results, section six concludes the findings of the study and provides implications and section seven discusses limitations and further research directions for this study.

LITERATURE REVIEW

To further this study, the need for green banking and the current practice of green banking services in Bangladesh has been highlighted, followed by the research platform and finally, the theoretical background of the proposed determinants of timeliness, environmental concerns and perceived financial cost, has been discussed to determine the gaps of this study.

Necessity of Green Banking

Bangladesh achieved a reasonably high rate of economic growth over the last decade, the average growth rate exceeding 6% per annum that nearly doubled the per capita income of the economy (Masum, 2015). There has been considerable improvement in human development as well with Bangladesh moving from low to medium Human Development Index (HDI) country group (The Financial Express, 15 July, 2015). This high economic growth rate is the result of significant progresses in the rice production, shrimp farming, readymade garments and textiles, leather and leather goods, ship building & ship breaking industries of Bangladesh (Faroque et al., 2013). In turn, these developments are rapidly increasing the urbanization of the overall economy too.

However, an unfortunate consequence of these economic developments is severe environmental degradation. For instance, any developments in the farming sector requires intensive farming which results in decreasing soil fertility due to overexploitation of soil nutrients, imbalance and loss of organic matters using chemical fertilizers, pesticides, etc. (Alam and Islam, 2013). Farmers also try to bring in forest and wetland under cultivation by increasing their cropping intensity facilitated by irrigation. Although this compensates the loss of river erosion, intensive farming is pursued all over again (Hossain, 2014). Moreover, arable land has been shrinking by 0.6% every year due to demands from housing and several industries and to meet the infrastructure needs of Bangladesh (Masum, 2015). Even the readymade garments and leather industries adversely effects the available water due to more than 1700 washing/dyeing/finishing (WDF) units consuming 1500 billion liters of ground water annually and discharging waste

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

water in the country (Rahaman et al., 2015). Lack of proper solid waste management solutions further leads to water pollution and cause health hazards for the residents of Bangladesh. As such, the emerging economy of Bangladesh can be cited as one of the most severely affected countries as a consequence of global environment pollution (The Financial Express, 1 August, 2015).

A more adverse aspect of the highlighted environmental problems is the fact that it is expected to accentuate, since Bangladesh may lose one sixth of its land due to a rise in sea-level with global warming and farming risks may also increase due to climate changes like current erratic monsoon rains and increased frequency of floods and storms (Hossain, 2014). Additionally, there has been significant movement of environmental refugees, victims of river erosion in particular to urban areas leading to increased rural landlessness in the country.

The financial sector is nowadays aware of and concerned about all these environmental problems of Bangladesh and considers the sustainability of the environment as part of their corporate social responsibilities (Kaeufer, 2010). As a result, the central bank of Bangladesh – Bangladesh Bank, formulated a guideline related to environmental risk management. The guideline, named as the Green Banking Policy, aims to ensure environment-friendly business practices by banks and financial institutions by incorporating environmental risks into Core Risk Management (CRM), thereby promoting sustainable financial and economic growth across the entire country (Nisha, 2016). Green banking has been made mandatory for all commercial banks of Bangladesh, since these financial institutions indirectly contribute to environmental pollution through investing in different pollutant industries (Hossain and Ahmed, 2015). Hence, the banks should be more active, responsible and enthusiastic for bringing about a positive change in the environment and this can only be achieved by being socially responsive and embracing the concept of green banking in Bangladesh.

Scope of Green Banking in Bangladesh

Global awareness about greenhouse effects and climate change gave rise to the notion of green banking in many developed countries and alongside, few developing countries also adopted the concept of "GO GREEN" (Singhal, 2014). Following the footsteps, Bangladesh joined the bandwagon around 2011. Green banking entered its first phase of drafting the policy framework and setting up of an institutional arrangement in Bangladesh under the leadership of Bangladesh Bank (Masum, 2015). The contribution of Bangladesh Bank to make green banking a reality in Bangladesh is a commendable move, as it is the only central bank in the South-Asian continent which has issued such an analytical guideline for the adoption of green banking.

Under the Policy Guidelines for Green Banking, all scheduled banks are required to adopt a comprehensive Green Banking policy in a formal and structured manner in order to reduce environmental degradation and to ensure sustainable banking practices (Ahmad et al., 2013). Bangladesh Bank initially selected ten commercial banks in the country, based on their CAMELS (capital adequacy, assets, management capability, earnings, liquidity and sensitivity) rating and Risk Based Capital Adequacy (RBCA) measurement for executing green banking practices under this Policy (The Daily Observer, May 26, 2015). The central bank instructed these banks to consider the following major activities under green banking: Green Banking Unit, Green Banking Policy, Green Banking Budget, Online banking, Mobile and Internet banking, Allotment of funds in green financing and Environment risk rating. Eventually, all the scheduled banks of Bangladesh initiated their own Green Banking Policy Guidelines approved by their respective Board of Directors as well as have Green Banking Unit (GBU) for pursuing Green

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Banking activities (Nisha, 2016). In fact, many of them have their own Green Office Guide for conducting various in-house green activities today. This includes the extensive use of online communications like video/audio conferencing, voice mail and e-mail instead of paper memos; using more daylight instead of electric lights or using energy saving bulbs; ensuring double-side printing to save papers; common use of table stationeries; efficient use of printer cartridges, photocopy toner and office stationary; installation of energy-efficient electronic equipment and their automatic shutdown after office hours; the use of solar energy to save electricity, etc. (Shakil et al., 2014; Hossain and Ahmed, 2015).

However, the most important aspect of this Green Banking Policy is actually directed towards the bank clients. Bangladesh Bank has mandated the commercial banks to introduce rigorous programs in order to educate clients and influence them to comply with the environmental regulations as well as to undertake activities which are going to benefit the environment (Islam and Kamruzzaman, 2015). For instance, leading commercial banks of the country have started communicating virtually with the clients through the use of e-statements instead of printed statements or e-mails instead of paper documents. Additionally, banks have radically transformed the distribution of services from the brick-and-mortar model to the branchless mode of banking (Saleem and Rashid, 2011; Nisha et al., 2015). This includes the use of technological services like internet baking, SMS banking, mobile banking, the use of Automated Teller Machines (ATM), Bangladesh Automated Cheque Processing System (BACPS), Bangladesh Electronic Fund Transfer Network (BEFTN) or other mobile financial services in the form of e-currency like bKash, mCash, EasyCash, etc. (Masukijjaman and Aktar, 2013). All these innovative mediums of financial services delivery promote green banking since it reduces the use of paper and works towards the achievement of environmental sustainability.

Although the commercial banks have introduced various forms of green banking services for the clients, these initiatives will only be successful if the clients are ready to adopt such environmental-friendly banking services. Hence, not only the environmental concerns of the clients, but relative advantages like timeliness and the cost attached to such services can be crucial factors here. As such, this study focuses on the examination of all factors that may influence the perceptions of bank clients towards green banking services in Bangladesh.

Research Gap

Recently, banks have started to design their financial products and services in such a way that they contribute to the saving of the environment by considering environmental aspects as part of their lending and investing principles (Masukujjaman and Aktar, 2013). In the process, banks have adopted eco-friendly banking practices through the extensive use of green technologies, broadly known as green banking.

Since green technology forms the basis of green banking, it is necessary to understand individual acceptance and use of this kind of information technology under the information systems research. Several theoretical models primarily developed from theories in psychology and sociology has been employed to explain technology acceptance and use. For instance, Davis (1989) and Davis et al. (1989) examines the determinants of computer technology acceptance and its utilization via the Technology Acceptance Model (TAM). On the basis of these prior researches, Venkatesh et al. (2003) developed the unified theory of acceptance and use of technology (UTAUT) model. Venkatesh et al. (2003) empirically compared eight competing models - namely the TRA, TAM and TAM2, Theory of Planned Behavior (TPB) and Decomposed Theory of Planned Behavior (DTPB), combined TAM and TPB (C-TAM- TPB), Innovation Diffusion Theory (IDT), Motivational Model (MM), Model of PC Utilization (MPCU) and

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Social Cognitive Theory (SCT) by surveying 215 respondents from four organizations. Based on their longitudinal studies, the authors further integrated and ultimately refined the new model of UTAUT. Four factors (performance expectancy, effort expectancy, social influence and facilitating conditions) were included in the model, primarily directed to predict the behavioral intention to use a technology and technology use in organizational contexts, moderated by individual difference variables like age, gender, experience and voluntariness (Venkatesh et al., 2012).

UTAUT served as a baseline model to study a variety of technologies in both organizational and non-organizational settings. However, given the number of technology devices, applications, and services that are targeted at consumers in recent times, it became necessary to identify the factors that can influence consumer adoption and use of technologies (Stofega and Llamas, 2009). This led to the introduction of the UTAUT2 model by Venkatesh et al. (2012). Venkatesh et al. (2012) adapted the four key constructs (i.e. performance expectancy, effort expectancy, social influence and facilitating conditions) that influence behavioral intention to use a technology and/or technology use from the original UTAUT model and tailored it to fit the consumer context. Thus, performance expectancy is defined as the degree to which using a technology will provide benefits to consumers in performing certain activities; effort expectancy is the degree of ease associated with consumers' use of technology; social influence is the extent to which consumers perceive that important others (e.g. family and friends) believe they should use a particular technology; and facilitating conditions refers to consumers' perceptions of the resources and support available to perform a behavior (Venkatesh et al., 2012).

Past studies like Venkatesh et al. (2003) claimed that the constructs of performance expectancy, effort expectancy and social influence determines the behavioral intention to use a technology, while behavioral intention and facilitating conditions influence the technology use in a particular context. In addition, Venkatesh et al. (2012) added three new constructs to the UTAUT2 model - hedonic motivation, price value and habit and included only three moderating variables of age, gender and experience to make the model applicable to the consumer use context. Venkatesh et al. (2012) further claimed that the addition of new constructs in a consumer context can contribute to the expansion of the theoretical horizons of UTAUT. Against this backdrop, this study has selected the original UTAUT and UTAUT2 model as a theoretical foundation to develop a proposed research model for this study. The goal of this study is not to replicate the UTAUT or the UTAUT2 model, but to ascertain the factors that can considerably influence clients' intention to use green banking in the context of an emerging economy.

Proposed Constructs: Environmental Concerns, Cost and Timeliness

Green banking mainly involves the use of online or mobile banking instead of branch banking in order to reduce the overall use of paper. The need for green banking is rightly justified in emerging economies like Bangladesh, since natural calamities are a common phenomenon here and Bangladesh is particularly more vulnerable to climate changes and environmental degradation (The Financial Express, 29 July, 2013). Perceptions, in view of environmental care, financial cost and relative advantages like timeliness among other factors, can therefore play an important role in influencing the behavior of the bank clients regarding the use of green banking in Bangladesh.

Nowadays, people have become fairly conscious about the environment - as a result of which, they often expect visible attempts from various sectors in terms of social responsibility and environmental sustainability (Rifat et al., 2016; Iqbal et al., 2017). These expectations are far greater from the banking sector owing to their involvement with the economic development of the country. In fact, past studies

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

like Bahl (2012) and Ahmad et al. (2013) stated that failure to fulfill the social responsibility towards environmental protection tends to tarnish the image of the banks in the eyes of their potential clients. This can be pretty costly to repair and the banks may end up losing clients. Hence, environmental concerns of the clients can play an influencing role in capturing the clients' overall perceptions and may even prompt them to adopt green banking. Few studies like Kranz and Picot (2011), Hossain et al. (2015) and Gomez and Scholtz (2016) have also identified environmental concerns as a major construct that can determine the behavioral intentions of clients in adopting green banking services. Following the lead, this study attempted to examine the extent of significance that environmental concerns of bank clients can have upon the adoption of green banking technologies.

Another issue that has been proposed as a construct in this study is the perceived financial costs related to the use of green banking services. Even though researchers generally investigate consumers' adoption of a technology from psychological and sociological theories, it has been proved by several empirical evidences that technology acceptance is highly influenced by financial factors as well (Luarn and Lin, 2005). Financial cost is therefore a significant predictor of the acceptance behavior of technological services as it refers to the cost associated with the learning and using of that technology (Nisha et al., 2015). If a user needs to spend a considerable amount of money to learn or use the technology-based service, he/she will not be willing to adopt it. This means a negative relationship can be established between financial cost and the behavioral intention of consumers. Several prior studies like Yu (2012), Nisha et al. (2015) and Sanakulov and Karjaluoto (2015) argue that increasing costs always has a negative impact on the willingness to adopt green banking services. Thus, in order to explore this relationship between perceived financial cost and acceptance of green banking technology from the clients' perspective, this study has chosen cost as a significant construct.

On the other hand, timeliness has also been observed to have a direct and positive impact upon the usage intentions of consumers in a number of technology acceptance studies. Empirical findings from past researches claimed that the time-saving feature under the relative advantages of technology-based services is one of the key reasons why users adopt such services. There are few studies like Lin (2011), Khraim et al. (2011) and Ketkar et al. (2012) which further measured the influence of timeliness on the usage of green banking technologies like internet banking or mobile banking. Findings of these studies reported timeliness to be a predominant factor of technology acceptance in the domain of green banking from the client perspective. This is because green banking services often reduces the need of clients to physically visit the bank, thereby saving time for the clients (Bihari, 2010). As a result, the association between timeliness and the adoption of green banking technology seems prominent and has been investigated in this study.

RESEARCH MODEL AND HYPOTHESES

The conceptual research model used in this study to address the influencing factors for clients' perceptions of green banking has been presented in Figure 1. Along with four key constructs of the original model, three additional constructs (e.g. environmental concerns, perceived financial cost and timeliness) drawn from previous literature of green banking services, has been incorporated in the proposed model to make a significant theoretical contribution to the client context of the UTAUT model. Thus, all variables hypothesized in this study and their likely relationships towards client acceptance and use of green banking services in Bangladesh has been discussed next.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Performance Expectancy

According to Venkatesh et al. (2003), performance expectancy reflects a users' view of the usefulness of adopting a technology. Mobile and internet based technologies generally frees users from temporal and spatial limitations, and thereby enables them to acquire information or services at any point of time from anywhere. Past evidences like Park et al. (2007), Lu et al. (2009) and Alwahaishi and Snasel (2013) reveals the impact of performance expectancy is the most relevant factor for the adoption of internet-based technologies like green banking. Nisha et al. (2015), Afshan and Sharif (2016), Chaouali et al. (2016) and Malaquias and Hwang (2016) further claimed that the usefulness in the context of green banking technologies can only be captured by the extent to which it can meet the expectations of the clients. If clients believe that using green banking services can satisfy their expectations, they are more likely to adopt this technology. Hence, the hypothesis is:

H1: Performance expectancy significantly affects individual intention to use green banking technologies.

Effort Expectancy

Effort expectancy depicts the perceived difficulty of using technologies. If the technology requires the users to invest great effort on learning to use, they cannot feel satisfied. In this regard, effort expectancy has a direct relationship with user satisfaction. In fact, users may discontinue their usage of a technology-based service if the providers cannot present an easy-to-use interface to them (Alwahaishi and Snasel, 2013). Prior empirical researches upon the adoption of technology-based services such as Sreenivansan and Noor (2010), Afshan and Sharif (2016), Alwahaishi and Snasel (2013), Chaouali et al. (2016) and Malaquias and Hwang (2016) have revealed effort expectancy as one of the salient determinants that can influence people to use internet banking or other internet related technologies like green banking. Therefore, this study hypothesizes that:

H2: Effort expectancy significantly affects individual intention to use green banking technologies.

Social Influence

Social influence can be defined as the extent to which an individual perceives that others who are important to them believe he or she should adopt a technology (Venkatesh et al., 2003). It basically reflects the impact of referees' opinion on individual user behaviour (Zhou, 2011). The idea behind social influence is that even though an individual may not be in favour of adopting a new technology like green banking, they intend to use it because of the belief that it will boost his/her image among his/her family and peers (Venkatesh and Davis, 2000). Researchers like Yu (2012), Slade et al. (2015), Afshan and Sharif (2016) and Malaquias and Hwang (2016) empirically find there is a significant positive relationship between social influence and adoption of green banking technology. Thus, the proposed hypothesis is:

H3: Social influence significantly affects individual intention to use green banking technologies.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Facilitating Conditions

Users generally need to be equipped with necessary resources and knowledge to operate any technology-based services. According to Venkatesh et al. (2003), facilitating conditions can be defined as the resources and technical infrastructure that a user believes should exist to support the adoption of a particular technology. Lack of these resources and knowledge may impede the adoption of technology related services (Zhou, 2011). On the other hand, availability of facilitating conditions like the access of clients to computer or Internet often results in a higher adoption rate for technological advancements like green banking. Many prior researchers like Yu (2012), Alwahaishi and Snasel (2013), Shaikh and Karjaluoto (2015), Afshan and Sharif (2016) and Chaouali et al. (2016) also claim a positive significant relationship between facilitating conditions and green banking technologies. Taking this concept into account, the next hypothesis is:

H4: Facilitating conditions significantly affects individual intention to use green banking technologies.

Environmental Concerns

According to Kranz and Picot (2011), environmental concerns arise from the basics of environmental psychology. They are typically used as the predictor of the adoption of environmental friendly behavior by most people. Few prior studies like Kranz and Picot (2011) and Gomez and Scholtz (2016) found positive correlation between environmental concern and adoption of behavior favoring the preservation of natural resources and sustainability of the environment. In this regard, many people today support the use of sustainable practices in business and expect social responsibility from all levels of functional activities (Nisha, 2016). As such, it is quite possible that people with greater environmental concern will have a higher likelihood to use green banking technologies (Hossain et al., 2015). Considering this aspect, the next hypothesis is:

H5: Environmental concern significantly affects individual intention to use green banking technologies.

Perceived Financial Cost

It has been proved by several empirical evidences that technology acceptance is influenced by economic factors to a large extent and hence, an important driving factor for the adoption of green banking technology is the financial cost or cost burden related to the use of such services. Past studies by Cruz et al. (2010) and Huili and Zhong (2011) empirically find economic factors like transaction fees of banking and service fees required to connect to green banking technologies play an essential role in green banking adoption. Researchers like Sripalawat et al. (2011), Yu (2012) and Sanakulov and Karjaluoto (2015) also found this construct to have a negative impact upon the behavioral intention of clients to use green banking services. In order to focus on this relationship further, this study hypothesizes that:

H6: Perceived financial cost significantly affects individual intention to use green banking technologies.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Timeliness

According to Taylor and Todd (1995), the extent to which a person views an innovation as offering an advantage over previous ways of performing the same task is known as relative advantage. One of the relative advantages in the context of green banking innovation is timeliness. Due to the busy lifestyle of people, anything that saves time is generally appreciated by the users. Thus, more people are using green banking technologies like internet banking, mobile banking, etc. today than ever before because of its convenience and time saving feature. Green technology can actually help clients to save time and do daily banking transactions in a branchless mode. Even prior studies like Lin (2011), Khraim et al. (2011) and Ketkar et al. (2012) found positive correlation between timeliness and individual intention to use green banking. Hence, the next hypothesis is:

H7: Timeliness significantly affects individual intention to use green banking technologies.

Behavioral Intention

Many empirical studies reveal that the behavior of using any technology is often influenced by the intention to use that technology. Particularly, the studies by Venkatesh and Zhang (2010), Yu (2012) and Nisha et al. (2015) argue that individual behavior is predictable and can be influenced by individual intention that, in turn, can have a significant influence on technology usage. Now, in the context of green banking, the ultimate goal of banks is to ensure that consumers adopt their services rather than just having an intention to adopt it. As such, Alwahaishi and Snasel (2013), Shaikh et al. (2015) and Afshan and Sharif (2016) took this relationship between behavioral intention and actual use into consideration against the backdrop of green banking technologies. Following the lead, this study next hypothesizes that:

H8: Behavioral intention significantly affects individual behavior of using green banking technologies.

RESEARCH METHOD

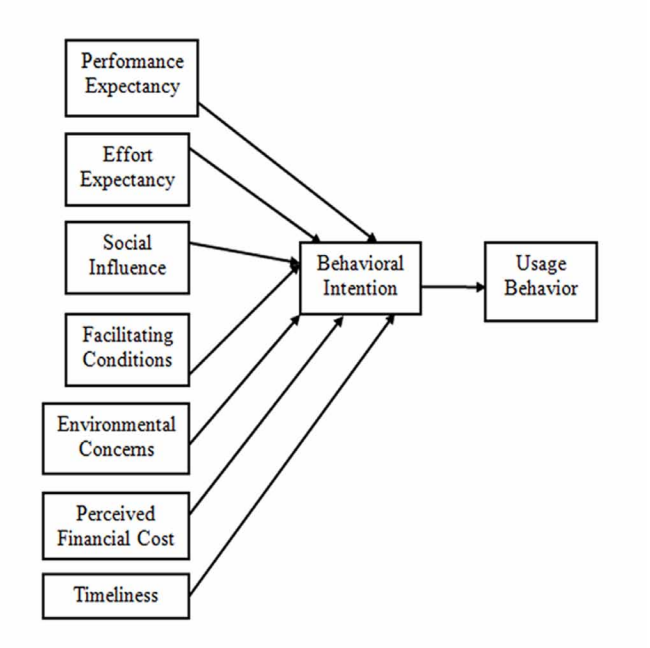
Data Collection

To investigate the proposed research model, methods and techniques employed for data collection involved a primary research. The primary research involved gathering of data by conducting survey of a representative convenience sample of 1000 bank clients from selected commercial banks operating in the capital city of Bangladesh - Dhaka. The use of this particular sampling method allows us to avoid biasness in data and provide equal opportunity for all city dwellers who are the present or potential users of green banking in Bangladesh.

The survey requires developing and circulating questionnaires for the clients by presenting the information in quantifiable terms, in order to determine the factors that can influence their perception towards green banking services. Since most of the respondents were educated and had English proficiency, they were asked to self-administer the English version of the questionnaire. In other cases, the participants self-administered the Bengali version of the questionnaire or the research assistants themselves filled in the questionnaire based on the respondents' verbal responses. After a three-week survey, 908 completed and usable responses were finally obtained from the survey.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 1. The Proposed Research Structure



Measurement

All the items used to measure the research variables of the survey were adapted from previous studies, with minor changes in wording to tailor them to the different green banking context in Bangladesh. This ensured the content validity of the questionnaire used to assess each constructs depicted in Figure 1.

The quantitative survey contained 31 statements in order to evaluate the five constructs of the UTAUT model and the three new constructs proposed for the model, as listed in Table 1. The scales for the UTAUT constructs (performance expectancy, effort expectancy, social influence, facilitating conditions and behavioral intention) were adapted from Venkatesh and Zhang (2010), Lin (2011), Yu (2012), Nisha (2016) and Rifat et al. (2017). The scale for environmental concerns was drawn from Ahmad et al. (2013) and Hossain et al. (2015), while the items used to assess perceived financial cost and timeliness were based on Luarn and Lin (2005), Khraim et al. (2011), Ketkar et al. (2012) and Nisha et al. (2015). All these items were measured using a five-point Likert scale, ranging from "strongly disagree" to "strongly agree".

DATA ANALYSIS AND RESULTS

The research model of this study is tested using the structural equation modeling (SEM) facilitates of SmartPLS (version 3.0). For this purpose, an exploratory factor analysis is run on the survey dataset to determine the underlying factor structures, i.e. to explore which observed variables are associated with each latent variable. Using the results of the exploratory factor analysis, a confirmatory factor analysis is run to examine the reliability and validity of the measurement model without identifying the directional relationship among the factors.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 1. Constructs and Corresponding Items

Constructs	Corresponding Items
Performance Expectancy	[PE1] Using green banking can make my banking transactions more efficient [PE2] Using green banking can save me time in conducting banking transactions [PE3] Using green banking can make my banking transactions more convenient [PE4] Using green banking can be useful in managing my finances
Effort Expectancy	[EE1] Learning to use green banking is easy for me [EE2] Becoming skillful at using green banking is easy for me [EE3] Interaction with green banking is easy for me [EE4] Overall, I think green banking is easy to use
Social Influence	[SI1] People who are important to me think that I should use green banking [SI2] People who are familiar with me think that I should use green banking [SI3] People who influence my behavior think that I should use green banking [SI4] Most people surrounding me use green banking
Facilitating Conditions	[FC1] Using green banking suits my living environment [FC2] Using green banking fits into my working style [FC3] Using green banking is compatible with my life [FC4] Help is available if I have problems in using green banking
Environmental Concerns	[EC1] I believe green banking will lead to better care for the environment [EC2] I believe green banking is a sustainable environmental practice by banks [EC3] I believe green banking will help to deal with environmental vulnerabilities [EC4] I believe green banking to be a socially responsible activity of the banks
Perceived Financial Cost	[PFC1] The cost of using green banking is higher than other banking channels [PFC2] The internet charges required to use green banking are expensive [PFC3] The mobile devices required to use green banking are expensive [PFC4] Using green banking services can be a cost burden to me
Timeliness	[T1] Using green banking provides me access to bank anytime-anywhere [T2] Using green banking reduces the waiting time for my banking transactions [T3] Using green banking provides me banking information in a timely fashion [T4] Using green banking makes transactions faster by reducing human interventions
Behavioral Intention	[BI1] I prefer to use green banking [BI2] I intend to use green banking [BI3] I believe it is worthwhile for me to use green banking

The method of partial least squares (PLS) is chosen to conduct this analysis since a number of interaction terms have been included in the research model and PLS is capable of testing these effects (Chin et al., 2003). The PLS path modeling approach is also known to be more accurate in explaining the complex relationship than any other approaches (Pavlou and Gefen, 2005). Through partial least squares (PLS) method, first the measurement model is examined to assess the reliability and validity of all variables and then, the structural model is analyzed to examine the relationships hypothesized in the research model. To do this, a detailed assessment of the measurement models at the item level and higher-order level are done and later an analysis of the posited structural relationships is conducted. Extensive tests for convergent validity and discriminant validity to assess the measurement model are done as well; while, the direction of path coefficients, the value of t-statistics, and the explanatory power of the independent variables is further tested for the structural model.

To test the validity of the measurement model, a conformity analysis test is conducted which includes both convergent validity and discriminant validity (Campbell and Fiske, 1959). Convergent validity measures whether the items effectively reflect their respective constructs, whereas discriminant validity shows whether the constructs are statistically different from each other. The convergent validity has

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

been checked through the standardized item loadings, average variance extracted (AVE) and composite reliability (CR) of the items and constructs. In order to test the discriminant validity, it is suggested that that square root of AVE of each construct should be greater than its highest latent variable correlation (Fornell and Larcker, 1981). If the result of the Fornell-Larcker criterion is satisfactory, the model is known to pose good discriminant validity. The bootstrapping method from PLS path modeling approach has been next used in this study to examine the structural paths of the proposed research model. Results of the study are subsequently reported in the following sections.

Measurement Model

Results from the measurement model are presented in Table 2 and Table 3 and it includes information about the reliability, validity, correlations and factor loadings. The composite reliabilities of the constructs ranged between 0.842 and 0.895, which exceeds the 0.7 recommended cut-off values (Nunnally and Bernstein, 1994). The average variance extracted (AVE) is greater than 0.5 in all cases and greater

Table 2. Factor Loadings, Composite Reliability and AVEs

Constructs	Items	Factor Loadings	Composite Reliability	AVE
Performance Expectancy	PE1	0.807	0.889	0.668
	PE2	0.847		
	PE3	0.850		
	PE4	0.761		
Effort Expectancy	EE1	0.822	0.895	0.680
	EE2	0.834		
	EE3	0.840		
	EE4	0.802		
Social Influence	SI1	0.867	0.891	0.732
	SI2	0.876		
	SI3	0.823		
Facilitating Conditions	FC1	0.776	0.864	0.680
	FC2	0.877		
	FC3	0.818		
Environmental Concerns	EC1	0.790	0.860	0.672
	EC2	0.835		
Perceived Financial Cost	PFC2	0.889	0.842	0.642
	PFC3	0.764		
	PFC4	0.743		
Timeliness	T1	0.825	0.876	0.702
	T2	0.835		
Behavioral Intention	BI1	0.868	0.891	0.731
	BI2	0.873		
	BI3	0.823		

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 3. Measurement Model Estimations

	ICRs	BI	EC	EE	FC	PE	PFC	SI	T
BI	0.815	**0.912**							
EC	0.809	0.545	**0.833**						
EE	0.884	0.567	0.443	**0.887**					
FC	0.832	0.489	0.688	0.413	**0.890**				
PE	0.816	0.087	-0.145	0.030	0.078	**0.806**			
PFC	0.867	0.513	0.401	0.323	0.421	0.067	**0.844**		
SI	0.854	0.429	0.221	0.376	0.355	0.135	0.328	**0.898**	
T	0.866	0.407	0.430	0.355	0.334	0.159	0.376	0.324	**0.955**

Notes:

1. BI (Behavioral Intention); EC (Environmental Concerns); EE (Effort Expectancy); FC (Facilitating Conditions); PE (Performance Expectancy); PFC (Perceived Financial Cost); SI (Social Influence); T (Timeliness).
2. Diagonal elements represent the AVEs, while off-diagonal elements represent the square correlations.

than each square correlations, which indicates that all the three models have both convergent validity and discriminant validity (Fornell and Larcker, 1981). Moreover, the internal consistency reliabilities (ICRs) of multi-item scales modeled with reflective indicators was 0.75 or greater, suggesting adequate reliability. The pattern of loadings and cross-loadings also supported internal consistency and discriminant validity, with some exceptions: two items from the construct of environmental concerns and timeliness; and, one item from each construct of social influence, facilitating conditions and perceived financial cost were deleted, due to their low loadings and high cross-loadings.

Structural Model

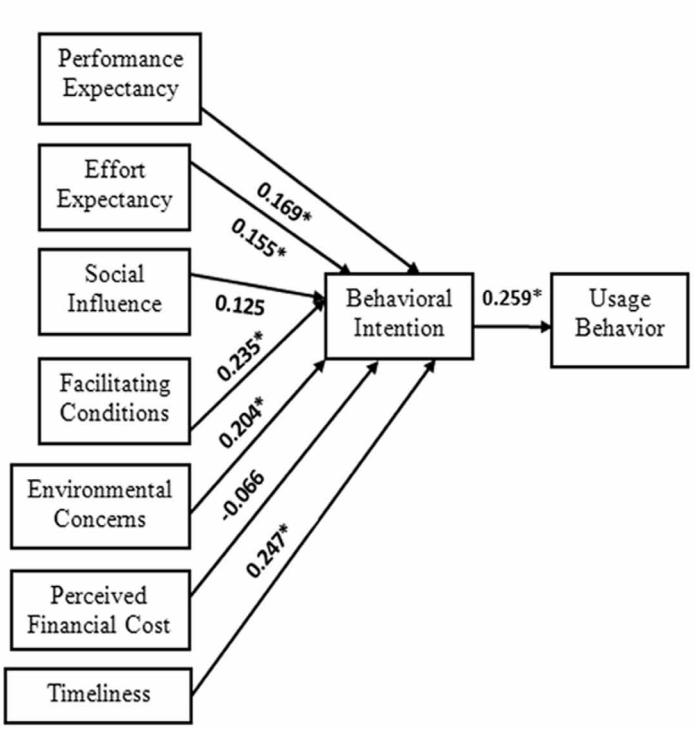
The path coefficients and significance levels in the structural model are presented in Figure 2. Furthermore, the t-statistics - calculated using the path coefficients of the constructs and their bootstrapped standard errors - are presented in Table 4. Results reveal that the constructs of timeliness (0.247, $p<0.05$), facilitating conditions (0.235, $p<0.05$), environmental concerns (0.204, $p<0.05$), performance expec-

Table 4. Path Coefficients, t-statistics and Hypotheses Results

Hypothesis	Path Coefficients (P)	Standard Error (STERR)	t-Statistics (P/STERR)	Results
H1: Performance Expectancy to Behavioral Intention	0.169	0.1153	1.4657	Supported
H2: Effort Expectancy to Behavioral Intention	0.155	0.1028	1.5078	Supported
H3: Social Influence to Behavioral Intention	0.125	0.1965	0.6361	Not Supported
H4: Facilitating Conditions to Behavioral Intention	0.235	0.1187	1.9798	Supported
H5: Environmental Concern to Behavioral Intention	0.204	0.1033	1.9748	Supported
H6: Perceived Financial Cost to Behavioral Intention	-0.066	0.1516	0.4354	Not Supported
H7: Timeliness to Behavioral Intention	0.247	0.1004	2.4602	Supported
H8: Usability to Behavioral Intention	0.259	0.1259	2.0572	Supported

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 2. Results of Structural Equation Modeling



tancy (0.169, $p<0.05$) and effort expectancy (0.155, $p<0.05$) show significant and positive paths to the behavioral intention of using green banking services, in their order of influencing strength.

However, the constructs of both social influence (0.125, $p>0.05$) and perceived financial cost (-0.066, $p>0.05$) report an insignificant path towards the individual behavior of using green banking services. Therefore, all hypotheses (except H3 and H6) dealing with behavioral intention to use green banking are supported. Subsequently, the hypothesized relationship between behavioral intention and usage (0.259, $p<0.05$) is statistically significant, thereby supporting hypothesis H8.

FINDINGS AND IMPLICATIONS

The objective of this study is to determine the constructs which stimulates the intention to adopt green banking in Bangladesh. The current study finds that timeliness, facilitating conditions, environmental concerns, performance expectancy and effort expectancy plays an important role in capturing clients' overall perceptions of green banking. Results therefore indicate that clients may be fairly pragmatic in developing general attitudes towards the use of green banking. On the other hand, constructs of social influence and perceived financial cost are identified as insignificant factors of client's behavioral intention in Bangladesh. The inclined reasons behind such findings are quite obvious and most of it is shaped by the local culture and infrastructure. Findings are presented below and are separately inclined with each hypothesis of the current study.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- The first hypothesis of the study claims that performance expectancy significantly affects individual intention to use green banking technologies. Performance expectancy is an important construct according to the research findings of this study. Sustainable qualities of green banking such as efficiency, saving time, convenient transaction and useful in managing finances, etc play an important role in shaping client behavior in terms of adopting green banking. Nisha et al. (2015), Chaouali et al. (2016) and Malaquias and Hwang (2016) have also found such similar results in their studies. The underlying cause behind such result is the novelty of such service in the culture of Bangladesh, where most of the errands are preferred to be served in a traditional manner from physical locations. Clinching benefits such as the efficiency, high responsiveness with empathy, ease of using services and the relative conveniences that are attached with such usages should be used as the major promoting ideas of their CSR to build a strong positive comprehension in the response process of the target clients. The banks must also ensure a lot of empathy and a high level of responsiveness while providing the accurate information through the website email and call center personnel to the clients.
- The second hypothesis states that effort expectancy significantly affects individual intention to use green banking technologies. Results of this study drills that most of the current and potential clients of green banking tend to judge the importance of the adoption based on the required effort expectancy for it. Respondents who expect less effort input in the service consuming process, especially at the adoption stage like that of green banking services in Bangladesh, are more likely to show positive attitude in embracing this service. This finding of the current study claiming that effort expectancy plays a deterministic role in influencing the adoption of green banking has also been supported by Sreenivansan and Noor (2010), Alwahaishi and Snasel (2013) and Malaquias and Hwang (2016). Hence, communications of the banks should focus more on the actual handiness of such services. By making sure that the target clients perceives the efforts needed to avail these services at an ease, banks can net a positive attitude towards these services. To do this, the software platform of the green banking service applications should be made more compatible and user-friendly for the ease of use of the clients.
- According to the third hypothesis, social influence significantly affects individual intention to use green banking technologies. However, the construct of social influence had no effect upon the clients' intentions of adopting green banking as per this study. This finding is certainly not in line with the results revealed by Yu (2012), Slade et al. (2015) and Malaquias and Hwang (2016). Even though the cultural stance of Bangladesh is mainly based on collectivism, the adoption decision of the target clients in case of green banking is not influenced by the family, friends, colleagues or acquaintances. As such, the banks need to focus on direct marketing while attracting the clients in adopting green banking since no word of mouth or social influences will work effectively and affect their intentions. Hence, the clients should be informed about new services and benefits related to green banking by the bank officials in order to enhance the chance of usage for such services.
- The fourth hypothesis of the study claims that facilitating conditions significantly affects individual intention to use green banking technologies. Facilitating conditions is found to be the second strongest direct determinant in influencing client's behavioral intention of adopting green banking in this study. This finding is consistent to Shaikh and Karjaluoto (2015), Afshan and Sharif (2016) and Chaouali et al. (2016). The penetration of green banking is a comparatively new concept in Bangladesh and particularly, when such services are being used as a platform of commuting other errands such as receiving conducting instant banking transactions, ensuring facilitating conditions

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

has a strong role to play. Facilitating conditions generally tend to be the wide availability of computers, strong mobile networks and fast internet services in the context of Bangladesh. Therefore, banks need to emphasize upon the compatibility between the offered services and the working/living styles of their target customers. That is, banks should put efforts in designing suitable services and infrastructures to meet specific needs of different customer segments. Only the availability of strong facilitating conditions can ensure to build the right perception in the mind of target clients by repeatedly focusing upon the benefits of green banking.

- The fifth hypothesis states that environmental concern significantly affects individual intention to use green banking technologies. This construct is found to positively affect the adoption of green banking for clients as per this study. Since Bangladesh is generally prone to natural calamities, it often causes huge losses to the environment. As a result, many people today are concerned about the protection and sustainability of the environment. Moreover, as per the Human Development Report by UNDP (United Nations Development Programme), the HDI (Human Development Index) of Bangladesh is currently 0.558 with a positive growth. This indicates that the healthcare, education and living expense of the country is positively increasing, which in turn increases the social and environmental awareness and understanding of people. This finding is similar to the results revealed by Kranz and Picot (2011), Hossain et al. (2015) and Gomez and Scholtz (2016). Bank clients thus particularly believe that green banking can lead to a better care for the environment, dealing with environmental vulnerabilities and degradation. This thought of the target clients of the banks has led to an increased adoption of green banking in Bangladesh.
- According to the sixth hypothesis, perceived financial cost significantly affects individual intention to use green banking technologies. An insignificant and negative impact of perceived financial cost is observed upon the behavioral intention of adopting green banking in Bangladesh in this study. It supports previous findings like Sripalawat et al. (2011), Yu (2012) and Sanakulov and Karjaluoto (2015). In the context of Bangladesh, this insignificance may have resulted due to the low call and internet subscription rates charged by the mobile network operators as well as for the credibility and trust that has been long-established by the local telecom providers. Additionally, most of the country's well-known banks have already managed to ensure a strong credibility among their target clients' through their banking services and low transaction rates. In fact, the cost of using green banking is much lower than the traditional banking services in Bangladesh due to the increased use of internet and mobile devices at the cheapest possible price. Hence, general people mostly have no complaints related to the cost of green banking services in the country – thereby, making it an insignificant factor in this study.
- The seventh hypothesis of the study claims that timeliness significantly affects individual intention to use green banking technologies. Adoption of green banking can help the clients in terms of saving their time and avoid travelling to bank branches and queuing up for simple banking transactions. Green banking allows banks to offer more services on electronic medium such as internet banking and mobile banking which benefits the clients by available information and service in real time. It requires less time for transaction or getting information for services such as bank statement, online payment, card instructions, etc. Also, green banking technologies provide banking anytime-anywhere, reducing waiting time, fastest transfer facility and such others. Hence, it is not surprising that the relative advantage of timeliness came out as the strongest positive factor that can influence the perception and intention of clients towards green banking adoption. In fact, past studies like Lin (2011), Khraim et al. (2011) and Ketkar et al. (2012) also supported this finding.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- The eighth and last hypothesis states that behavioral intention significantly affects individual behavior of using green banking technologies. This has been found positive and significant according to the results of this study. Therefore, the argument by previous studies like Rifat et al. (2016), Iqbal et al. (2017) and Rifat et al. (2017) that individual behavior is predictable and can be influenced by individual intention can be supported. Moreover, these past studies further claim that behavioral intention can, in turn, have a significant influence on green banking technology usage. Therefore, the government and the central bank should be more forthcoming in this regard by making budgetary allocations and by providing more financing facility for extensively implementing green banking in the financial sector of Bangladesh.

In conclusion, the development of behavioral intention and then usage of green banking might be a long-term project in emerging economies; but, the fairly positive perception of clients for the environment and an equally positive attitude towards the relative advantage of timeliness clearly paves the way of a higher rate of adoption of green banking in Bangladesh.

LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

Like most empirical research, this study has several limitations. First, the conclusions drawn from this study are based solely upon the urban population. Future research can explore the behavioral intention of the rural people, since access to green banking services still remains restricted to a certain extent in the rural areas of Bangladesh. Second, the moderating impact of voluntariness needs to be explored for a thorough understanding of the influencing factors from the client perspective towards green banking. Finally, other than the proposed dimensions of this study, there can be other factors that can influence the acceptance and use of green banking. Further research considering different factors can thus enhance the understanding of precise determinants for green banking services in Bangladesh.

REFERENCES

Gani, M.O. (2013, July 29). Green banking: Concept and policy guidelines. *The Financial Express*, *20*(157).

Afshan, S., & Sharif, A. (2016). Acceptance of mobile banking framework in Pakistan. *Telematics and Informatics*, *33*(2), 370–387. doi:10.1016/j.tele.2015.09.005

Ahmad, F., Zayed, N. M., & Harun, M. A. (2013). Factors behind the adoption of green banking by Bangladeshi commercial banks. *ASA University Review*, *7*(2), 241–255.

Alam, M. S., & Islam, M. A. (2013). Long-term assessment of rice production scenario in Bangladesh: A macro dynamics. *Bangladesh Journal of Agricultural Research*, *38*(2), 257–269. doi:10.3329/bjar.v38i2.15889

Alwahaishi, S., & Snasel, V. (2013). Acceptance and use of information and communications technology: A UTAUT and flow based theoretical model. *Journal of Technology Management & Innovation*, *8*(2), 61–73. doi:10.4067/S0718-27242013000200005

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Bahl, S. (2012). Green banking - The new strategic imperative. *Asian Journal of Research in Business Economics and Management*, *2*(2), 176–185.

Bahl, S. (2012). The role of green banking in sustainable growth. *International Journal of Marketing. Financial Services and Management Research*, *1*(2), 27–35.

Bihari, S. C. (2010). Green banking towards socially responsible banking in India. *International Journal of Business Insights & Transformation*, *4*(1), 82–87.

Biswas, N. (2011). Sustainable green banking approach: The need of the hour. *Business Spectrum*, *1*(1), 32–38.

Campbell, D. T., & Fiske, D. W. (1959). Convergent and discriminant validation by the multitrait- multimethod matrix. *Psychological Bulletin*, *56*(2), 81–105. doi:10.1037/h0046016 PMID:13634291

Chaouali, W., Yahia, I. B., & Souiden, N. (2016). The interplay of counter-conformity motivation, social influence and trust in customers' intention to adopt Internet banking services: The case of an emerging country. *Journal of Retailing and Consumer Services*, *28*, 209–218. doi:10.1016/j.jretconser.2015.10.007

Chin, W. W., Marcolin, B. L., & Newsted, P. R. (2003). A partial least squares latent variable modeling approach for measuring interaction effects: Results from a Monte Carlo Simulation study and an Electronic-Mail Emotion/Adoption study. *Information Systems Research*, *14*(2), 189–217. doi:10.1287/isre.14.2.189.16018

Cruz, P., Barretto Filgueiras Neto, L., Muñoz-Gallego, P., & Laukkanen, T. (2010). Mobile banking rollout in emerging markets: Evidence from Brazil. *International Journal of Bank Marketing*, *28*(5), 342–371. doi:10.1108/02652321011064881

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *Management Information Systems Quarterly*, *13*(3), 319–340. doi:10.2307/249008

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science*, *35*(8), 982–1003. doi:10.1287/mnsc.35.8.982

Faroque, M. A. A., Asaduzamman, M., & Hossain, M. (2013). Sustainable agricultural development under climate change in Bangladesh. *Journal of Science Foundation*, *11*(1), 17–28. doi:10.3329/jsf.v11i1.19396

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *JMR, Journal of Marketing Research*, *18*(1), 39–50. doi:10.2307/3151312

Gomez, J. M., & Scholtz, B. (2016). Information Technology in Environmental Engineering. In *Proceedings of the 7th International Conference on Information Technologies in Environmental Engineering (ITEE 2015)*, Springer.

Goyal, K. A., & Joshi, V. (2011). A study of social and ethical issues in banking industry. *International Journal of Economics and Research*, *2*(5), 49–57.

Hossain, M. (2014). Sustaining food security: Achievements and challenges. In *Paper presented at The First BEF Conference, Bangladesh Economist's Forum*, Bangladesh, June 21-22.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Hossain, M. Z., & Ahmed, M. (2015). Green banking in Bangladesh. In Green Banking in Bangladesh and Beyond (pp. 17-47). Bangladesh: Zaman Printing and Packaging.

Hossain, M. Z., Ahmed, M., & Nisha, N. (2015). Consumer attitudes and perception towards green banking in Bangladesh. In Green Banking in Bangladesh and Beyond (pp. 48-76). Zaman Printing and Packaging, Bangladesh.

Huili, Y. A. O., & Zhong, C. (2011). The analysis of influencing factors and promotion strategy for the use of mobile banking. *Canadian Social Science*, *7*(2), 60–63.

Inderst, G., Kaminker, C., & Stewart, F. (2012). Defining and measuring green investments: Implications for institutional investors' asset allocations. OECD Publishing.

Iqbal, M., Nisha, N., & Raza, S. A. (2017). Customers' perceptions of green banking: Examining service quality dimensions in Bangladesh. In P. Ordóñez de Pablos (Ed.), *Managerial Strategies and Solutions for Business Success in Asia*. Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1886-0.ch001

Islam, M. A., & Kamruzzaman, M. (2015). Green banking practices in Bangladesh. *IOSR Journal of Business and Management*, *17*(4), 37–42.

Kaeufer, K. (2010). *Banking as a Vehicle for Socio-economic Development and Change: Case Studies of Socially Responsible and Green Banks*. Cambridge, MA: Presencing Institute.

Ketkar, S. P., Shankar, R., & Banwet, D. K. (2012). Structural modeling and mapping of M-banking influencers in India. *Journal of Electronic Commerce Research*, *13*(1), 70.

Khraim, H. S., Al Shoubaki, Y. E., & Khraim, A. S. (2011). Factors affecting Jordanian consumers' adoption of mobile banking services. *International Journal of Business and Social Science*, *2*(20), 96–105.

Kranz, J. & Picot, A. (2011). Why are consumers going green? The role of environmental concerns in private green-IS adoption. In *Proceedings of ECIS 2011*.

Lin, H. (2011). An empirical investigation of mobile banking adoption: The effect of innovation attributes and knowledge-based trust. *International Journal of Information Management*, *31*(3), 252–260. doi:10.1016/j.ijinfomgt.2010.07.006

Lu, J., Yu, C. S., & Liu, C. (2009). Mobile data service demographics in urban China. *Journal of Computer Information Systems*, *50*(2), 117–126.

Luarn, P., & Lin, H. H. (2005). Toward an understanding of the behavioral intention to use mobile banking. *Computers in Human Behavior*, *21*(6), 873–891. doi:10.1016/j.chb.2004.03.003

Malaquias, R. F., & Hwang, Y. (2016). An empirical study on trust in mobile banking: A developing country perspective. *Computers in Human Behavior*, *54*, 453–461. doi:10.1016/j.chb.2015.08.039

Masukujjaman, M., & Aktar, S. (2013). Green banking in Bangladesh: A commitment towards the global initiatives. *Journal of Business and Technology*, *8*(1&2), 17–40.

Masum, M. (2015). The need for Green banking in Bangladesh. In Green Banking in Bangladesh and Beyond (pp. 3-16). Bangladesh: Zaman Printing and Packaging.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Nisha, N. (2016). Exploring the dimensions of mobile banking service quality: Implications for the banking sector. *International Journal of Business Analytics*, *3*(3), 60–76. doi:10.4018/IJBAN.2016070104

Nisha, N. (2016). Green investments and returns: A developing country perspective. In M. Mihai (Ed.), *Measuring Sustainable Development and Green Investments in Contemporary Economies* (pp. 1–21). Hershey, PA: IGI Global.

Nisha, N., Idrish, S., & Hossain, M. Z. (2015). Consumer acceptance and mobile banking services in Bangladesh. In Z.H. Mohammad (Ed.), Green Banking in Bangladesh and Beyond (pp. 155-182). Bangladesh: Zaman Printing and Packaging.

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric Theory*. New York: McGraw-Hill.

Park, J., Yang, S., & Lehto, X. (2007). Adoption of mobile technologies for Chinese consumers. *Journal of Electronic Commerce Research*, *8*(3), 196–206.

Pavlou, P. A., & Gefen, D. (2005). Psychological contract violation in online marketplaces: Antecedents, consequences, and moderating role. *Information Systems Research*, *16*(4), 372–399. doi:10.1287/isre.1050.0065

Rahaman, M. M., Zayed, N. M., & Islam, M. F. (2015). The necessity of new commercial banks in Bangladesh: An exploratory study for evaluating the need assessment. *DIU Journal of Business and Economics*, *9*(1), 91–110.

Rifat, A., Iqbal, M., Nisha, N., & Sharif, A. (2017). Acceptance of green banking framework in Bangladesh: The case of Islamic banks. *Journal of Islamic Economics*. *Banking and Finance*, *13*(2), 152–178.

Rifat, A., Nisha, N., Iqbal, M., & Suvittawat, A. (2016). The role of commercial banks in green banking adoption: A Bangladesh perspective. *International Journal of Green Economics*, *10*(3/4), 226–251. doi:10.1504/IJGE.2016.081906

Saleem, Z., & Rashid, K. (2011). Relationship between customer satisfaction and mobile banking adoption in Pakistan. *International Journal of Trade*. *Economics and Finance*, *2*(6), 537–544.

Sanakulov, N., & Karjaluoto, H. (2015). Consumer adoption of mobile technologies: A literature review. *International Journal of Mobile Communications*, *13*(3), 244–275. doi:10.1504/IJMC.2015.069120

Shaikh, A. A., & Karjaluoto, H. (2015). Mobile banking adoption: A literature review. *Telematics and Informatics*, *32*(1), 129–142. doi:10.1016/j.tele.2014.05.003

Shakil, M. H., Azam, M. K. G., & Raju, M. S. H. (2014). An evaluation of green banking practices in Bangladesh. *European Journal of Business and Management*, *6*(31), 8–16.

Singhal, K. (2014). Green banking: An overview. *Asian Journal of Multidisciplinary Studies*, *2*(6), 196–200.

Slade, E. L., Dwivedi, Y. K., Piercy, N. C., & Williams, M. D. (2015). Modeling consumers' adoption intentions of remote mobile payments in the United Kingdom: Extending UTAUT with innovativeness, risk and trust. *Psychology and Marketing*, *32*(8), 860–873. doi:10.1002/mar.20823

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Sreenivasan, J., & Noor, M. N. M. (2010). A conceptual framework on mobile commerce acceptance and usage among Malaysian consumers: The influence of location, privacy, trust and purchasing power. *WSEAS Transactions on Information Science and Applications*, *7*(5), 661–670.

Sripalawat, J., Thongmak, M., & Ngramyarn, A. (2011). M-banking in metropolitan Bangkok and a comparison with other countries. *Journal of Computer Information Systems*, *51*(3), 67–76.

Stofega, W., & Llamas, R. T. (2009). *Worldwide Mobile Phone 2009-2013 Forecast Update, IDC Document Number 217209*. Framingham, MA: IDC.

Taylor, S., & Todd, P. A. (1995). Understanding information technology usage: A test of competing models. *Information Systems Research*, *6*(2), 144–176. doi:10.1287/isre.6.2.144

Islam, M.T. (2015, May 26). Green banking and its present scenario in Bangladesh. *The Daily Observer*.

Roy, J.K. (2015). Green stocks: Green investment, green return. *The Financial Express, 22*(255).

Roy, J.K. (2015). Promoting green businesses in Bangladesh. *The Financial Express*, *22*(241).

Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science*, *46*(2), 186–204. doi:10.1287/mnsc.46.2.186.11926

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *Management Information Systems Quarterly*, *27*(3), 425–478. doi:10.2307/30036540

Venkatesh, V., Thong, J. Y. L., & Xin, X. (2012). Consumer acceptance and use of information technology: Extending the Unified Theory of Acceptance and Use of Technology. *Management Information Systems Quarterly*, *36*(1), 157–178.

Venkatesh, V., & Zhang, X. (2010). Unified theory of acceptance and use of technology: U.S. vs. China. *Journal of Global Information Technology Management*, *13*(1), 5–27. doi:10.1080/1097198X.2010.10856507

Yu, C. (2012). Factors affecting individuals to adopt mobile banking: Empirical evidence from the UTAUT model. *Journal of Electronic Commerce Research*, *13*(2), 104–121.

Zhou, T. (2011). Understanding mobile Internet continuance usage from the perspectives of UTAUT and flow. *Information Development*, *27*(3), 207–218. doi:10.1177/0266666911414596

This research was previously published in the International Journal of Asian Business and Information Management (IJABIM), 9(3); edited by Patricia Ordóñez de Pablos, pages 14-34, copyright year 2018 by IGI Publishing (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 5
The Green School:
A Superintendent's Perspective

Maggie Shook
Thomaston-Upson Schools, USA

Michael D. Richardson
Columbus State University, USA

ABSTRACT

Green schools are supportive and efficient spaces, the places that the authors speculate should inspire others to value students, sustain the environment, and promote learning. They illustrate that the benefits of a green school go far beyond the environment to include student health and student academic performance. Seen from a superintendent's perspective, the authors conclude that green schools also help lower operational costs and reduce waste, while also encouraging the active involvement of occupants in these conservation efforts, teaching them to be responsible stewards of the environment and learning.

INTRODUCTION

More than 53 million children and 6 million adults spend their days in one of the 120,000 public and private school buildings in the United States (United States Environmental Protection Agency, 2008). Over half of these school buildings have polluted indoor air, lead, asbestos, chemical fumes, pesticides, and other harmful toxins (Healthy Schools Campaign, 2010). "It's estimated that at least 22 million school days are lost every year because of colds caught by students and faculty, according to the Centers for Disease Control and Prevention" (Alderson, 2009, p. 1).

Not surprisingly, there is a growing realization that K-12 schools can play a pivotal role in preventing environmental degradation (Edwards, 2010; Edwards & Naboni, 2013)). By influencing human minds at an impressionable age, K-12 institutions can instill a more long-term mindset among future policy makers, business leaders, politicians, and decision makers about the benefits of preserving the environment (Gordon, 2010; Gough, 2005). K-12 institutions that follow practices that prevent environmental damage are typically referred to as "Green Schools" (Freeman & Klein, 2011; U. S. Department of Education, 2009). Some issues that green schools have focused on are benefits of recycling, biological

DOI: 10.4018/978-1-5225-7915-1.ch005

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

pest control, energy conservation, and sustainability (Association for Enterprise Opportunity, 2013; Gleed, 2009; Sneirson, 2009).

The term "Green Schools" has its origin in the literature on "Green Ergonomics" (Thatcher, 2013), and represents a fusion of the interrelated concepts of (a) environmental education and (b) sustainable utilization of natural resources (Gutter & Knupp, 2011; Iffrig, 2009). While several conceptualizations of green schools are available, from an operational standpoint, a school is considered as "Green" if it adheres to leadership in energy and environmental design or an internationally recognized certification system that focuses on (a) energy savings, (b) water efficiency, (c) sustainable land use, (d) air quality, and (e) stewardship of natural resources (Leadership in Energy and Environmental Design, 2013). What is a "green school?" No generally accepted definition exists either from professional organizations or from researchers and educators (DuBose, Bosch, & Pearce, 2007; Gisason, 2009; Hornman, Lapinski, Korkmaz, Pulaski, Magent, Luo, Hardig, Dahl, 2006; Mardaljevic, Heschong, & Lee, 2009). For some, green school buildings are the definition of green schools, while for others it means a healthy school environment, and for others it might indicate an environmentally literate student body (Kensler, 2012; Inside Binghamton University, 2011; Kats, Braman, & James, 2010). The U.S. Department of Education (2008) defined a green school as a school that produces environmentally literate graduates, minimizes its environmental footprint, and has a positive impact on student and staff health (Kats, 2003; Matich, 2012).

While conventional schools incur costs to create physical infrastructure and other tangible assets, they are often lacking sufficiency for their human occupants (Matsuoka, 2008; Olson & Kellum, 2003). In contrast, green schools provide an atmosphere through energy efficient lighting, solar panels, green roofs, water efficiency, day-lighting, sound control, and recycling (Murphy, 2010; Orsato, 2006; Roe & Mell, 2013).

The "Greening" of America's schools has resulted in several tangible performance outcomes such as increased school attendance, teacher retention rates and better student grades (Kats, 2006; Hoffman 2009). Green schools have also contributed better outcomes for student health and staff welfare (Bell & Dyment, 2008) as well as impressive operational savings (Issa, Attalla, Rankin, & Christian, 2010). Despite the undeniable benefits of green schools to society, selling the concept to K-12 administrators remains a huge challenge given significant up-front investment costs (Psacharopoulos & Patrinos, 2004). For example, optimally designed green schools are estimated to cost almost 70% more than conventional school buildings (Kats, 2006). For green schools to be adopted and used effectively, administrators and other stakeholders must be convinced of their benefits (Lavy & Bilbo, 2009; Lawton, 2007; Oreopoulos & Salvanes, 2011). According to the U.S. Energy Information Administration (2009), buildings are significant contributors to energy consumption and global warming (EIA, 2009; Ornstein, Moreira, Ono, Franca, & Nogueira, 2009). Famous politicians, celebrities, and journalists have continuously stressed the effects of buildings on environmental isses such as global warming and resource depletion (American Federation of Teachers, 2006).

The basic goals of green school are to:

- Cut energy costs through creative use of daylighting, solar heating, and shade and building placement.
- Improve air quality by minimizing or eliminating sources of indoor and outdoor pollution.
- Reduce noise to aid teaching and learning.
- Use recycled and recyclable building materials
- Conserve natural resources

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

GREEN SCHOOL POLITICS

The need for the interwoven dimensions of political, economic, legal, social and environmental has been agreed upon for achieving sustainability and green school efficiency (Bentzin & Lombardo, 2012). In order to accomplish efficiency with green schools, a critical understanding of its complementary parts is needed, such as how environmental, socio-political and economic factors influence people, as well as impacting choices and actions regarding the development and commitment to green schools (Benedict & McMahon, 2006; Bentzin & Lombardo, 2012; Christiansen, Joensen, & Nielsen, 2007; Davies & Quirke, 2007; Duran-Narucki, 2008; Edwards, 2006; Elliott, Fourali, & Issler, 2010; Humblet, Owens, & Roy, 2010; Murphy, 2010).

Economists, politicians and policymakers are interested in education in part because of their interest in securing a return on school investments (Olson & Kellum, 2003; Schimmel, 2011; Schneider, 2002). The American educational system is funded out of public resources meaning, that governments have an ethical obligation to optimize rates of return on the educational investment (Ahuja, 1996; U.S. Green Building Council, 2009; U. S. Energy Information Administration, 2013). Politicians often have broader objectives that inform their push for adequate return on investments (Ackley, 2009; Ackley & Begley, 2010; Barr, Leigh, & Dunbar, 2011; Blackwell, Cobb, & Weinberg, 2002; Crosss, Byrne, & Lueck, 2010). Some politicians and leaders often have particular preferences; some see equity as better than efficiency, to some productivity means more effective use of funds than equality, etc (Bertels, Papanin & Papania, 2011; Houston, 2009; McDonough, Braungart, Anastas & Zimmerman, 2003; Peponis, Bafna, Bajaj, Bromberg, Congdon & Rashid, 2007).

As the saying goes, 'information is power' and this is especially so in today's school (Evans & Lindsay, 2005). The world is experiencing an information revolution making the industrial revolution obsolete (Christensen, Horn, & Johnson, 2008). With this change comes an explosion of data, which educators are left to assimilate into useful information (Christiasen, Joensen, & Nielsen, 2007). However, the ability to interpret this avalanche of data, to extract meaning from artificial fields of data, has expanded much more slowly, if at all (Dunbar & Plaut, 2008). Education is experiencing a social and economic change that is evolving from an industrial focus at a national level, to an information focus at a global level (Christensen, Horn, & Johnson, 2008). There is so much data, that some describe districts as drowning in it (Celio & Harvey, 2005). With this flood of available data in education, when is too much data detrimental and no longer powerful (Corcoran, Fuhrman & Belcher, 2001)? What is the optimal level of data that educators can manage before rendering themselves powerless and unable to manage or process that data?

The positive effects of investments in education on the level and evolution of earnings, employment, and other aspects of well-being is one of the most robust and important empirical findings in labor economics (see e.g. Blundell, Dearden, Meghir & Sianesi, 1999; Oreopoulos & Salvanes, 2011; Psacharopoulos & Patrinos, 2004). In developed countries, education is an important resource for the economy and assumed to be one of the key determinants in development, production and, thus, economic growth. Therefore, as politicians seek to increase the population's educational level they often focus on the individual's (economic) benefits of education, mainly the increase in earnings due to investments into more education (Buckley, Schneider & Shang, 2005). Such politicians are now beginning to see the importance of investment in green as a demonstrated method for increasing economic and development productivity (Lockwood, 2006).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Green building is not a matter of choice or luxury but a necessity for the environmentally conscious industry professionals, owners, developers, government officials and the rest of the stakeholders (Crampton & Thompson, 2008). Growing awareness of environmental aspects and demand on green building worldwide shows that, the status quo as it exists in the construction industry simply cannot go on. The industry must, and is, changing. In the United States, buildings are responsible for 72% of electricity consumption, 39% of energy use, 35% of carbon dioxide emissions, 40% of raw material usage, 30% waste output and 14% potable water consumption. (USGBC, 2009) It is estimated that 73% of these buildings will stand for decades to satisfy demand with their negative environmental impact. As more and more research has been done over the years, the results confirm the positive impact from building with sustainability and green building standards in mind (Williams & Brown, 2013).

BENEFITS OF GREEN SCHOOLS

As the demand for 'sustainable' or 'green' buildings continues to increase, the need for a better understanding of how these buildings are designed has also increased (USGBC, 2009; Yudelson, 2008). Despite the many aspects of going green, most research focuses on cost, performance aspects, and the benefits of green buildings (Christopherson & Clark, 2006). A recent GSA study of green buildings indicated that, they had 33% less carbon emissions, 27% higher occupant satisfaction, used up to 45% less energy, experienced 13% lower aggregate maintenance costs and used up to 54% less water when compared to national averages (Healthy Schools Network, 2013; Olson & Carney, 2006). Even though the benefits are categorized as environmental, health and community, financial, market, and industry, most of the categories have secondary financial benefits as well (Edwards, 2010). Employees in buildings with interiors that are compliant with green building standards experience less absenteeism and fewer turnovers.

Fortunately, green buildings can be designed and in unique places are being designed explicitly with environmental education in mind (Rainwater & Hartke, 2011). The phenomenon is best seen today in school buildings. School building research has focused on air quality, daylighting, and energy performance (Mardaljevic, Heschong, & Lee, 2009; National Research Council, 2007; United States Green Building Council, 2009). The school building is arguably the largest and most visible physical artifact of school sustainability, and one that changes less often relative to other aspects of the school environment such as curriculum or the sourcing of green office supplies. The notion of sustainability has evolved significantly from the conventional view of being "green" to the linking of social and economic dimensions with ecological protection goals (Kohler, 2002).

BENEFITS OF GREEN SCHOOLS

- Enhance and protect eco-system and biodiversity,
- Improve water and air quality,
- Reduce solid waste,
- Conserve natural resources,
- Improve air, thermal, daylight and acoustic environments,
- Enhance occupant comfort and health,
- Minimize strain on local infrastructure,

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- Contribute to the overall quality of life,
- Reduce operating costs,
- Reduce life cycle energy costs,
- Improve employee productivity and satisfaction,
- Lower absenteeism / increased productivity,
- Lower health related costs such as insurance premiums,
- Lower employee turnover,
- Promote longer economic life of the facility,
- Obtain federal grants used as enticements to promote green buildings, and
- Improve student performance.

Researchers investigating effects of green building design on occupants have indicated green building occupants experienced fewer rates of absenteeism, lower turnover, and higher productivity (Kats, 2006; Steinberg, Patchan, Sehunn, & Landis, 2009). Kats (2006) validated that green buildings do not come at high premiums as originally assumed. According to Kats, premium for green is typically 2% of total cost of the project. Green school buildings on average are 25-30% more efficient compared to conventional buildings, use less water, produce less waste, are cheaper to maintain, and enhance occupant productivity (Kats, 2006). When a small increase in total project cost is compared to savings of lifetime energy costs, there is potential financial savings equal to ten times the initial investment to construct a green building (Kats, 2003).

Schools have the unique freedom to develop new ideas, comment on society, and engage in bold experimentation, as well as to contribute to the creation of new knowledge (Cortese, 1999). Schools contribute to the health and well-being of society through the creation and dissemination of knowledge and values (Cortese, 1992). As Vierderman (2006) concluded,

Higher education will play a role in shaping the vision and practice for a sustainable society for better or worse. It has a responsibility and an obligation for the better. Its graduates will be leaders of countries, corporations, religious institutions, art thought, science, engineering, and people of power. They will be citizens, great and small, asked to participate in decision making for the commonwealth. Its faculty will have access to the halls of power and will be called upon by society for assistance. (p.2)

Educational institutions should be responsive to the social, economic and cultural needs of the communities in which they are located and foster a more active engagement with communities (Chatterton & Goddard, 2000).

GREEN IMPACT ON STUDENT PERFORMANCE

The "greening" of schools—a growing national movement that now includes thousands of K-12 private, public, and charter schools across the country—can provide solutions to many economic and community challenges (Metzger, 2011). Tanner (2008), in a recent survey by the University of Colorado-Denver of 100 "green" schools in 28 states, found a positive correlation between student achievement in science and green school practices (Tanner, 2008, 2009). These green practices included a curriculum that advances environmental literacy and sustainability, opportunities for stewardship and service learning,

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

sustainable facilities design and management, and an emphasis on student health and well-being (Taylor, 2009). Student achievement can also increase with building improvements alone (Clark, 2006; Frantz, 2010; Gough, 2005; Heerwagen, 2000).

The link between quality school facilities and student achievement is well-documented in research. The continued state investment in school facilities should improve schools, communities, and the lives of students (Waughray & Kerr, 2012). Schools should be learner--centered, safe, and sustainable centers of their communities (Humblet, Owens & Roy, 2010).

Roughly one quarter of the US population spends the majority of their day in K-12 school buildings—students, the youngest citizens (Hatrick, 2010). Although schools have been studied and analyzed, recent scholarship on building performance has focused primarily on commercial buildings. But school buildings are very different from offices; they have different occupants, different daily routines, different management systems, different budgets, and different decision making structures (Olson & Carney, 2006). Additionally, as more schools move towards "green" design, there is an increased need to verify that they are meeting expected energy-related goals (Weston & Brooks, 2008). Green schools are not achieved through green building alone; all aspects of the school must support and embrace the green philosophy (Ramesh, Prakask & Shukla, 2010). Incorporating green (an environmentally-conscious perspective) into the curriculum has become an important part of green schools. Improved productivity, performance, and happiness are simply by-products of overall improvement in health. Conversely, the main contributors to improved health are better day lighting and indoor air quality, making it difficult to analyze whether increased student performance is due to overall building design or these variables alone (Anastas & Simmerman, 2003).

HEALTH BENEFITS

Researchers have found that the benefits of building green appear quickly in the form of energy savings and decreased human resource costs related to staff turnover and employee absenteeism (Clark, 2006; Edwards, 2006; Frantz, 2010). Proof that green schools can positively impact academics, student health, and a school's financial health continue to mount among green-minded administrators, teachers, and students (Coffey, 2001). Whether the topic is a curriculum that advances environmental literacy and sustainability, recycling programs and organic foods on the cafeteria line, or improving indoor air quality, the "greening" of the nation's schools points the way toward saving money, improving student health and achievement—and saving the planet in the process (Corcoran, Fuhrman & Belcher, 2001).

This movement began as individual educators advocating the "greening" of schools, but the green school movement now has broad appeal for school boards that want initiatives to save energy costs, and for teachers who want curricula changes. Green efforts significantly impact school culture and school planning and progress. The question of how the form and functioning of schools can be changed to create the least possible adverse impact on their local environment through the way they are planned, designed, laid out, and managed is only just being asked (Fast, 2013). It is important for green building initiatives to identify: the organizations that accelerate the adoption of green building guidelines in a society, the incentives and barriers associated with the green building guidelines, and the necessary motivations for the adopter organizations (Elliott, Fourali & Issler, 2010; Santone, 2010).

Another common health risk in today's buildings is poor indoor air quality. Individuals spend 80-90% of their time indoors (USGBC, 2009). Poor air quality is often unnoticed by occupants but clearly

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

reflected in the number of sick days and in employee complaints. In schools, poor air quality can have pronounced effects on asthma and allergies, increasing sick days taken by students and teachers (Kats, 2006). Because nearly 25% of our nation's schools are considered below standard, designed with minimum required performance for lowest cost, with air quality and ventilation rarely regulated by the state, these poor air quality conditions will most likely continue in years to come (Kats, 2006).

FINANCIAL CONCERNS

Why are there not more green schools? Most observers would indicate that the supposed financial concerns about green schools have limited both the discussion and building. But what about the financial impacts of a green school building? As school leaders strive to make schools more environmentally inclusive and "green," fiscal constraints are making schools more "lean" (Rothenberg, Pil, & Maxwell, 2001). The twentieth century reminded the world's population that the earth is finite in both its ability to produce raw material and safely process waste (Janda, 2009). The past century also showed how industrialization gone unchecked can pollute water and airways making the very elements of life toxic (Christopher, 2009). Although technology has greatly decreased the environmental impact of industry, the rate of consumption and production outpaces these innovations (Richardson, Chan, & Lane, 2000; Schelly, Cross, Franzen, Hall, & Reeve, 2011). One of the essential components of a sustainable society is "green development and productivity." Yet, given all of the importance of green productivity to the global environmental problem, many are still skeptical about the business benefits of green productivity especially in schools (Rudd, Reed, & Smith, 2008). However, if all new school construction and school renovations went green starting today, energy savings alone would total $20 billion over the next 10 years (Ryland, 2003; Sackett, 2007). Green schools typically cost less than $3 per square foot more to build, an investment that is paid back within a few years of operation (Waughray & Kerr, 2012).

ONE SCHOOL DISTRICT'S JOURNEY TO GREEN

The Thomaston-Upson School System (Georgia) Leadership and Board of Education recognizes that it is the responsibility of the school system to ensure that every effort is made to conserve energy and natural resources while exercising sound financial management. According to Chapman (2013), "the nation's schools spend more than $8 billion a year on energy, and as much as 30 percent of that energy is used inefficiently or unnecessarily" (p. 41). Chapman went on to generalize that when schools recognize that they have the potential to significantly cut their electricity use, they will save money and reduce their burden on the environment (Fast, 2013). Schimmel (March/April2011) emphasized "America can no longer use energy today and pay for it tomorrow. Schools have the opportunity to be leaders in modeling energy use" (p. 8).

The Thomaston-Upson School System started looking at ways to save money through energy management as early as 2006 (Frantz, 2010). Gutter and Knupp (2011) support this savings initiative by saying "a series of incremental improvements can lead a school district to reduced utility costs" (p. 26). In order to produce energy savings throughout the school system, the Thomaston-Upson County Board of Education entered into a five-year partnership contract with Energy Education, Inc. in March of 2006. The cost of this partnership was $310,000. Schimmel advised school districts to not try and go

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

it alone, but to seek help for research and changes (2011). He went on to say how important it was to do a cost analysis and to decide whether to outsource or manage alone. That is exactly the process the Thomaston-Upson School district went through in a partnership with Energy Education. The purpose of the partnership was to provide training and assistance with an Energy Education program. This approach started with an in-depth, on-site assessment of every facility in our district. The school buildings' use and needs of energy at all hours of the day and night were analyzed. Logs of temperatures, humidity, and other conditions important to equipment and facility use were obtained.

Gutter and Knupp (2010) speculated that a district has not made energy savings a concrete initiative unless it is someone's job to oversee the implementation. The school system demonstrated an agreement to this thought by hiring an Energy Manager to oversee the implementation of the energy savings program. The Energy manager was responsible for implementing a cost avoidance program through gathering data through the energy caps computer program, monitoring the school system's HVAC system, and implementing an energy education program for all of the Thomaston-Upson County School system employees.

Gutter and Knupp (2010) said that committing to an energy management program and adopting a policy or resolution will make the initiative official. The Thomaston-Upson County School System adopted an Energy Management Conservation Policy in October of 2006. The school system also implemented guidelines for energy conservation and building management. Gutter and Knupp said "show me the money" (p. 19). After implementing the energy management program, the estimated energy savings for the school system after 6 months was $57,643 or 12%, and after 11 months of reviewing plans and implementations of suggested cost effective measures, the estimated energy savings for the school system was $136,354 or 15%. Beyond initial energy savings benefits, this school district remove we realized we made a positive environmental impact by demonstrating stewardship of our natural resources. Leaders have continued to make energy conservation a priority to further shift dollars for energy costs to educating our students. Throughout the remainder of the partnership though 2010 the district realized a consistent savings in energy of approximately $100,000 per year. This was a necessary help not only in energy conservation costs but also with other budget restraints (Hatrick, 2010).

In 2010, the district continued to experience budget shortfalls and could no longer keep the position of energy manager in our budget. The responsibility of monitoring energy fell to an assigned individual at each school who also had additional responsibilities. While our savings have not continued to be as significant through the 2013 school year, our budgeted amount for energy has remained consistent even though costs for energy have increased. The school system continues to make energy conservation a priority. During school shut-down periods, we keep the ball rolling (Gutter & Knupp, 2010). We continue to tackle low- and no-cost improvements and follow the "un-plug" concept for all energy consuming devices during long breaks. If a benefit is described as "something that aids or promotes well-being" (wordnet.princeton.edu/), green building is all about promoting wellbeing, usually as it relates to environmental health and community wellbeing. There are also direct economic benefits through the reduction of energy and water use. Green buildings also produce many less obvious benefits, such as market and industry benefits. The biggest obstacle to green buildings is misconception regarding the perceived overwhelming costs of environmentally efficient products. In summary, the Superintendent and Board of Education knew how important it was to "Green" our schools. We did this by following a plan like Chapman recommends today: by developing policy, empowering leadership, organizing the effort in a partnership, developing a plan by completing an audit, and following a consistent process (2012, p. 44).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

WHAT OF THE FUTURE OF GREEN?

Green buildings are receiving increased attention in the public sector in the United States (Weston & Brooks, 2008). Over the past ten years, public sector organizations have gone from "testing the waters" with green building pilot projects to developing wide-reaching policies that incorporate green building practices and standards as a formal part of capital project decision processes (Sims, 2012). Like other green buildings, green schools decrease our reliance on fossil fuels, thus decreasing carbon dioxide emissions and other forms of harmful pollution (Schmitz, 2008). Green schools can help turn back the clock on global warming, improving the environmental outlook for the children who will one day be faced with the challenge of finding resolutions to this problem (Bardacke, 2009; Bell & Dyment, 2008).

According to researchers, green design increases productivity, performance, health and well-being, and satisfaction (Buckley, Schneider, & Shang, 2005; Center for Green Schools, 2010). School culture consists of elements such as core norms, traditions, mission, rituals, organization, leadership, roles, curricula and programs (Chapman, 2013). Leadership plays a large role in how each of these elements manifest (Bottery, 2008). The operation of the facility, and the ability for students to interact with its operation, enhance the school's ability to be an educational tool (Brager & Baker, 2009). Kats (2006) showed that green schools average a 3% increase in cost, but have a financial return of 20 times that amount. Benefits accumulate through lower water and energy use, increased teacher retention and lower health costs (Kats, 2006). An additional benefit, not measurable in dollars, is the increased competitiveness of the school. As parents are provided greater choice and freedom about where to send their children to school, the benefit of green building will become even more valuable. Research on the healthy indoor environment present in green buildings demonstrates benefits beyond cost effectiveness into the realm of societal responsibility (USGBC, 2009; Kats, 2006).

REFERENCES

Ackley, C. R. (2009). *Leadership in green schools; School principals as agents of social responsibility. State College*, PA: Pennsylvania State University.

Ackley, C. R., & Begley, P. T. The changing face of purpose-driven school administration: Green school leadership. In A. H. Normore (Ed.), *Global perspectives on educational reform: The development and preparation of leaders of learning and learners of leadership* (pp. 377–396). London, UK: Emerald Group Publishing Limited. doi:10.1108/S1479-3660(2010)0000011021

Alderson, K. (2009, February). Germ wars. *American School & University*, *81*(6), 30–33.

American Federation of Teachers. (2006). *Building minds, minding buildings: Turning crumbling schools into environments for learning*. Washington, DC: Author.

Anastas, P. T., & Zimmerman, J. B. (2003). Design through the 12 principles of green engineering. *Environmental Science & Technology*, *37*, 94A–101A. doi:10.1021/es032373g PMID:12666905

Association for Enterprise Opportunity, EcoVentures International, Green America. (2013). *The big green opportunity for small business in the U. S. Small Business Sustainability Report.* Available at http://biggreenopportunity.org/wp-content/uploads/2013/05/Big-Green-Opportunity-Report-FINAL-WEB.pdf

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Bardacke, T. (2009). Green schools. Global Green. Retrieved from http://www.globalgreen.org/greenurbanism/schools/

Barr, S., Leigh, K., & Dunbar, B. (2011). *Green schools that teach: A research report*. Fort Collins, CO: Colorado State University.

Bell, A. C., & Dyment, J. E. (2008). Grounds for health: The intersection of green school grounds and health promotion schools. *Environmental Education Research*, *14*(1), 77–90. doi:10.1080/13504620701843426

Benedict, M., & McMahon, E. (2006). *Green infrastructure: Linking landscapes and communities*. Washington, DC: Island Press.

Bentzin, B., & Lombardo, B. (2012, October). *Sustainability at ASU: Going green in the office.* Paper presented at the Arizona State University Global Institute of Sustainability Annual Conference. Tempe, AZ. Retrieved from http://sustainabilityasu.edu/docs/gios/green-office/green-office-level-1.pdf

Bertels, S., Papanin, L., & Papania, D. (2011, August). *Sustainability, employment and organisational outcomes*. Paper presented at the Academy of Management Annual Meeting: West meets East. San Antonio, TX.

Blackwell, M., Cobb, S., & Weinberg, D. (2002). The economic impact of educational institutions: Issues and methodology. *Economic Development Quarterly*, *16*(1), 88–95. doi:10.1177/0891242402016001009

Blundell, R., Dearden, L., Meghir, C., & Sianesi, B. (1999). Human capital investment: The returns from education and training to the individual, the firm, and the economy. *Fiscal Studies*, *20*(1), 1–23. doi:10.1111/j.1475-5890.1999.tb00001.x

Bottery, M. (2008). Educational leadership, the depletion of oil supplies and the need for an ethic of global sustainability. *School Leadership & Management*, *28*(3), 281–297. doi:10.1080/13632430802145969

Brager, G., & Baker, L. (2009). Occupant satisfaction in mixed-mode buildings. *Building Research and Information*, *37*(4), 369–380. doi:10.1080/09613210902899785

Buckley, J., Schneider, M., & Shang, Y. (2005). Fix it and they might stay: School facility quality and teacher retention in Washington, DC. *Teachers College Record*, *107*(5), 1107–1123. doi:10.1111/j.1467-9620.2005.00506.x

Celio, M. B., & Harvey, J. (2005). *Buried treasure: Developing a management guide from mountains of school data.* Retrieved from http://www.crpe.org/pubs.shtml#leadership

Center for Green Schools. (2010). *Why green schools are so important*. Retrieved from http://centerforgreenschools.org/why-green-schools.aspx

Chapman, P. (2013, Fall). The benefits of green schools. *Independent School*, 41-47.

Chatterton, P., & Goddard, J. (2000). *The responses of higher education institutions to regional needs*. Retrieved from http://www.paulchatterton.com/wp-content/uploads/2009/05/chatterton-and- goddard-he-and-regfonal-needs.pdf

Christensen, C., Horn, M., & Johnson, C. (2008). *Disrupting class: How disruptive innovation will change the way the world learns*. New York, NY: McGraw-Hill.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Christiansen, C., Joensen, J. S., & Nielsen, H. S. (2007). The risk-return trade-off in human capital investment. *Labour Economics*, *14*(6), 971–986. doi:10.1016/j.labeco.2007.06.001

Christopher, G. (2009). Nonfinancial reasons for being environmentally conscious. *School Business Affairs*, *75*(11), 25.

Christopherson, S., & Clark, J. and Task force on Sustainability in the Age of Development. (2006). *Report of the Task Force on Sustainability in the Age of Development.* Retrieved from http://www.sustainablefuture.cornell.edu/attachments/SustFinalRept.pdf

Clark, B. (2006). Happier, healthier, higher-achieving students. *Environmental Design & Construction*, *9*(2), 70–71.

Coffey, A. (2001). Transforming school grounds. In T. Grant & G. Littlejohn (Eds.), Greening school grounds: Creating habitats for learning (pp. 2–4). Toronto, Canada: Green Teacher and Gabriola Island, BC: New Society Publishers.

Corcoran, T., Fuhrman, S. H., & Belcher, C. L. (2001). The district role in instructional improvement. *Phi Delta Kappan*, *83*(1), 78–84.

Cortese, A. (1992). Education for an environmentally sustainable future. *Environmental Science & Technology*, *26*, 1108–1114. doi:10.1021/es50002a012

Cortese, A. (1999). *Education for sustainability – The need for a new human perspective*. Boston, MA: Second Nature.

Crampton, F., & Thompson, D. (2008). *Building minds, minding buildings: School infrastructure funding need: A state--by--state assessment and an analysis of recent court cases*. Washington, DC: American Federation of Teachers.

Cross, J. E., Byrne, Z. S., & Lueck, M. A. M. (2010). *Organizational change for energy conservation: A case study of Poudre School District*. Fort Collins, CO: Colorado State University.

Davies, S., & Quirke, L. (2007). The impact of sector on school organizations: Institutional and market logics. *Sociology of Education*, *80*, 66–89. doi:10.1177/003804070708000104

DuBose, J. R., Bosch, S. J., & Pearce, A. R. (2007). Analysis of state-wide green building policies. *Journal of Green Building*, *2*(2), 161–177. doi:10.3992/jgb.2.2.161

Dunbar, B. H., & Plaut, J. M. (2008). Informing green school design and construction projects through graduate student research. Retrieved from http://ascpro0.asweb.org/ac\archives/cd/2008/paper/CEGE-308002008pdf

Durán-Narucki, V. (2008). School building condition, school attendance, and academic achievement in New York City public schools: A mediation model. *Journal of Environmental Psychology*, *28*(3), 278–286. doi:10.1016/j.jenvp.2008.02.008

Edwards, A. R. (2010). *Thriving beyond sustainability: Pathways to a resilient society*. Gabriola Island, BC: New Society.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Edwards, B. W. (2006). Environmental design and educational performance. *Research in Education*, *76*, 14–32. doi:10.7227/RIE.76.2

Edwards, B. W., & Naboni, E. (2013). *Green buildings pay: Design, productivity and ecology*. New York, NY: Routledge.

Elliott, G., Fourali, C., & Issler, S. (2010). *Education and social change: Connecting local and global perspectives*. London: Continuum.

Energy Information Administration. (2009). Official energy statistics from the U.S. Government. Washington, DC: Department of Energy. Retrieved from http://www.eia.doe.gov

Evans, J. R., & Lindsay, W. M. (2005). *The management and control of quality* (6th ed.). Mason, OH: South-Western.

Fast, S. (2013). A Habermasian analysis of local renewable energy deliberations. *Journal of Rural Studies*, *30*, 86–98. doi:10.1016/j.jrurstud.2012.12.004

Frantz, S. (2010). Greening a K-12 school system. *School Administrator*, *67*(7), 19–24.

Freeman, V., & Klein, J. (2011). Building a greener school with LEED certification. *Review of Management Innovation & Creativity*, *4*(11).

Gislason, N. (2009). Mapping school design: A qualitative study of the relations among facilities design, curriculum delivery, and school climate. *The Journal of Educational Research*, *40*(4), 17–33.

Gleed, A. (2009). The science of light: The benefits of daylight modeling, a site specific simulation that aids the process of intelligent daylight design. *American School & University*, *82*(2), 32–34.

Gordon, D. E. (2010, September). *Green schools as high performance learning facilities.* Washington, DC: National Clearinghouse for Educational Facilities.

Gough, A. (2005). Sustainable schools: Renovating educational processes. *Applied Environmental Education and Communication*, *4*(4), 339–351. doi:10.1080/15330150500302205

Gutter, R., & Knupp, E. (2010). The road to a green district. *School Administrator*, *7*(67), 12–18.

Hart, G. (1996). Does it pay to be green? An empirical examination of the relationship between emissions reduction and firm performance. *Business Strategy and the Environment*, *5*(1), 30–37. doi:10.1002/(SICI)1099-0836(199603)5:1<30::AID-BSE38>3.0.CO;2-Q

Hatrick, E. B. (2010). Going green and getting credit. *School Administrator*, *7*(67), 44–45.

Healthy Schools Campaign. (2010). *The quick+easy guide to green cleaning in schools.* Retrieved from http://www.greencleanschools.org/ag-resources-tools.html

Healthy Schools Network. (2013). Healthy and high performance schools: ESEA—No Child Left Behind Act of 2001. Retrieved from http://www.healthyschools.org/HHPS_Act_2002.pdf

Heerwagen, J. (2000). Green buildings, organizational success and occupant productivity. *Building Research and Information*, *28*(5-6), 353–367. doi:10.1080/096132100418500

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Hoffman, P. J. (2009). Making the change to sustainability: Building green builds a better education. *Techniques*, *84*(3), 16–21.

Horman, M., Riley, M., Lapinski, D., Korkmaz, A., Pulaski, S., Magent, M., & ... (2006). Delivering green buildings: Process improvements for sustainable construction. *Journal of Green Building*, *1*(1), 123–140. doi:10.3992/jgb.1.1.123

Houston, P. D. (2009). Building sustainable leadership capacity. Thousand Oaks, CA: Corwin Press.

Humblet, E. M., Owens, R., & Roy, L. P. (2010). *Roadmap to a green campus*. Washington, DC: U.S. Green Building Council.

Iffrig, A. (2009). Green design and schools for healthy children: Benefits of sustainable approach to building learning environments. *Suite101.com*. Retrieved from http://architecture.suite101.com/article.cfm/green_design_and_schools_for_healthy_children

Inside Binghamton University. (2011). Top middle school students take part in go green institute. Retrieved from http://www.binghamton.edu/inside/index.php/inside/story/local-middle-school-students-go-green

Issa, M., Attalla, M., Rankin, J., & Christian, A. (2010). Detailed analysis of electricity, water and gas consumption quantities and costs in Toronto's public schools. *Canadian Journal of Civil Engineering*, *37*(1), 25–36. doi:10.1139/L09-122

Janda, K. B. (2009, June). Buildings don't use energy: People do. In *Proceedings of the International Conference on Passive and Low Energy Architecture (PLEA)*. Québec, Canada: PLEA.

Kats, G. (2003). *Green building costs and financial benefits*. Boston, MA: The Massachusetts Technology Collaborative.

Kats, G. (2006). *Greening America's schools: Costs and benefits.* Retrieved from http://www.greenbuildingpages.com/KatzGreenSchools.pdf

Kats, G. A., Braman, J., & James, M. (2010). *Greening our built world: Costs, benefits, and strategies*. Washington, DC: Island Press.

Kensler, L. A. W. (2012). Ecology, democracy and green schools: An integrated framework. *Journal of School Leadership*, *22*(4), 789–814.

Kohler, N. (2002). The relevance of BEQUEST: An observer's perspective. *Building Research and Information*, *30*(2), 130–138. doi:10.1080/096132102753436503

Lavy, S., & Bilbo, D. L. (2009). Facilities maintenance management practices in large public schools, Texas. *Facilities*, *27*(1/2), 5–20. doi:10.1108/02632770910923054

Lawton, J. H. (2007). Ecology, politics and policy. *Journal of Applied Ecology*, *44*(3), 465–474. doi:10.1111/j.1365-2664.2007.01315.x

Leadership in Energy and Environmental Design. (2013). Infographic: Top 10 States for LEED in 2013. Retrieved from http://centerforgreenschools.org/leed-for-schools.aspx

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Lockwood, C. (2006). Building the green way. *Harvard Business Review*, *84*(6), 129–132, 134, 136–137, 146. PMID:16770900

Mardaljevic, J., Heschong, L., & Lee, E. (2009). Daylight metrics and energy savings. *Lighting Research & Technology*, *41*(3), 261–283. doi:10.1177/1477153509339703

Matich, E. (2012, February). *Green schools and students' science scores are related*. Paper presented at the Green Schools National Network. Denver, CO.

Matsuoka, R. H. (2008). *High school landscapes and student performance*. Ann Arbor, MI: University of Michigan.

McDonough, W., Braungart, M., Anastas, P. T., & Zimmerman, J. B. (2003). Applying the principles of green engineering to cradle-to-cradle design. *Environmental Science Technology*, *37*(23), 434A–441A. doi:10.1021/es0326322 PMID:14700308

Metzger, A. B. (2011). Five successful strategies for greening your school. *Educational Facility Planner*, *45*(3), 20–23.

Murphy, J. (2010, May). *Economics of green schools: Rethinking learning spaces*. Paper presented at the TRLEF conference. Retrieved from http://www.tarleton.edu/facilitieslab/documents/Economic%20of%20Green%20Schools_TRLEF_May%202010%20Final.pdf

National Research Council. (2007). *Green schools: Attributes for health and learning*. Washington, DC: National Academies Press.

Olson, S., & Carney, J. (2006, January 31). *Sustainable k-12 schools*. Madison, WI: Leonardo Academy, Inc.

Olson, S., & Kellum, S. (2003). *The impact of sustainable buildings on educational achievements in K-12 schools.* Leonardo Academy, Inc. Retrieved from http://www.cleanerandgreener.org/download/sustainableschools.pdf

Oreopoulos, P., & Salvanes, K. G. (2011). Priceless: The nonpecuniary benefits of schooling. *The Journal of Economic Perspectives*, *25*(1), 159–184. doi:10.1257/jep.25.1.159

Ornstein, S. W., Moreira, N. S., Ono, R., Franca, A. J., & Nogueira, R. A. (2009). Improving the quality of school facilities through building performance assessment: Educational reform and school building quality in Sao Paulo, Brazil. *Journal of Educational Administration*, *47*(3), 350–367. doi:10.1108/09578230910955782

Orsato, R. (2006). Competitive environmental strategies: When does it pay to be green? *California Management Review*, *48*(2), 127–143. doi:10.2307/41166341

Peponis, J., Bafna, S., Bajaj, R., Bromberg, J., Congdon, C., & Rashid, M. (2007). Designing space to support knowledge work. *Environment and Behavior*, *39*(6), 815–840. doi:10.1177/0013916506297216

Psacharopoulos, G., & Patrinos, H. A. (2004). Returns to investment in education: A further update. *Education Economics*, *12*(2), 111–134. doi:10.1080/0964529042000239140

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Rainwater, B., & Hartke, J. (2011). A national action plan for greening America's schools. Special Report from Sundance: Local leaders in Sustainability. Retrieved from http://eeinalabama.org/files/eewi/2011/USGBC.pdf

Ramesh, T., Prakash, R., & Shukla, K. K. (2010). Life cycle energy analysis of buildings: An overview. *Energy and Building*, *42*(10), 1592–1600. doi:10.1016/j.enbuild.2010.05.007

Richardson, M. D., Chan, T. C., & Lane, K. E. (2000). Planning for technology: Issues and concepts. *Educational Planning*, *12*(4), 67–75.

Roe, M., & Mell, I. (2013). Negotiating value and priorities: evaluating the demands of green infrastructure development. *Journal of Environmental Planning and Management*, *56*(5), 650–673. doi:10.1080/09640568.2012.693454

Rothenberg, S., Pil, F., & Maxwell, J. (2001). Lean, green, and the quest for superior environmental performance. *Production and Operations Management*, *10*, 228–243. doi:10.1111/j.1937-5956.2001.tb00372.x

Rudd, P., Reed, F., & Smith, P. (2008). *The effects of the school environment on young people's attitudes toward education and learning*. Washington, DC: National Foundation for Education Research.

Ryland, J. (2003). Fads, fancies and fantasies: An educator's perspective on current educational facility issues. *School Planning and Management*, *42*(6), 16–20.

Sackett, J. (2007). Schools going green. *Environmental Design & Construction*, *10*(7), s44–s48.

Santone, S. (2010). The greening of curricula: Seed and weed the landscape. *School Administrator*, *7*(67), 46–50.

Schelly, C., Cross, J. E., Franzen, W. S., Hall, P., & Reeve, S. (2011). Reducing energy consumption and creating a conservation culture in organizations: A case study of one public school district. *Environment and Behavior*, *43*(3), 316–343. doi:10.1177/0013916510371754

Schimmel, B. (2011). What makes green schools better? *Leadership*, *40*(4), 8–10.

Schmitz, O. J. (2008). *Ecology and ecosystem conservation*. Washington, DC: Island Press.

Sims, T. (2012). Green building benefits. *School Construction News, 15*(4), 17, 20.

Sneirson, J. F. (2009). Green is good: Sustainability, profitability, and a new paradigm for corporate governance. *Iowa Law Review*, *94*, 987–1022.

Steinberg, D., Patchan, M., Schunn, C., & Landis, A. (2009). Developing a focus for green building occupant training materials. *Journal of Green Building*, *4*(2), 175–184. doi:10.3992/jgb.4.2.175

Tanner, C. K. (2008). Explaining relationships among student outcomes and the school's physical environment. *Journal of Advanced Academics*, *19*(3), 444–471.

Tanner, C. K. (2009). Effects of school design on student outcomes. *Journal of Educational Administration*, *47*(3). doi:10.1108/09578230910955809

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Taylor, A. (2009). *Linking architecture and education: Sustainable design of learning environments*. Albuquerque, NM: University of New Mexico Press.

Thatcher, A. (2013). Green ergonomics: Definition and scope. *Ergonomics*, *56*(3), 389–398. doi:10.1080/00140139.2012.718371 PMID:22928500

U. S. Department of Education. (2009). *Numbers and types of public elementary and secondary schools from the common core of data: School year 2007–08 (NCES 2010-305)*. Washington, DC: Department of Education, National Center for Education Statistics. Retrieved from http://nces.ed.gov/pubs2010/2010305.pdf

United States Department of Energy. (2008). *Energy efficiency and renewable energy: Energy smart schools*. Washington, DC: U. S. Department of Energy.

United States Environmental Protection Agency. (2008). *Green communities: Basic information*. Washington, DC: U. S. Environmental Protection Agency.

U.S. Green Building Council. (2009). Green schools 101. Retrieved from http://www.buildgreenschools.org/gs101/

Viederman, S. (2006). Can the universities contribute to sustainability? In R. Forrant & L. Silk (Eds.), *Inside and out: Universities and education and sustainability*. Amityville, NY: Baywook Publishers.

Waughray, D., & Kerr, T. (2012). *The green investment report: The ways and means to unlock private finance for green growth*. Retrieved from Green Growth Action Alliance website: http://www3.wefprum.org/docs/WEF_GreenInvestment_Report_2013.pdf

Weston, M., & Brooks, D. (2008). Critical constructs as indicators of a shifting paradigm in education: A case study of four technology-rich schools. *Journal of Ethnographic and Qualitative Research in Education*, *2*(4), 281–291.

Williams, D., & Brown, J. (2013). *Learning gardens and sustainability education: Bringing life to schools and schools to life*. London: Routledge.

Yudelson, J. (2008). *The green building revolution*. Washington, DC: Island Press.

KEY TERMS AND DEFINITIONS

Environment: The world in which life exists and shared by all whose actions affect the environment.

Environmental Education: A learning process that increases knowledge and awareness about the environment, including challenges and opportunities for the environment.

Green Design: Green design provides the opportunity to achieve exceptional performance above requirements including innovative performance not typically addressed in schools.

Green School Cost: The financial commitment and resources to obtain, operate, repair, and decommission (or salvage) a building over a defined period of time.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Green Schools: Green schools "are education buildings that operate in harmony with the natural environment. They are built to reduce energy costs and conserve natural resources, make use of recycled and recyclable materials, and operate in a sustainable manner" (AFT 2009).

School Environment: Total space within which children learn inclusive of equipment, furniture, and the context within which the school is situated.

Sustainability: It is the continuous regrowth promoted as an alternative process to examine the role of humans in the environment. It is the ability to meet the needs of the present without compromising the future.

This research was previously published in Marketing the Green School edited by Tak C. Chan, Evan G. Mense, Kenneth E. Lane, and Michael D. Richardson, pages 243-257, copyright year 2015 by Information Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 6
Green IT Adoption:
Lessons from the Philippines Business Process Outsourcing Industry

Alexander A. Hernandez
De La Salle University, Philippines & Technological Institute of the Philippines, Philippines

Sherwin E. Ona
De La Salle University, Philippines

ABSTRACT

Green Information Technology (GIT) refers to using information technology in ways that help to reduce environmental impacts including the use of energy more efficiently and reducing waste. To date, however, few studies attempt to provide a holistic understanding of GIT adoption in developing countries, which GIT plays a significant role in achieving a sustainable environment and economic performance. This paper explores the practices, processes and enablers in GIT adoption within the Philippines Business Process Outsourcing Industry (BPO). The authors used the revelatory multiple-case study as a research approach in understanding GIT adoption in BPO organizations. They found five areas of GIT adoption covering IT procurement, IT applications as low carbon enabler, working environment, data center and IT end of life management. Essentially, strategy and governance, processes, structure, people, technology support, and measurement and improvement enabled GIT adoption in BPO organizations. The authors further found that BPO organizations have the strong long-term commitment to environmental sustainability.

1. INTRODUCTION

Green IT refers to the using of Information Technology (IT) resources in an energy-efficient and cost-effective manner (Bose & Luo, 2011), and it is foreseen as the most important strategic technology in the imminent future. According to Mines (2009), the GIT service market was expected to reach nearly $5 billion by 2013. Organizations are now actively pursuing GIT solutions for a multitude of reasons and benefits, including lower power consumption, lower costs, lower carbon emissions, less environmental impact, improved system performance and use, increased collaboration and interaction amid constituents,

DOI: 10.4018/978-1-5225-7915-1.ch006

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

space savings, and an agile workforce (Bose & Luo, 2011). According to a 2009 GIT report surveying 426 companies in North America including a total of 1052 companies worldwide, 86% stated that it is significantly important that their IT organization implement GIT initiatives. This report also states that 97% of these firms are at least considering a GIT strategy (Symantec, 2009).

GIT is attributed to the initiatives and programs that directly or indirectly address environmental sustainability. According to Siegler and Gaughan (2008), GIT is about information technology and system initiatives, including programs that address environmental sustainability. It also addresses energy consumption as well as waste associated with the use of hardware and software which tends to have a direct and positive impact (Jenkin, McShane, & Webster, 2011a). Hilty et al. (2006) also support this view by stating that the production, use, and disposal of IT have a direct effect on the natural environment and eco-sustainability (Hilty et al., 2006). Estimates indicate that the IT industry accounts for 2% of global CO2 emissions, which is equivalent to the amount generated by the aviation industry (Goasduff & Forsling, 2007). Jenkin et al. (2011b) outlined the objective of GIT to be reducing the overall environmental impact of Information Communication Technology (ICT) by adopting a number of measures ranging from (1) taking environment-friendly approaches to the production; and (2) use of IT equipment and facilities to optimize the use of ICT equipment along with network infrastructure in order to reduce energy consumption at every stage.

A study by the Australian Computer Society (2010) noted that in 2009, Australia's ICT users consumed 13.248 million KWh of electricity which generated an equivalent of 14,248 million tonnes of CO2 emission, which is nearly 2.5% of Australia's total emissions (539 million tonnes). In 2010, Google's overall consumption of electricity was reported to be 2.26 million MW h (Albanesius, 2011). As Google has operations and major servers in many countries with different types of energy sources and different Green House Gases (GHG) emission rates, it is difficult to translate accurately this energy consumption figure to its GHG emission equivalent. Corbett, Sayili, Zelenika, and Pearce's (2010) analysis of articles published in the CIO magazine shows that economic benefit is the most commonly cited driver for Green IT. In Australia, the ANZ Bank's initiative to eliminate screensavers has resulted in approximately 4% reduction in the annual electricity bill with an estimated value of AU$500,000 per year (Molla & Cooper, 2010). A global survey of 1260 IT professionals indicated that 50% are concerned about climate change (Info-Tech, 2008). Governments, in particular, can encourage the adoption of Green IT by legislations that create the framework for a low-carbon economy (Chen, Boudreau, & Watson, 2008).

Prior studies deal with introducing Green IT as a research focus in information systems research. Also, research gaps have been identified. First, most of these studies explore only general Green IT and practices (including virtualization, IT end of life management and general data center practices). Only a handful of studies assesses a broad aspect of green IT such as IT procurement, IT working environment, data center operations, IT as low carbon enablers and IT end of life management. Furthermore, green IT is relatively new research topic, several studies developed a research model that predicts the adoption of a broad range of green IT initiatives. Also, many of these studies aggregate green IT adoption experience across multiple industries within a country using quantitative methods. Second, in the perspective developing countries, there are limited researches on Green IT adoption from small to large organizations. In addition, there are limited empirical studies in understanding green IT adoption by developing countries, in spite of a number of growing number technology diffusions that have taken place in those nations in the recent years (Kartiwi & MacGregor, 2007; Chowdhury, 2003). For a detailed summary, refer to Table 2 in Appendix A. An understanding of the adoption of GIT by developing countries is thus significant for both practitioners and academics. Moreover, the contextual situations of countries are

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

arguably different in nature. For example, the maturity of the ICT infrastructure, e-commerce readiness, the degree of government support, and extent of business competitiveness vary considerably, not only between the developed and developing countries but also among developing countries. Furthermore, it would be inappropriate to assume that various dimensions of national culture remain somewhat similar across all developing countries. In fact, distinct cultural differences are noted among developing countries. Hence, it could be argued that qualitative studies focusing on GIT adoption in some developing countries not be necessarily reflective of the GIT trends and adoption dynamics of all developing countries across the globe. Thus, a detailed understanding of organizations' adoption experience is lacking.

Therefore, in summary, we argue that there is currently a lack of rich understanding of the GIT adoption phenomenon in developing countries due to the dominance of quantitative studies and the limited application of adoption theories (Oliveira & Martins, 2011). In fact, the adoption process involves dynamic interactions among social, legal, economic, political and technological factors that call for more studies involving several theoretical perspectives to understand better the adoption phenomenon in different contexts of developing countries. Each developing country may have specific GIT experience involving different dynamics and interplays, which may have differing effects on the adoption phenomenon. In-depth studies of how GIT is adopted in a context that has not yet been thoroughly investigated, thus, contribute to the present knowledge in the GIT area.

The key goal of the present work is to build a holistic understanding of GIT through a qualitative study to address the identified knowledge gap. In this study, we investigate the enablers, practices and processes in GIT adoption. As GIT adoption is complex and heavily negotiated by contexts within which organizations operate (Seyal & Rahim, 2006), we have employed multiple case study approach to help us better understand the underlying enablers, processes and practices in GIT adoption. The specific research questions we address are as follow:

1. What are the practices and processes in Green IT adoption?
2. What are enablers that contribute to Green IT adoption?

To address these questions, we conducted a revelatory multiple case study involving three organizations with different business nature, position, and experience within the Philippine BPO industry. These participating organizations represent typical IT-BPO, Business Process Management, and IT-Supply Chain within that industry. The BPO industry was chosen because it is characterized by a higher volume of use in IT, contributions in economic performance and, therefore, often pioneers technology adoption. The study focuses on single industry rather than multiple industries to allow for thorough and detailed investigations into the interplays of GIT adoption by organizations within the industry. The Philippines was selected as a reference of a developing nation since it represents typical features of developing countries, particularly in the ASEAN region (Lertwongsatien & Wongpinunwatana, 2003; Seyal et al., 2007). The Philippines, despite the benefits from the stable economic development at an average of 5.2% between the period of 2010 and 2014, the E-Readiness Index (ERI) and Network Readiness Index (NRI) is still very low. Also, it has only dedicated a small amount of its Gross Domestic Product (GDP) to Information and Communications Technology (ICT) adoption (Indjikian and Siegel, 2005). Hence, this research is expected to be significant for other growing nations, leading countries with comparable technological, socio-economic, civic, cultural, and legal environment as the Philippines. At present, there has been no comprehensive study on the enablers, practices and processes in GIT adoption in the Philippines.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

2. LITERATURE REVIEW

This section presents the background of GIT, practices and initiations by organizations. Furthermore, we also present the GIT adoption phases, approaches and strategies and relevance of the BPO industry.

2.1. Background of Green IT

In this section, we describe GIT, initiation, and adoption phases in organizations.

2.1.1. Green IT Definition

There are considerable varying definitions of GIT in the literature. According to Hedwig et al. (2009), GIT comprises activities, programs and efforts that embeds ecologically friendly innovative processes and technologies in the information technology lifecycle; the data center's sustainable operation plays an essential role in this area by emphasizing on conservation and reduction of energy used during its function. On the other hand, Srivastava et al. (2001) defined "environmental technologies" as "production equipment, method and procedures, product designs, and product delivery mechanisms that conserve energy and natural resources, minimize the environmental load of human activities, and protect the natural environment." It includes both operational approaches (e.g. resource conservation-oriented work environment and waste management practices) and hardware (cleaner design and production technologies, pollution control equipment etc.) More importantly, GIT challenges include emissions of greenhouse gases and CO2, climate change, resource and energy use, and end of life or electronic waste. Koo et al. (2014b) suggests that GIT deals with the IT purpose/industry, which acts an important role in decreasing the ecological impacts caused by IT and using IT as solutions for environmental problems.

For end-users standpoint, GIT has been linked mainly with innovative technologies and initiatives devised to reduce the cooling, power and operational costs related with IT functions (Molla et al., 2009). Also, it affects the environment throughout the full lifecycle starting from the design, development, production, utilization, and eventual disposal (Murusegan, 2008). More importantly, it is aimed to establish a win-win solution for both environment and end users.

2.2. Green Practices and Initiatives

2.2.1. Benefits

Given the newness of GIT, prior empirical findings present direct and indirect benefits of reducing energy consumption in the data center (Kurp, 2008, Nanath & Pillai 2012) and lesser carbon emissions (Overby, 2007). Also, some studies explain commitment to reducing energy resource used in business and data center operations (Beach, 2008), savings earned from the total cost of ownership (Swanborg, 2009) and increased profitability (Ricknas, 2009). There are studies tried to present technologies aligned to GIT practices. For instance, Perenson (2009) presented an energy-saving green storage device. In another study, GIT via virtualization and cloud computing are identified useful technologies to consolidate data centers highlighting the benefits on resource conversation (Oliveira et al., 2014). Lastly, several studies have dealt with GIT in office environment through the Leading in Energy and Environmental Design

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

(LEED) to achieve higher performance in energy-efficiency (Sartori & Hestnes, 2007; Hwang & Tan, 2012; Dwaikat & Ali, 2015; Huang et al., 2015).

The significance of GIT is now slowly becoming more familiar with organizations. Kuo and Dick (2010) emphasized the important role of GIT as a solution to environmental challenges. In another study, Murusegan (2008) found that lowering costs and reducing power consumption were the main motivations for adopting GIT. It is consistent with the study of Hopper and Rice (2008) suggesting cost reduction as a primary advantage of GIT practices overarching operating and maintenance costs in IT systems within organizations. Vykoukal et al. (2009) suggests that GIT practices had both economic and environmental benefits through several adoption strategies. Also, Bose and Pal (2012) explore on green supply chain management adoption complementing stock price needs of the organization.

In general, we argue that benefits of GIT should not be limited only to the reduction of environmental footprint, however, can be used to design strategic business embedding GIT in a wider range of activities. Therefore, the benefits established from GIT practices and initiatives in the literature. However, we argue that their several eco-goals for GIT practices result in different economic and environmental benefits. Lastly, GIT can bring other benefits not only cost reduction, but it can also result to enhanced business processes, systems efficiency, quality of outcomes and corporate competitive advantage and image.

2.2.2. Initiation

The GIT literature has started discussing the factors, challenges, and enablers in GIT adoption. Based the existing literature, Lei and Ngai (2012) categorized the antecedents of GIT adoption in organizations. However, few studies have been empirically validated to better understanding the factors in GIT adoption. Prior empirical studies investigated individual and contextual factors affecting GIT. Technological characteristics were found significant in GIT adoption including compatibility, complexity, and observability consistent with the practices, attitude and values of the organization and level of difficulty of GIT and observability of the outcomes of adoption (Moore & Benbasat, 1991; Kuo & Dick, 2010; Corbett, 2012). For organizational contexts, the literature continuous to prove that organizational resources (Lei & Ngai, 2012; Bose & Luo, 2011; Sayeed and Gill, 2008), strategic orientations (Seidel et al., 2010; Molla, 2009; Seidel et al., 2010; Sayeed & Gill, 2008) and altruistic objectives (Molla, 2009), and support plays a significant role in GIT adoption (Seidel et al., 2010). Also, external environmental context affects decisions such as external pressures (Lei & Ngai, 2012) and external supports (Bose & Luo, 2011; Tarafdar et al., 2010). Furthermore, individual factors such as attitude and resistance to change are more likely to affect decisions to adopt GIT (Sarkar & Young, 2009; Carlet, 2015; Oliveira et al., 2014). Prior studies in technology adoption are consistent with new empirical findings in GIT emphasizing the effects of individual factors in any technology adoption (Harison et al., 1997; Riemenschneider & McKinney, 2001; Olson and Boyer, 2003). Thus, we argue that individual and contextual factors are affecting decisions to adopt GIT in organizations.

2.2.3. Green IT Adoption Phases

There are also limited studies on phases for adopting GIT. However, these studies present salient phases such as (1) assessment, (2) planning and (3) implementation (Mines, 2009). In the assessment phase, organizations understand their present situation and construct a baseline for possible GIT activities; specifically it involves creating an overall GIT strategy and plan while assessing the return on investments

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

(Elliot, 2011, Erek et al., 2011). Subsequently, planning covers developing the roadmap and direction for certain GIT initiatives and identifying a preferred GIT initiatives that are more significant based on the strategy and plan initially formulated in the earlier phase (Mann et al., 2009). In the implementation phase, organizations procure and establish appropriate IT assets and related systems to implement a specific GIT initiative (Park et al., 2012). More importantly, organizations implement a new IT infrastructure; introduce a new set of business processes and procedures, related policies and guidelines. Therefore, GIT adoption requires careful planning a selection of GIT initiatives complemented by appropriate IT investments and management activities.

2.2.4. Green IT Approaches and Strategies

With GIT approaches and strategies, the literature suggests how to achieve the benefits from GIT activities. For instance, Murusegan (2008) explains a comprehensive approach to GIT focused on four complementary directions including green design, green use, green manufacturing and green disposal. These categories cover area of importance and actions such as energy-efficient computing through virtualization, power management, and conservation; designs and approaches for environmental sustainability by energy-efficient data center design and location; disposal and recycling practices such as supplier-take back, 3R program and remarketing activities that are more sustainable, compliant and ecologically responsible to relevant regulatory requirements with gradual reduction of waste and pollution prevention. Prior studies also present design of GIT metrics, review, assessment and evaluation tools for effective adoption and practice. Also, Murusegan (2008) proposes Enterprise GIT strategies that organizations could follow including three-level approach: strategic, deep green, and incremental tactical approaches. The literature emphasizes that GIT can spread in several forms not only reduction of energy consumption, cost savings and efficiency. Furthermore, these studies are more directed towards eco-efficiency provided that benefits mostly come from energy efficiency and savings. Prior studies relate eco-effectiveness with green design and manufacturing highlighting lesser natural resource use and enhanced longer product lifespan. Also, eco-collaboration efforts are mainly focused on improved IT asset disposal practices, new green design outcomes and procedures and integration of green manufacturing standards. In general, GIT literature highlights eco-goals to determine better possibilities, advantages, and benefits derived from GIT.

2.3. Overview of the Philippine BPO Industry

The Philippines is an archipelago consisting of 7107 islands, and its location is in the Southeast Asia. Its population is estimated to be over 100 million, and it is the twelfth most populous country in the world (UNFPA, 2014). The Philippines has 82 provinces, and the capital is Quezon City-NCR. Regarding national culture, Philippines has a relatively high power distance index (94) low individualism index (32) and moderate masculinity index (64) and uncertainty avoidance index (44) (Hofstede, 1983). Therefore, Filipinos generally accept power inequality within the society, value collective actions, traditions, and norms; tend to avoid actions such as confrontations that lead to ambiguous consequences; and strive for harmony, the establishment of a caring society, and quality of life.

The Philippines has many natural resources, and its economic position has developed rapidly. The Philippines economy is ranked 13th in Asia-Pacific region based on GDP, and its BPO industry ranks 1st among top destinations in developing countries (IBPAP, 2015). Philippines has been an important BPO

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

destination in the world in many developing countries. In particular, foreign companies quietly seek to develop BPO presence in any country with large population base capable of speaking in English. Also, given years of continuous impressive and sustained economic growth in the Philippines during 2000, the BPO industry presented the tremendous potential for future growth in the eyes of foreign investors (Alexander and Myers, 1999).

Strong growth in the Philippine economy comes from robust information technology and business outsourcing sector. It has proven to be largest and fastest growing industry in the country. It plays an important role in providing quality jobs, encouraging economic activity and investments in various locations outside the country's capital city. In 2015, the BPO industry generated a revenue of 15.5 billion US dollars that comprised of 5.4 percent of the country's total GDP and it employed 900, 000 Filipinos in full-time (IBPAP, 2015).

The division of the current BPO industry into the information technology and business process innovation includes software development, digital technologies, financial and banking, tourism, health and medical, game development, and sustainability services. In the National Capital Region, there is more than competing for market share and in tight competition with new entrants in the BPO business. The first foreign BPO companies, however, continuous to dominate the NCR BPO market, which competition is much more intense (Usui, 2011; Magtibay-Ramos, 2008).

In the last five years, the BPO industry has been the fastest growing sector in the Philippines. During 2009-2013, the BPO market grew by as much as 19.8% per year, the highest among other industry (Gereffi, 2010). The BPO industry continued to have the largest share of other industries up until 2014, with up to 42.5% of the total market share. However, since 2010, the BPO industry has been a dominator in developing countries, which is the most profitable in the Philippine economy. The BPO industry is expected to grow continuously, projected to generate 1.3 million jobs by 2016, with 17 percent annual growth. The influence of the growing BPO business has driven technology adoption within the industry (IBPAP, 2015).

3. METHODOLOGY

This study utilizes a revelatory multi-case study approach (Dubé & Paré 2003, Yin, 2008) to explore GIT adoption by organizations within the Philippine BPO industry. Case study research enables researchers to conduct in-depth investigations of a phenomenon of interest over a period, which is currently lacking in the literature on GIT adoption by developing countries. This study is at the theory-building stage, contributing to the growth of knowledge associated with GIT adoption, mainly in the context of developing countries. The case study approach is considered an appropriate method for research building theory (Shanks & Arnott, 1993). In comparison to the single case study approach, the multiple case study approach is often considered more compelling and more robust, although it typically requires extensive resources and time beyond the means of a single researcher. Multiple case studies are preferred over single case studies, as analytical conclusions independently arising from multiple cases tend to be more powerful than those from single case studies alone (Yin, 2003). This argument serves as the main motivation behind the selection of a multiple case study as our research method. The use of multiple case study involving different types of organizations within the industry that have different BPO business activities is particularly valuable for the purpose of this study. There should be a development of

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

a more comprehensive understanding of the adoption experience, particularly concerning the enablers, practices, and processes.

Several foreign-owned companies, including information technology, business process management, and supply chain within the Philippine BPO industry, were selected for the multiple case study. Presented in Table 1 is a brief descriptor of the interviewees from the three cases. There were also several interviews conducted with primary participants concerned in GIT-related roles within the three cases. We employed semi-structures open-ended questions during the interviews and documented upon full consent and agreement of the participants. There were follow-up interviews performed after the initial interviews. Besides this, we collected additional organization's relevant digital documents.

Furthermore, we transcribed the interviews for multi-level approaches qualitative analysis such as open coding, axial coding, and selective coding techniques (Neuman, 2006). As defined, a unit of analysis is an individual, a group or unit, an organization, part of social life and a case under consideration (Neuman, 2006). It is essential to data collection and analysis, observation, empirical measurement, and concept development. This research utilizes three companies within the BPO sector as the unit of analysis that sufficiently provides breadth and depth of GIT adoption background which serves as the basis for answering the research questions adequately.

Addressing Rigor in this study follows the guidelines of Yin (2003) and Neuman (2006). Four techniques are used to ensure construct validity. It includes triangulation through the use of multiple sources of evidence, a thorough literature review on relevant areas related to the research topic, interviewee reviews of the case study reports. All these techniques ensure the accuracy of the transcription and translation and establish a chain of evidence through the use of case study repository, and the use of a case study protocol. Addressing external validity is through the utilization of the replication logic technique. The design of the multiple case study approach helps increase the generalizability of the overall study findings. Addressing internal validity is by a careful selection of cases and interviewees, sound data collection procedures, correct selection of theory and literature review that can explain the GIT adoption phenomenon. Internal validity is tested to ensure that the causal relationship identified in the study reflects the theoretical ground.

To address Reliability in this study is through the use of a case study protocol for all interviews, the use of case study repository to store all research data, and a pilot study to ensure interview questions are appropriate. The use of a pilot study is advised by Neuman (2006) as a method that can increase the reliability of measures. Two preliminary studies with BPO companies were conducted to assess the feasibility of investigating the research topic among some organizations within the Philippines BPO industry. The pilot study serves as a solid foundation for further follow-up interviews in the study and helps identify subsequent case study participants.

Table 1. Participants of multiple case study

Company	BPO Type	Annual Revenue	Designation(s)	Interview Period*
A	Information Technology	USD $30 Billion	IT Manager, IS Manager, Purchasing Manager, Facility Head	1,2,3
B	Business Process Management	USD $140 Million	IT Director, Assistant IT Manager, Purchasing Head, Facility Officer,	1, 3
C	IT Supply Chain	USD $34 Billion	IT Manager, IS Manager, Assistant Purchasing Head, Facility and Engineering Head	1, 2, 3

*Interview Period: 1(March 2014-July 2014), 2(August 2014-December 2014), 3(November 2014 – February 2015)

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

4. CASE STUDY BACKGROUND

Table 1 lists the participating companies and the interviewees involved in each case study. A short profile of each company is provided in Appendix C. In general; we involved large information technology – BPO, one business process management – BPO and one supply-chain - BPO. All of the companies are foreign owned from the very start of their operation in the Philippines. The three companies have distinct business activities within the BPO industry. Company A is focused on software development while Company B's business is mainly on business process management and Company C is the only IT supply chain that distributes products and services to its retail partners. All interviews were conducted between March 2014 and February 2015. Both Company A and C participants were interviewed in three periods to ensure that all necessary GIT information were covered. However, Company B participants were interviewed in two periods given that the first interview period already provided significant volume information of GIT adoption experience, thus, the second interview period was only dedicated to some follow up interviews and clarifications. In the end, all interviews conducted sufficiently helped in fully understanding GIT adoption experience of the three BPO companies.

In terms of GIT adoption, all organizations apply five areas of GIT including asset procurement, IT as low carbon enabler, working environment, asset disposal, and data center operations. Furthermore, one company has matured GIT in supply chain within the BPO business. However, only one organization has sufficiently matured to adopt in all GIT areas practice.

5. RESULTS

In this section, we describe the enablers, practices and processes in GIT adoption within BPO organizations. We also summarize the practices and processes from Table 3 of Appendix B. Discussed below are the enablers, practice, and the process.

5.1. Green IT Practices and Processes

All three cases are committed to environment protection and accountability. Through their corporate mission and business strategy, they were able to develop guidelines incorporating sustainability objectives and target, which GIT is an important implementation approach. Analysis of findings revealed that all three cases are pursuing innovations in environmental technology, product development and promoting business activities supporting the lead for a sustainable environment and economy to reduce environmental risks and continuously improve environmental performance in their respective areas of businesses. The focus areas are on reducing environmental impact in every phase of business or product life-cycle, environmental management by enhancing environmental management systems furthering strategic management and fostering environmental education and awareness of their employees, and proactive environmental conservation and by strong coordination and collaboration with social enterprise and community.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

5.1.1. IT Procurement and Management (ITPM)

The empirical findings revealed two important approaches to IT procurement including supplier and product approach. In supplier approach, a major consideration is verifying the supplier's compliances to environmental management standards and performance such as the EMS and commitment and actions towards reducing environmental footprint in the supply chain lifecycle. In product approach, it takes priority in the procurement of GIT products and services with strong adherence to the elimination of hazardous materials, energy-resource saving, and end-of-life management through 3R (reduce, reuse, recycle), which all these are conforming to environmental conservation. These approaches are introduced by all three cases as their basic framework in green procurement. Enforcement of these activities is significantly observed and monitored by a central purchasing unit, which plays a significant role in achieving the entire green purchasing objectives. More importantly, any green purchasing decisions are primarily targeted to satisfy increasing business needs and customers' expectations.

All of these are bind with strong top management commitment from all three cases to escalate continuous education, skills and knowledge relevant to the success or failure of the initiatives. Also, the findings of the study revealed that top management support is essential to progress in raising awareness and education among all stakeholders involved in the program. Collaboration and coordination with suppliers complements these activities, which well-defined roles have considerable effects in ensuring that they proactively engage themselves to voluntary measures that reduces resource use and save energy, banning of toxicity and hazardous materials, and decrease waste generation in the supply chain.

The findings revealed that communication of these activities to the public improves the corporate image in all three cases as well as recognizing them as good stewards of environment protection and preservation by the customers, business partners, regulatory agencies, and competitors. Its attribution is through the commitment of the three cases in environment management systems (EMS) implementation along with other internal practices and processes in IT purchasing.

The empirical findings revealed significant challenges experienced by the three cases in IT procurement such as supplier relationship management, a limited number of local suppliers adhering to environmental standards and lack of rewards and incentives systems to facilitate greater reduction of environmental impact from supply-chain. First, the suppliers are covered by supplier relationship management to observe levels of strategic performance while reducing total cost of ownership. However, risks exposures in the supply chain are not yet fully developed as a major success factor concerning GIT adoption. Second, limited suppliers in the country have full compliances to EMS because of the insufficient regulatory framework to govern the transition of vendors to a greener approach in supply-chain activities. Although the government recently signed an agreement to commit the country to the green supply chain, there was no publicly available guideline on how "green" criteria should be operational, monitored, assessed and evaluated in supply-chain activities. Lastly, rewards and incentives program to increase value creation further than conventional cost reduction objectives driven by sustainability and innovation through co-creation that encourages understanding and commitment in the entire GIT procurement.

5.1.2. Working Environment

In this study, another major theme that emerged from the analysis of empirical data is working environment. All three cases from this study have considerable efforts to increase energy efficiency by promoting energy-conscious working environment among all employees. The majority of the three cases have

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

introduced energy-efficient computing devices as practice in saving energy and conservation. Also, energy-management solutions are available to monitor consumption and compliance to resource saving practices by all employees. As observed, there is a considerable reduction of consumables through the 3R program, which builds a culture of maximizing the use of technology support tools such as software to minimize resource-intensive activities. There are also efforts to enhance office design by sectoral arrangement to reduce practically energy consumption and usage of LED lighting systems. Moreover, provisions to monitor working environment temperature through building management systems are made available for some BPOs.

However, there are challenges in improving the office design and setup to incorporate green office design standards such as natural lighting due to constraints in leasing the working environment with property and building owners. Leasing agreements were found to be unsupportive in improving office designs by all three cases that could be fully utilized to take advantage of reducing power consumption through the use of automatic sensor-based intelligent lighting systems. Additionally, there is the growing number of employees working in the BPOs that requires additional office space and IT equipment to be reconfigured to improve mobility among the three cases.

Another major challenge is in the area of measurement and improvement in work environment practices and processes. Although there are efforts to reduce considerably energy consumption through IT investments, raise awareness and education among all employees in these activities, no further analysis is conducted by a majority of the three cases to measure the effectiveness of the programs regarding environmental benefits, which could be attained by this continuous management strategy. While the energy efficiency of IT equipment is a major consideration, concrete monitoring processes and related rules are lacking.

More importantly, there was no objective evidence discussing and identifying areas of growth in increasing collaboration and involvement of property managers in effectively planning improvements in working environment by developing joint scorecards that include performance indicators in both parties that measure the quality of outcomes produced from these endeavours.

All of these practices and processes are part of the long-term investments of three cases in GIT adoption to enhance working environment, signifying major responsibility to top management to exercise their decision-making capabilities and authority to introduce the changes needed continuously. Furthermore, the IT investments made along with financial budget are helpful, therefore, increased the level of GIT adoption maturity in the area such as the working environment. More importantly, these considerable efforts are directly linked to GIT maturity expected to result in major cost reduction among them.

5.1.3. IT Applications as Low Carbon Enabler

Another major theme that emerged from the empirical findings is IT enabled work practices. All of the three cases significantly employs IT applications for work practices as low carbon enabler. Digitization of most business activities is highly observed together with optimized and designed web-based systems for an efficient transaction with stakeholders such as business partners, customers, and suppliers. Paperless transactions are the highly considerable effort to lessen the use of consumables and other expense in maintaining information and using them in succeeding business needs. More importantly, the empirical findings revealed strong top management support in investing in communication systems that improved collaboration and creation of shared value among stakeholders. A major finding is the high level of travel reduction by practicing web-conferencing and virtual meetings regularly, which minimize physical

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

travelling, costs, and environmental footprint. It complemented with home-based work programs that encourage employees with relatively good web-based technology support making them more productive and efficient in performing tasks at home with preferential and flexible schedules activated.

Additionally, the majority of the three cases raise awareness and education on resource-intensive business transactions, which contributes to their understanding and commitment to involving themselves in practices and processes that reduce environmental footprint. First, in-house training is made available supported by learning management systems, which allows employees to update constantly themselves on practical ways to apply GIT at their level of functional business tasks. Also, the formation of focus groups is observed to provide a venue to share, interact and solicit inputs on enhancing GIT adoption practices, evaluated later on in its winning ideas for possible implementation in the organizations. A major challenge raised by one of the cases is decentralization of their office locations to reduce travel expense along with its contribution to the environmental footprint. By establishing decentralized offices, employees will likely accept nearby job offers based on their proximity to the office locations. Although the three cases have become aware of risks involved in their business cases that could contribute to environmental footprint, few can implement adequate measures to allow their processes to further analysis of environmental impacts concerning all instances of activity with the main indicators of performance on reduced costs and increased environmental benefits.

Also, there is a lack of measurement in the individual contribution of employees to achieving GIT practices about IT aided work practices. It could be a good source of input to identify areas of development to strengthen related mechanisms and programs and establish a policy or guideline to advance IT aided work practices as low carbon enabler together sound management system and established policies. Furthermore, review of job roles within business processes could be explored to align them with GIT adoption targets and objectives.

5.1.4. IT End of Life Management (ITELM)

This work also discovered a major theme in GIT adoption by all three cases is IT asset disposal and management. It is an important area of practice by all three cases, which significantly contributed to reducing the environmental footprint of their business activities. A major finding is the available ITELM disposal guidelines that promote environmentally-friendly 3R program, disposal practice and remarketing initiatives. First, the 3R program implemented contributes to a close-loop end of life management approach, which ensures that no IT equipment is sent to landfill for disposal. It is supported by the strong observance of planning end of life management options at the beginning of the IT equipment purchasing process along with constant monitoring and maintaining optimum stock levels based on efficient asset replacement and inventory management practices. Moreover, take-back scheme enhances the effectiveness of the 3R program by committing suppliers to take full ownership and responsibility of end of life management in all IT equipment used within organizations. Second, reassignment and redeployment of computers to less critical business functions and roles are highly implemented to maximize return on investments including licensing, warranties and preventive maintenances services provided by suppliers. Next, the adoption of remarketing activities is in partnership with vendors and Treatment, Storage and Disposal (TSD) facilities to recover precious components through remanufacturing and recycling by third-party companies to gain additional business value. Lastly, few of the three cases encourage the donation of used IT equipment to social enterprises; however, the passing of ITELM management's responsibility to the recipients may not have formal experience in end of life management. It will result in

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

environmental risks once the IT equipment donations made have reached the end of life, a possibility of non-conformities in the responsible end of life management will happen at the recipient's liability. These efforts have considerable direct impacts to reducing the environmental footprint of the three cases. It is a result of a strong collaboration with suppliers, TSD facilities and social enterprises who committed to environmental protection and accountability related to ITELM management.

In measurement and improvements, the majority of three cases have conducted Life-Cycle Assessment to further analysis of costs and benefits of IT end of life management activities and its contribution to reducing environmental footprint. However, the three cases need to optimize the use of consumables to reduce wastes by introducing new processes and rules to govern acquisition and reuse of consumables. Despite the continuous awareness and education program conducted by the three cases in ITELM, full engagement of all employees on these activities are lacking as well as rewards and incentives system, which could encourage further participation in ITELM activities and boost their morale of the potential efforts related to reducing environmental footprint recommended.

Another challenge of the three cases is few e-waste or TSD facilities are supporting 3R programs in the country, which could potentially provide full-scale end of life management backed by environmental management systems and compliances to regulatory requirements found in prior studies critical in minimizing environmental footprint in end-of-life management. Moreover, few participants from the three cases conducted further review end of life management processes by suppliers and determine potential risks and challenges experienced by the TSD facilities. More importantly, the majority of the three cases mentioned the need for concrete training plans for ITELM. The cascading of these plans should not only be to the facilities unit but all employees, whose in-charge of the ITELM and end of life management. Although there are considerable efforts made by the three cases on ITELM, there is no regulatory framework available in the country to support their practices and processes, which could have stringent policies and guidelines on ITELM, offer disposal alternatives and remarketing programs and measurement of outcomes.

5.1.5. Data Center, Cloud Computing and Virtualization

The last theme that emerged from the empirical findings is the group of the data center, cloud, and virtualization. Analysis of empirical findings revealed that majority of the three cases are focused on continuous development in data center operations mainly on embedding energy-efficiency measures on server assets, support infrastructure, and physical equipment. Consolidation and rationalization of data center become two major approaches to reducing the number of data center along with virtualized servers in offering new IT services. In addition, procurement of energy-efficient data center equipment is highly observed; however, few participants mentioned that they have used real-time power and energy monitoring systems, and continuous effort should be made to evaluate constantly and optimize energy efficiency.

Although there are efforts in enhancing the design of data center energy-efficiency, there are challenges in improvement power supply equipment to minimize power losses in conversion to energy. More importantly, few BPOs have implemented real-time PUE and DCiE monitoring constantly the energy consumption used by the data center as well as carbon emissions produced. There also need to enhance intelligent refreshing and orchestration tools to manage effectively manage service control.

Additionally, participants revealed that they also experience issues and challenges in multi-vendor performance management to maintain with them various services level agreements based on the design of the data center improvements as well as the ensure the quality and reliability of services provided.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Furthermore, data security and privacy issues are brought by growing multi-platform IT services provided by the organizations to their client organizations. However, considerable efforts have implemented to manage accordingly critical assets, which have to be secured and protected by increasing risks involved in network and connective and the internet.

5.2. Enablers in Green IT Adoption

Based on the results and cross-case synthesis, it is not enough to explore on the practices and processes in GIT adoption. The cross-case analysis also suggests to present the enablers in GIT adoption of the three cases. The enablers include strategy and governance, process, structure, people, technology support and measurement and improvement. It centered on collaboration, partnership, and relationship and their corresponding discussions.

The first enabler of GIT adoption in BPOs is strategy and governance. It is setting of major direction, what to achieve in GIT adoption aligned to the organization's business strategy and long-term goals and objectives. More importantly, it is fully centered on shared value creation of GIT strategy in concert with business strategy. It is found a significant enabler for direction setting in the organizations that resulted in an increase performance and competitive advantage. The organizations clearly described shared value creation in GIT through the structured approach to value mapping to progress from strategy and governance. Significantly, value mapping encouraged the organizations to think beyond decreasing costs and facilitating means to embed value enablers and key drivers contributing to growth revenue, deployment of assets and risk reduction. By mapping shared value in GIT, it provided better communication among stakeholders and defining the corporate business goals as input to the GIT program. The aims and objectives in GIT were documented and signed off explicitly and shared within the organization, therefore, internally aligning always lead external alignment with stakeholders such as vendors and suppliers. Lastly, the business case was developed with finance and accounting to build confidence and credibility to defining the impact of GIT and regularly carry out benefits tracking. According to the Purchasing Manager of BPO (Company A):

We want to add value to the GIT ecosystem. We set GIT as corporate strategy for sustainable products and services with lesser environmental footprint and to assist them to maintain our client business needs.

IT Manager of BPO (Company C):

We came up with a clear GIT strategy and embedded it in the overall corporate strategy. I believe that is a biggest positive factor, the driver that we have achieved.

Second, the establishment of the process that the organizations played and how GIT's sustenance through a standard documented process. The GIT process' full integration, collaboration and partnership strategy jointly developed and managed by the organizations. The study confirmed from the analysis of data that majority of the organizations developed their processes tailored to GIT. It is supported by the strategy and governance direction to fully accelerate GIT adoption in organizations. Formalization of processes encouraged GIT language across partnerships and stakeholders that indicated the need to harmonize and formalize GIT adoption process including the use of appropriate tools and templates. As a result, GIT become more cost-efficient and effective as well as encouraged time collaborating, and

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

knowledge development and sharing. Also, organizations incorporated GIT into the working framework while facilitating integration with other processes is guaranteed. Thus, important processes and IT support systems are not missed. According to the IT Director of BPO (Company B):

In our early transitions to GIT, we have mapped our GIT targets to existing business activities; we defined core processes, standardized way in a process-oriented way to have a holistic view and then integrating them into line of business.

IS Manager of BPO (Company A):

We have streamlined our business processes in adherence to emerging global and standardized sustainable practices to achieve our key strategic goals.

Thirdly, structure refers as to how the organization structures GIT, its establishment, and centralization of roles and responsibilities of every unit to manage it. GIT leadership was significant in driving full support, participation and actions towards the attainment of GIT adoption goals and objectives. The organizations established a well-defined cross-functional team to facilitate better collaboration and partnership to encourage full participation and serve the interest of all relevant stakeholders, which also means that organizations owned the relationship and foster collaboration with external stakeholders to achieve GIT objectives. More importantly, top management promoted the significance of partnerships with the organizations while ensuring that support ensures GIT objectives are aligned, establish key priorities and lead informed decisions and actions. Lastly, the organizations developed a devoted governance structure for the GIT adoption program and partnerships similarly with existing functional units of the organization. It means there is a need to design fully the organizational chart to highlight the functional unit charter with its description of roles and responsibilities, the definition of goals and objectives, required competencies, communication plans and measurement, and improvement tasks of an organization. According to the IT Director of BPO (Company B):

It is important that you know the skills of your people. Our objective is a better implementation of GIT through our in-house initiative to build success through partnering with highly competent technology champions.

IT Manager of BPO (Company A):

If you observed at our GIT, the decisions primarily came from the central office. The head office is stressing overseas office of the value of GIT in their respective areas.

Fourthly, people refer to the unique competencies does the organizations needed to establish and manage to adopt GIT. The empirical findings revealed that people skills and competencies should be upgraded to provide deep GIT competencies through tailored GIT training. The organizations invested in people capability building, which required the design of GIT skills and competency model covering technical, relational and developmental competencies need to accelerate GIT adoption. Moreover, they also established a GIT training program covering diverse areas completely aligned with GIT competency model. Lastly, the organization observed excellent actions and pursued a co-creation approach, which

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

promoted better understanding and commitment to GIT supported by a directed GIT training program that built a culture of continuous innovation and change among employees. According to the IT Manager of BPO (Company A):

Green IT procurement was lead from the start by our sustainability manager, who has 25 years strong supply chain and logistics experience.

IT Director of BPO (Company B):

We have thought of people who can work on the requirements. We have talent resource that can execute project plans and measure areas of growth more often in certain areas such as requisition, data center, and cloud services.

Fifthly, technology support is an important enabler of GIT adoption in organizations. It refers to a set of support systems that the organizations deployed. The analysis of empirical evidence revealed that real-time communication of strategic, operational and tactical information was important in GIT adoption. The findings revealed that IT aided work processes as low carbon enabler improved transparency, efficiency and effectiveness in achieving GIT adoption target enhancing knowledge management, which highlights constraints and benefits of its continued utilization. More importantly, the organizations emphasized improving real-time monitoring of expense in GIT, compliance to contract and timely performance reporting, which guides informed decision-making activities to benefit from an IT support system. Lastly, organizations assessed accuracy, reliability and timeliness of data and information requirements critical to decision-making in conjunction with implementing open systems promoting collaboration with internal and external stakeholders. According to the IT Manager of BPO (Company C):

We continuously adopt the latest technologies suggested by our suppliers. We have upgraded our IT infrastructure and information systems to allow us to implement emerging GIT solutions.

IS Manager of BPO (Company C)L:

So I think without systems support, IT would be challenged to the management sustainability.

Lastly, measurement and improvement enabler is focused on how does organizations measure and improve partnership performance and identify and mitigate risks at key actions with suppliers. The organizations jointly developed with vendors the measurement of performance covering wide-range areas of GIT adoption. Also, the study suggests well-defined risks mitigation plan and relevant approach with all stakeholders. The organizations focused on using the value mapped to develop performance management scheme and indicators that measure the quality of outcomes from GIT and partnerships established. Scorecards using KPIs and KRAs jointly developed with stakeholders clearly build an understanding of the expected performance of all groups involved. Lastly, co-develop and initiate risk analysis approach in GIT with stakeholders embedding complete risk management approach fully integrated with strategic planning, control, and CQIs. According to the IT Manager of BPO (Company A):

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The reason it worked well is because they really sustain the continuous improvement and make everyone accountable for that. We also apply our IT maturity models to assess and evaluate improvement opportunities as we continue GIT. It was part of our targets, was part of the company targets.

6. ANALYSIS AND DISCUSSION

This study revealed the GIT experience of the Philippines BPO industry through the empirical findings of the study. We have identified five major areas of GIT adoption including IT asset procurement, IT applications as low carbon enabler, working environment, data center, and IT end of life management. These major areas contribute to the goal of sustainability, specifically, reducing energy consumption, carbon footprint and resource conservation that leads to protecting the natural environment. First, IT procurement has seen important in ensuring that all products or services procured by the organizations from suppliers and vendors are environmentally compliant. These ensure that suppliers take full responsibility in verifying acceptable standards mandated by regulatory agencies and private organizations. It resulted in major compliance with the most number of IT equipment sourced out by the BPO organizations. More importantly, continuous monitoring of IT procurement activities is essential in achieving lower total cost of ownership, thus, translating it into savings and extended product lifespan and other related benefits. In the area of IT applications, the BPO organizations have migrated to digital business processes signifying productivity, efficiency and accuracy and reliability of outcomes. Also, telecommuting and work at home programs have helped in reducing the impacts of physically traveling. It resulted in a lower resource used and conservation, awareness in energy-savings, and low carbon enabled business activities. These outcomes contribute to increasing the potential benefits of GIT in both operational and maintenance activities. Next, the working environment of the organizations has been responsive to the need of GIT adoption. Although there are some challenges in leasing agreements of these organizations, they are still able to reconfigure office environments embedding some green office environment standards such as the use LED, smart and intelligent lighting systems and automation of temperature control. These practices contribute to resource conservation as well as reducing carbon footprint. More importantly, the case study participants have initiated a good number of practices and processes in improving data center through adopting to green data center design as well considering energy-efficient data center equipment and support systems to monitor efficiently energy consumptions and carbon emissions. Likewise, monitoring tools assisted the organizations to set a higher level of targets in term of energy consumption reduction and carbon emissions. Lastly, the IT end of life management has seen critical in ensuring that no IT waste are sent to landfills, which resulted in major success in 3R program along with remarketing activities. These activities are valuable in lessening IT waste disposal given its potential occupational, health and environmental risks within the organizations. It also allowed the organizations to promote awareness and education among end users to become more responsible for IT waste disposal processes and initiatives. Generally, the GIT practices and processes within the Philippines BPO organizations have been situated to continuously achieved long-term sustainable business and environmental protection, thus, contributing to the reduction of carbon footprint, resource conservation, and other related benefits.

We discovered salient enablers in any GIT adoption including structure, strategy, and governance, process, people, technology, measurement, and improvement. In this study, strategy and governance played a significant role as an enabler in formally establishing GIT within BPO organizations. It was

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

helpful in setting a direction to understand fully the benefits and needs of the adoption of GIT, thus, allowing for stakeholders participation complementing with top-down decisions aligned to objectives of making GIT as corporate strategy. Second, the established processes as an enabler in GIT-assisted in realizing the strategy and governance at an operational and management level. Through formalization of processes, the organizations have device appropriate measures and tools to monitor all process implementations quickly. Next, the structure as enabler assisted the organizations to identify the roles and responsibilities and also allowed them to create a central unit to manage GIT adoption activities, therefore, providing support for other functional business units on how to proceed with GIT. It has resulted in improved cross-functional activities aiming at involving all stakeholders as key implementers of GIT in various units. Also, the structure as an enabler situated the organization to take advantage of the available human resource to develop their skills and competencies in several GIT areas. Hence, it helps the BPO organizations to raise awareness and education on several implications of GIT as they continue to grow their competencies within the GIT ecosystem adopted within organizations. More importantly, people as an enabler played an important role in co-development of GIT programs, training, and other work initiatives. Likewise, technology support significantly assisted the organization in promoting GIT at various levels of operations and management. It provides the architecture to adopt efficiently the strategy and governance approach as well as execute the well-defined GIT processes to ensure that these goals and objectives are continuously achieved by the organizations. Lastly, measurement and improvement as an enabler for GIT adoption promotes continuous quality improvement resulting in cost efficient IT infrastructure, increasing business outcomes and long-term commitment to GIT implementations. Therefore, these enablers played an important role in the case study participants' organizations to facilitate better roles and responsibility in developing an appropriate GIT ecosystem within the Philippines BPO industry.

The practices, processes and enablers in GIT adoption address the need to develop organizational capabilities to become economically, ecologically, and socially sustainable. More importantly, the BPO organizations strive to provide GIT solutions for sustainability to their clients. Thus, ecological and social sustainability should be observed from responsibility and also from an economic viewpoint. Likewise, these initiatives and efforts are urged by internal needs and guided by ethical motivations; there is also need to become internally sustainable to be recognized as credible contributors of sustainable solutions.

7. RECOMMENDATIONS FOR GREEN IT PRACTICE

This section details the recommendations for three cases to enhance GIT adoption based on the empirical evidence including IT asset procurement, working environment, IT applications as low carbon enabler, data center operations and IT end of life management. It guides the organization to further areas needing improvement by implementing a strategy and key tasks.

7.1. IT Procurement and Management

In this study, IT asset procurement is a major practice in the three cases. Essentially, ITPM required supplier relationship management to enable business performance and leadership with consistent value orientation driven by proactive innovation and sustainability metrics. The organizations should critically

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

assess suppliers and vendors capability to deliver more environmentally friendly options in products and services, requiring them to be evaluated on their environmental management systems commitment and compliances to relevant government regulations. Also, they should highlight responsible resource management at an optimum level by fully integrating asset and inventory management, serving the needs of both customers and internal stakeholders of the organizations. Also, companies may introduce enhancements in purchasing logistics to the suppliers via route optimization and tracking tools. Lastly, strong collaboration should take place between suppliers and the organizations to carefully assess and measure environmental impacts, benefits, and risks involved in IT procurement and management.

7.2. Working Environment

Although the three cases have considerable efforts in improving the working environment, the study recommends enhancing collaboration with building and property owners to allow provisions in energy-centered office design. Establish a formal structure to improve participation in virtualization or home-based work program with decentralized office locations or environment to newly developed green buildings and offices extending better office design, setup and collaborative working to increase efficiency and productivity. Significantly decrease consumables by purchasing and using more environmentally friendly products that can be reused or recycled after usage. Moreover, improve wireless connectivity by reducing networks and switches used in different locations. Lastly, foster better GIT education programs to develop awareness and understanding of GIT benefits to increase commitment and participation among the employees building higher positive attitude, communication, and atmosphere fully.

7.3. IT Applications as Low Carbon Enabler

The three cases should continuously increase value in using digitization and paperless business processes as main support to business process management centered on their green management strategy. Also, review of GIT governance structure to reflect major roles and responsibilities of each employee in the organization, setting up targets and performance indicators aligned with GIT strategy and business objectives. More importantly, provide means to enhance collaborative remote support using web-conferencing tools and work support systems to increase cost-efficiency and productivity. It is also important to establish optimization plans at the beginning of every new IT services to be launched to lessen resource use such as power and consumables. Finally, the organizations should develop processes for environmental impact and benefits recording and reporting aligned with value driven GIT strategy.

7.4. Data Center

The organizations should focus on enhancing server and storage virtualization to optimized its infrastructure increasing energy-efficiency while real-time infrastructure monitoring and reporting. Also, they should completely deploy backup integration tools in servers and storage installed. It also recommended to constantly conducting measurement and management systems in a decentralized approach to monitor environmental footprint and impacts of data center operation. Also, renewable or alternate source energy to balance power consumption jointly with optimized building energy management systems and transition to LEED certified green data center and buildings, which considered more environmentally

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

friendly and allowed various reconfigurations of building space to take place. Furthermore, automate heating and cooling management systems to improve the efficiency of the data center equipment. Lastly, consider benchmarking from international standards developed by independent and government agencies that promote best practices in data center operations.

7.5. IT End of Life Management

Lastly, ITELM is part of the growing e-waste globally proved by prior empirical evidence. It is considered as an important GIT practice within the three cases which contribute to the environmental footprint. However, measures should be in place to maximize the value of IT equipment and lessen waste disposal. Organizations should focus on enhancing 3R guidelines and policies incorporating clear procedures on resource reuse and recycling at an individual level for employees. It will contribute to developing awareness and education on risks involved in ITELM. Analysis of the findings also suggests the establishment of suitable rewards and incentive to encourage of winning mindset ideas reducing negative environmental impact. Cross-functionally integrates IT asset procurement with IT asset disposal to facilitate better reporting and decision-making concerning performance in ITELM and diagnosing risks of any unsolicited actions, thereby, contributing to the achievement of 3R program. Finally, the continuous building of network suppliers with environmentally compliant 3R program jointly with accredited local TSD facilities by the government, needing careful evaluation.

8. CONCLUSION, CONTRIBUTION, AND FUTURE WORK

This study is based on a revelatory case of GIT experience within the Philippines BPO industry. We describe the GIT adoption enablers, practices and processes within the organizations providing implications for both academe and professional practice. First, we describe major areas in GIT adoption from the empirical findings including IT asset procurement, IT applications as low carbon enabler, working environment, IT end of life management and data center operations. The GIT adoption practices and processes clearly indicate the commitment of case study participants towards sustainability through GIT. Second, we also explain some challenges of the organizations in adopting GIT including technical, operational, awareness and education, and management. Based on the empirical findings, structure, strategy and governance, people, technology, and measurement and improvement are significant enablers in GIT adoption in organizations. These enablers contribute to speedily accepting GIT in organizations, thus, allowing them to design appropriate measures to initiate GIT technologies that are more appropriate to the needs of the BPO industry. However, GIT adoption in the Philippines BPO industry is still at an early stage; it signifies the necessity of policy framework as regulatory support and guide in implementing GIT within organizations.

The result of our work presents essential insights about the state of adoption of GIT in the Philippines BPO industry. It is valuable to identify which GIT areas are appropriate and presently in use and how the GIT vision of being implemented realized differently by organizations in the Philippines, as a good case of a developing country. This new understanding is also useful for locally owned Philippine BPO companies within the sector should they aspire to remain updated with most recent GIT technologies, initiatives, and practices to keep competitiveness with foreign-owned organizations considering the growing BPO industry in the country.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Despite the contribution of our study, it is not free from limitations. First, we only consider organizations within the Philippines BPO industry. Other industries with different characteristics (e.g., power distribution in the semiconductor) may have different experiences with GIT adoption. Second, we do not explore the role of industry associations and standard bodies in assisting organizations in adopting various GIT and resultant benefits. By including such third parties, a more comprehensive understanding of GIT adoption could be developed. Furthermore, from the interviews with the participating organizations, we discover that the industry associations and standard bodies are currently playing an active role. It would be useful for future studies to investigate how the roles of such bodies change over time and the impacts of this change on the GIT adoption process within the industry. Finally, as our study is based on a multiple case study involving three organizations within the Philippines BPO industry, the findings should be interpreted carefully within the relevant contexts. This study compromises statistical generalization to obtain a more detailed understanding of the adoption experience of the participating organizations. Significantly, the case study participants have successfully implemented programs to sustain skills and knowledge of human resources associated with the adoption of GIT.

REFERENCES

Albanesius, C. (2011). How much electricity does Google consume each year? PCMag.com. <http://www.pcmag.com/article2/0,2817,2392654,00.asp> 11.09.11.

Alexander, N., & Myers, H. (1999). European retail expansion in South East Asia. *European Business Review*, *99*(2), 91–104. doi:10.1108/09555349910256836

Aoun, C., Vatanasakdakul, S., & Cecez-Kecmanovic, D. (2011). Can Is Save the World? Collaborative Technologies for Eco-Mobilisation. *Proceedings of the Australasian Conference on Information System*.

Beach, G. (2008, March 8) Are You Green? *CIO*.

Bengtsson, F., & Ågerfalk, P. J. (2011). Information technology as a change actant in sustainability innovation: Insights from Uppsala. *The Journal of Strategic Information Systems*, *20*(1), 96–112. doi:10.1016/j.jsis.2010.09.007

Benitez-Amado, J., & Walczuch, R. M. (2012). Information technology, the organizational capability of proactive corporate environmental strategy and firm performance: A resource-based analysis. *European Journal of Information Systems*, *21*(6), 664–679. doi:10.1057/ejis.2012.14

Bose, I., & Pal, R. (2012). Do green supply chain management initiatives impact stock prices of firms? *Decision Support Systems*, *52*(3), 624–634. doi:10.1016/j.dss.2011.10.020

Bose, R., & Luo, X. (2011). Integrative framework for assessing firm's potential to undertake Green IT initiatives via virtualization - A theoretical perspective. *The Journal of Strategic Information Systems*, *20*(1), 38–54. doi:10.1016/j.jsis.2011.01.003

Bose, R., & Luo, X. (2011). Integrative Framework for Assessing Firms' Potential to Undertake Green It Initiatives Via Virtualization–a Theoretical Perspective. *The Journal of Strategic Information Systems,* 20(1), 38- 54.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Butler, T. (2011). Compliance with institutional imperatives on environmental sustainability: Building theory on the role of Green IS. *The Journal of Strategic Information Systems*, *20*(1), 6–26. doi:10.1016/j.jsis.2010.09.006

Butler, T., & Hackney, R. (2012). *Breaking the iron Law:* Implementing Cost Effective, Green ICT in the UK Public Sector. Proceedings of ECIS (p. 62).

Cai, S., Chen, X., & Bose I. (2013). Exploring the role of IT for Environmental Sustainability in China: An Empirical Analysis. *International Journal of Production Economics*, 146(2), 491-500.

Carlet, F. (2015). Understanding attitudes toward adoption of green infrastructure: A case study of US municipal officials. *Environmental Science & Policy*, *51*, 65–76. doi:10.1016/j.envsci.2015.03.007

Chen, A. J., Watson, R. T., Boudreau, M. C., & Karahanna, E. (2009). Organizational adoption of green IS & IT: An institutional perspective. *Proceedings of ICIS '09* (p. 142).

Chen, A. J. W., Boudreau, M.-C., & Watson, R. T. (2008). Information systems and ecological sustainability. *Journal of Systems and Information Technology*, *10*(3), 186–201. doi:10.1108/13287260810916907

Chow, W.S., and Chen, Y. (2009). Intended Belief and Actual Behavior in Green Computing in Hong Kong. *Journal of Computer Information Systems*, 50(2), 136.

Chowdhury, A. (2003). Information technology and productivity payoff in the banking industry: Evidence from the emerging markets. *Journal of International Development*, *15*(6), 693–708. doi:10.1002/jid.1027

Cooper, V. A., & Molla, A. (2012). Developing Green It Capability: An Absorptive Capacity Perspective. Proceedings of PACIS (p. 46).

Corbett, J. Webster, Sayili, K., Zelenika, I., & Pearce, J. (2010). Developing and justifying energy conservation measures: Green IT under construction. Proceedings of the Americas conference on information systems, Lima, Peru (pp. 194). Association for Information Systems.

Corbett, J. (2012). Leaders and lemmings: Organizational responses to smart grid transformation. Association for Information Systems. *Proceedings of the 18th Americas Conference on Information Systems*, Seattle, Washington.

Datta, A., Roy, S., & Tarafdar, M. (2010). Adoption of Sustainability in IT Services: Role of IT Service Providers. Proceedings of AMCIS (p. 41).

Deng, Q., & Ji, S. (2015). Organizational Green IT Adoption: Concept and Evidence.

Dubé, L., & Paré, G. (2003). Rigor in information systems positivist case research: Current practices, trends, and recommendations. *Management Information Systems Quarterly*, 2003, 597–636.

Dwaikat, L. N., & Ali, K. N. (2015). *Green Buildings Cost Premium: A Review of Empirical Evidence*. Energy and Buildings.

Elliot, S. (2007). Environmentally sustainable ICT: A critical topic for IS research? *Proceedings of the 11th Pacific Asia Conference on Information Systems*, Auckland, New Zealand (pp. 114). Association for Information Systems.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Elliot, S. (2011). Transdisciplinary Perspectives on Environmental Sustainability: A Resource Base and Framework for IT-Enabled Business Transformation. *MIS Quarterly*, 35(1), 197-236.

Erek, K., Loeser, F., Schmidt, N.-H., Zarnekow, R., & Kolbe, L. M. (2011). Green It Strategies: A Case Study- Based Framework for Aligning Green It with Competitive Environmental Strategies. Proceedings of the *Pacific Asia Conference on Information Systems* (p. 59).

Fuhr, J. P., & Pociask, S. (2011). Broadband and telecommuting: Helping the US environment and the economy. *Low Carbon Economy*, *2*(01), 41–47. doi:10.4236/lce.2011.21007

Gereffi, G., & Fernandez-Stark, K. (2010). The offshore services value chain: developing countries and the crisis. World Bank Policy Research Working Paper.

Gholami, R., Sulaiman, A. B., Ramayah, T., and Molla, A. (2013). Senior Managers' Perception on Green Information Systems (IS) Adoption and Environmental Performance: Results from a Field Survey. *Information & Management*, 50(7), 431-438.

Goasduff, L., & Forsling, C. (2007, May 22). Gartner Says 50 Percent of Mid and Large Sized Western European IT organisations will develop a Green Strategy by the End of 2008. *Gartner*, Egham, UK.

Goodhue, D. L., & Thompson, R. L. (1995). Task-technology fit and individual performance. *Management Information Systems Quarterly*, *19*(2), 213–236. doi:10.2307/249689

Harrison, D. A., Mykytyn, P. P. Jr, & Riemenschneider, C. K. (1997). Executive decisions about adoption of information technology in small business: Theory and empirical tests. *Information Systems Research*, *8*(2), 171–195. doi:10.1287/isre.8.2.171

Hedwig, M., Malkowski, S., & Neumann, D. (2009). Taming energy costs of large enterprise systems through adaptive provisioning. *Proceedings of ICIS '09* (p. 140).

Hilty, L. M., Arnfalk, P., Erdmann, L., Goodman, J., Lehmann, L., & Wäger, P. A. (2006). The relevance of information and communication technologies for environmental sustainability – a prospective simulation study. *Environmental Modelling & Software*, *21*(11), 1618–1629. doi:10.1016/j.envsoft.2006.05.007

Hofstede, G. (1983). The cultural relativity of organizational practices and theories. *Journal of International Business Studies*, 1983, 75–89.

Hopper, A., & Rice, A. (2008). Computing for the future of the planet. *Philosophical Transactions of the Royal Society: Mathematical, Physical and Engineering Sciences*, 366(1881), 3685–3697.

Huang, A. H. (2008). A model for environmentally sustainable information systems development. *Paper presented at the Pacific Asia Conference on Information Systems (PACIS)*, Suzhou, China.

Huang, K. T., Huang, W. P., Lin, T. P., & Hwang, R. L. (2015). Implementation of green building specification credits for better thermal conditions in naturally ventilated school buildings. *Building and Environment*, *86*, 141–150. doi:10.1016/j.buildenv.2015.01.006

Hwang, B. G., & Tan, J. S. (2012). Green building project management: Obstacles and solutions for sustainable development. *Sustainable Development*, *20*(5), 335–349. doi:10.1002d.492

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Ijab, M. T., Molla, A., & Cooper, V. (2012). Green information systems (green IS) practice in organisation: tracing its emergence and recurrent use.

Indjikian, R., & Siegel, D. S. (2005). The impact of investment in IT on economic performance: Implications for developing countries. *World Development*, *33*(5), 681–700. doi:10.1016/j.worlddev.2005.01.004

IT-BPO Road Map 2011-2016. (2015). *IT and Business Process Association of the Philippines*. Retrieved from http://www.ibpap.org/about-us/it-bpo-road-map-2011-2016

Jenkin, A. T., Webster, J., & McShane, L. (2011a). 'An agenda for Green information technology and systems research. *Information and Organization*, *21*(1), 17–40. doi:10.1016/j.infoandorg.2010.09.003

Jenkin, T. A., McShane, L., & Webster, J. (2011b). Green information technologies and systems: Employees' perceptions of organizational practices. *Business & Society*, *50*(2), 266–314. doi:10.1177/0007650311398640

Jung, H. S., Kim, Y., & An, J. A. (2011). Effects of the Internal and External Factors of Small and Medium sized Corporations on Green Management Performances through the Establishment and Utilization of Information Systems and Building Relationships for Information and Knowledge.

Karanasios, S., Cooper, V., Deng, H., Molla, A., & Pittayachawan, S. (2010). Antecedents to greening data centres: A conceptual framework and exploratory case study. *Proceedings of the 21st Australasian Conference on Information Systems (ACIS 2010)*.

Karin, B. (2009, September 16). Scavenging Hazardous 'E-Waste' for a Few Redeemables. *The Washington Post*.

Koo, C., Chung, N., & Lee, Y.-C. (2013a). The Influential Motivations of Green IT Device Use and the Role of Reference Group Perspective. *Proceedings of PACIS 2013*.

Koo, C., Lim, M. K., & Park, K. (2014b). e-Smart health information adoption processes: Central versus Peripheral route. *Asia Pacific Journal of Information Systems*, *24*(1), 67–94. doi:10.14329/apjis.2014.24.1.067

Kuo, B. N., & Dick, G. N. (2010). Organizational Green IT: It seems the bottom line rules. *Proceedings of AMCIS '10*.

Kurp, P. (2008). Green Computing. *Communications of the ACM*, *51*(10), 10, 11–13. doi:10.1145/1400181.1400186

Lei, C. F., & Ngai, E. W. T. (2013). Green IT Adoption: An Academic Review of Literature. Proceedings of PACIS (p. 95).

Lei, C. F., & Wai Ting Ngai, E. (2012). Green IS assimilation: A theoretical framework and research agenda.

Lertwongsatien, C., & Wongpinunwatana, N. (2003). E-commerce adoption in Thailand: An empirical study of Small and Medium Enterprises (SMEs). *Journal of Global Information Technology Management*, *6*(3), 67–83. doi:10.1080/1097198X.2003.10856356

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Loock, C.-M., Staake, T., & Thiesse, F. (2013). Motivating Energy-Efficient Behavior with Green Is: An Investigation of Goal Setting and the Role of Defaults. *Management Information Systems Quarterly*, *37*, 4.

Magtibay-Ramos, N., Estrada, G., & Felipe, J. (2007). An analysis of the Philippine business process outsourcing industry. ERD working paper series No. 93.

Mann, H., Grant, G., & Singh Mann, I. J. (2009). Green It: An Implementation Framework. *Proceedings of the Americas Conference on Information Systems*.

Mines, C. (2009). *The dawn of GREEN IT services*. Forrester.

Mithas, S., Khuntia, J., & Roy, P. K. (2010). Green Information Technology, Energy Efficiency, and Profits: Evidence from an Emerging Economy. *Proceedings of the 31th International Conference on Information Systems*, St. Louis (pp. 11). Association for Information Systems.

Molla, A. (2009a, December 3-5). The Reach and Richness of Green IT. *Proceedings of the 20th Australasian Conference on Information Systems*, Melbourne, Australia.

Molla, A. (2009b). Exploring The Extent of Green IT Adoption and its Driving and Inhibiting factors. *Journal of Information Science and Technology*, *6*(4), 3–21.

Molla, A. (2009c, July 10-12). Organizational motivations for Green IT: exploring Green IT matrix and motivation models. *Proceedings of PACIS*, Hyderabad, India.

Molla, A., & Abareshi, A. (2011). Green IT Adoption: A Motivational Perspective. Proceedings of PACIS (p. 137).

Molla, A., & Cooper, V. (2010). Green IT readiness: A framework and preliminary proof of concept. *Australasian Journal of Information Systems*, *16*(2), 5–23. doi:10.3127/ajis.v16i2.545

Molla, A., Cooper, V., & Pittayachawan, S. (2009, December 15-18). IT and Eco-sustainability: Developing andValidating a Green IT Readiness Model. *Proceedings of International Conference of Information Systems*, Phoenix, AZ, USA.

Molla, A., Cooper, V., & Pittayachawan, S. (2011). The Green IT readiness (G-Readiness) of organizations: An exploratory analysis of a construct and instrument. *Communications of the Association for Information Systems*, *29*(1), 67–96.

Molla, A. V. A., Cooper, S., & Pittayachawan, S. (2011). IT and eco-sustainability: developing and validating a green it readiness model. Proceedings of ICIS 2009.

Moore, G. C., & Benbasat, I. (1991). Development of an instrument to measure the perceptions of adopting an information technology innovation. *Information Systems Research*, *2*(3), 192–222. doi:10.1287/isre.2.3.192

Murugesan, S. (2008). Harnessing Green IT: Principles and practices. *IT Professional*, *10*(1), 24–33. doi:10.1109/MITP.2008.10

Nanath, K., & Pillai, R. R. (2012). A Sustainability Model of Green It Initiatives. *Proceedings of the International Conference on Information Systems*, Orlando, FL, USA.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Nedbal, D., Wetzlinger, W., Auinger, A., & Wagner, G. (2011). Sustainable IS Initialization Through Outsourcing: A Theory-Based Approach. Proceedings of AMCIS.

Neuman, W. L. (2006). *Qualitative and quantitative research designs. WL Neuman, Social research methods: Qualitative and quantitative approaches* (6th ed., pp. 149–178). Boston: Pearson Prentice-Hall.

North-America Underperforms in Green IT Attitudes and Actions. (2008, January). Info-Tech Research Group.

Oliveira, T., & Martins, M. F. (2011). Literature review of information technology adoption models at firm level. *The Electronic Journal Information Systems Evaluation*, *14*(1), 110–121.

Oliveira, T., Thomas, M., & Espadanal, M. (2014). Assessing the determinants of cloud computing adoption: An analysis of the manufacturing and services sectors. *Information & Management*, *51*(5), 497–510. doi:10.1016/j.im.2014.03.006

Olson, J. R., & Boyer, K. K. (2003). Factors influencing the utilization of Internet purchasing in small organizations. *Journal of Operations Management*, *21*(2), 225–245. doi:10.1016/S0272-6963(02)00089-X

Overby, S. (2007). Clean, Green Machines. *CIO*, *20*(12), 36–44.

Park, S. H., Eo, J., & Lee, J. J. (2012). Assessing and managing an organization's green IT maturity.

Pavlakis, P., Alexandry, S., & Sieber, A. (1996). Monitoring oil-spill pollution in the Mediterranean with ERS SAR. *Earth Observation Quarterly*, *52*, 8–11.

Perenson, M. (2009). Western Digital Debuts First 2TB Hard Drive. *PC World*, 27(4), 60.

Ricknäs, M. (2009). Greener Profits. *CIO*, 22(11), 18.

Riemenschneider, C. K., & McKinney, V. R. (2001). Assessing belief differences in small business adopters and non-adopters of web-based e-commerce. *Journal of Computer Information Systems*, *42*(2), 101.

Ryoo, S.Y., Koo, C., & Wati, Y. (2011). Why Go Green: The Influence of Green Practices Coordination on Firm Performance. *Proceedings of AMCIS '11*.

Sarkar, P., & Young, L. (2009). Managerial attitudes towards Green IT: An explorative study of policy drivers. *Proceedings of the 13th Pacific Asia Conference on Information Systems*, Hyderabad, India (pp. 95). Association for Information Systems.

Sartori, I., & Hestnes, A. G. (2007). Energy use in the life cycle of conventional and low-energy buildings: A review article. *Energy and Building*, *39*(3), 249–257. doi:10.1016/j.enbuild.2006.07.001

Sayeed, L., & Gill, S. (2008). An exploratory study on environmental sustainability and IT use. *Proceedings of the 14th Americas Conference on Information Systems*, Toronto, Canada (pp. 55). Association for Information Systems.

Sayeed, L., & Gill, S. (2009). Implementation of Green IT: Implications for a dynamic resource. *Proceedings of the 15th Americas Conference on Information Systems*, San Francisco (pp. 381). Association for Information Systems.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Schmidt, N. H., Erek, K., Kolbe, L. M., & Zarnekow, R. (2010). Predictors of Green IT Adoption: Implications from an Empirical Investigation. Proceedings of AMCIS (p. 367).

Schmidt, N. H., & Kolbe, L. M. (2011). Towards a contingency model for green IT governance. Proceedings of ECIS.

Seidel, S., Recker, J. C., Pimmer, C., & vom Brocke, J. (2010). Enablers and Barriers to the Organizational Adoption of Sustainable Business Practices. *Proceedings of the Americas Conference on Information Systems: Sustainable IT Collaboration around the Globe*. Association for Information Systems.

Seyal, A. H., Noah Abd Rahman, M., & Awg Yussof Hj Awg Mohammad, H. (2007). A quantitative analysis of factors contributing electronic data interchange adoption among Bruneian SMEs: A pilot study. *Business Process Management Journal*, *13*(5), 728–746. doi:10.1108/14637150710823183

Seyal, A. H., & Rahim, M. M. (2006). A Preliminary investigation of electronic data interchange adoption in Bruneian small business organizations. *The Electronic Journal of Information Systems in Developing Countries, 24*.

Shanks, G., Arnott, D., & Rouse, A. (1993). *A review of approaches to research and scholarship in information systems*. Department of Information Systems, Faculty of Computing and Information Technology, Monash University.

Siegler, K., & Gaughan, B. (2008). A practical approach to Green IT (Webinar). Retrieved from http://www.itmanagement.com/land/green-it-webinar/?tfso=2058

Srivastava, R. P., Kogan, A., & Vasarhelyi, M. A. (2001). Balanced scorecard approach to sustainability and value creation: A challenge for survival in the new economy. *The Journal of Eastern IILM (Calcutta)*.

Swanborg, R. (2009). Where Green IT Is No Fad. *CIO*, 22(15), 20.

Symantec Green IT Report. (2009, May). Symantec.

Tan, B., Ling Pan, S., & Zuo, M. (2011). Attaining and enacting green leadership: Insights from the green IT initiatives of China Mobile.

Tarafdar, M., Modi, S., Roy, S., & Datta, A. (2010). Adoption of sustainability in IT services: Role of IT service providers. *Proceedings of the 16th Americas Conference on Information Systems*, Lima, Peru (pp. 41). Association for Information Systems.

Thomas, M., Costa, D., & Oliveira, T. (2015). Assessing the role of IT-enabled process virtualization on green IT adoption. *Information Systems Frontiers*. doi:10.100710796-015-9556-3

Thong, J. Y. (1999). An integrated model of information systems adoption in small businesses. *Journal of Management Information Systems*, *15*(4), 187–214. doi:10.1080/07421222.1999.11518227

The state of world population 2014. (2014). United Nations Fund Report. Retrieved from http://www.unfpa.org/sites/default/files/pub-pdf/EN-SWOP14-Report_FINAL-web.pdf

Usui, N. (2011). Transforming the Philippine Economy: 'Walking on Two Legs'. *Asian Development Bank Economics Working Paper 252*.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Vatanasakdakul, S., Tibben, W., & Cooper, J. (2004). What prevent B2B eCommerce adoption in developing countries?: A socio-cultural perspective.

Vykoukal, J., Wolf, M., and Beck, R. (2009). Does Green IT Matter? Analysis of the Relationship between Green IT and Grid Technology from a Resource-Based View Perspective. *Proceedings of PACIS '09.*

Wati, Y., & Koo, C. (2010, January). The green IT practices of Nokia, Samsung, Sony, and Sony Ericsson: content analysis approach. *Proceedings of the 2010 43rd Hawaii International Conference on System Sciences HICSS* (pp. 1-10). IEEE.

Yin, R. K. (2003). Applied social research methods series: Vol. 5. *Case study research design and methods* (3rd ed.).

Yin, R. K. (2008). *Case study research: Design and methods*. Sage publications.

Zhang, Y. (2012). *It enabled environmentally friendly consumption:* IT Features Addressing Challenges in Consumer Decision Making. Proceedings of ECIS (p. 233).

This research was previously published in the International Journal of Social Ecology and Sustainable Development (IJSESD), 7(1); edited by Elias G. Carayannis, pages 1-34, copyright year 2016 by IGI Publishing (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

APPENDIX A

Table 2. A detailed summary of Green IT adoption studies undertaken in developed and developing countries

Country	Literature Sources	Green IT Type/Area	Industry Type	Research Approach	Data Analysis	Theoretical Frameworks	Significant Factors
Australia	Molla, 2009	Sourcing, operations, end of life management	Across industries including IT companies, health, wholesale sector, utility, transport, construction, manufacturing, finance and insurance	Survey(n=109)	Principal component and cluster analysis	Institutional theory	Cost reduction consideration, cost of Green IT, strategic target definition, social responsibility, mimetic pressures, normative pressures, regulatory support
Australia	Molla & Abareshi, 2011	Energy-efficiency of IT infrastructure and pollution	Across industries and government organization	Survery(n=176)	Exploratory factory analysis, confirmatory factor analysis	Organizational motivation theory	Cost reduction consideration, eco-effectiveness motive, coercive pressures
Australia	Karanasios et al., 2010	Green data center	University, data center provider	Qualitative case study	Qualitative data analysis	Institutional theory, motivational theory, performance-expectancy theory	Performance and effort expectancy, organizational capability, motivation, normative pressures, coercive pressures
Australia	Nedbal et al., 2011	Sustainable is-outsourcing, B2B	Small-medium enterprise	Qualitative case study	Qualitative data analysis	Technology-organization-environment, diffusion of innovation, transaction cost theory	Compatibility, complexity, top management commitment and support, firm size, transaction costs, coercive pressures, regulatory support
Australia	Sarkar & Young, 2009	Carbon emissions, green IT Infrastructure and governance	University, information technology services and telecommunications	Qualitative case study	Qualitative data analysis	Theory of reasoned action	Managerial attitudes, normative pressures
Australia	Cooper & Molla, 2012	Green IT capability (G-readiness) including, Green IT policy and governance, green IT practice and technology	Green IT vendors (consulting, technology provider, educator), legal firm, small-medium enterprises, university	Qualitative case study	Qualitative data analysis	Theory of absorptive capacity	Organizational learning
Australia	Ijab et al., 2012	Eco-sustainability practices, green IS	Telecommunications	Qualitative case study	Qualitative data analysis	Institutional theory	Mimetic pressures, normative pressures
Australia, Thailand	Aoun et al., 2011	Collaborative technologies for eco-mobilisation	Environmental non-governmental organisations	Qualitative case study	Qualitative data analysis	Actor network theory	No specific factors
China	Tan et al., 2011	Green Leadership, IP-based network, Intelligent ventilation and heat transfer systems, green packaging	Telecommunications provider	Qualitative case study	Qualitative data analysis	Organizational theory	Commitment trust, dependence, transaction cost economics, relational norms
China	Cai, Chen & Bose, 2013	IT for energy and environmental sustainability	Across industries including IT and non IT firms	Survey(n=70)	Smart partial least square analysis	Porter's concept of competitive advantage; diffusion of innovation theory	Public concerns, regulatory forces, cost reduction, differentiation, perceived complexity
Cross-Country (Europe)	Thomas et al., 2015	IT-enabled process virtualization capabilities	Across industries	Survey(251)	Partial list squares, correlation	Technology-organization-environment framework, process virtualization theory, and diffusion of innovation theory	Competition intensity and regulatory support, sensory readiness, relationship readiness, synchronism readiness, and identification and control readiness
Germany	Schmidt & Kolbe, 2011	Green IT governance	Transportation, computer software, financial services, newspaper media, pharmaceuticals and chemicals	Qualitative case study	Qualitative data analysis	Contingency theory	Competitive strategy, firm size, organization structure, performance strategy, environmental impact of industry, environmental strategy, IT infusion, observed green IT governance

continued on following page

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 2. Continued

Country	Literature Sources	Green IT Type/Area	Industry Type	Research Approach	Data Analysis	Theoretical Frameworks	Significant Factors
Germany	Loock et al., 2013	Energy-efficiency and conservation	Private households – electricity consumers	Survey(1791)	Anova	Extended model of goal-directed behavior	Goal setting
Germany	Schmidt et al., 2010	Enterprise green IT, corporate social responsibility	Across industries under german stocks indexes	Survey (116)	Regression analysis	no specific theory	Technological uncertainty, perceived importance of green IT
Hong Kong	Zhang, 2012	IT enabled environmentally friendly consumption	Fishing	Qualitative case study	Qualitative data analysis	Theory of planned behavior	Attitude, subjective norm, perceived behavioral control
Hong Kong	Chow & Chen, 2009	Green IT	University	Survey(n=267)	Regression analysis	Theory of reasoned action and theory of planned behavior	Attitude toward green computing, subjective norm, perceived behavioral control, intention to green computing, actual behavior
India	Datta et al., 2010	Sustainable IT services value chain	IT service providers	Qualitative case study	Qualitative data analysis	Inter-organizational knowledge transfer view, resource dependency theory	Supplier education
India	Mithas et al.,2010	IT equipment energy consumption, energy-efficiency, profits in green IT	Across industries in india	Survey (293)	Descriptive analysis	Belief-action-outcome theory	Perceived importance of green IT, top management commitment and support
Malaysia	Gholami et al. (2013)	Green IS	Manufacturing, services	Survey(n=405)	Partial least square based structural equation modelling	Belief action outcome framework, institutional l theory	Coercive pressure, mimetic pressure, attitude, consideration of future consequences
North America	Corbett, 2012	Utilities smart grid	Utilities, system operator, industry association, software vendor and consulting	Qualitative field study	Qualitative data analysis	Institutional theory	Technological uncertainty, mimetic pressures
Spain	Benitez-Amado & Walczuch, 2012	IT enabled capabilities	Across industries including banking and insurance, electronics, IT, telecommunications, food and beverages, chemicals and pharmaceuticals, consulting and outsourcing, aerospace, apparel, construction and hotels	Survey (n=63)	Structural equation modelling, path analysis	No specific theory	IT capability, corporate environment strategy, firm performance
South Korea	Jung et al., 2011	Green IT management performance, use of IS and IT resources	Small-medium enterprises	Survey (n=178)	Confirmatory factor analysis	Resource based theory	Information technology resource, top management commitment and support, coercive pressures
South Korea	Ryoo et al., 2011	Green manufacturing, marketing, green IT/IS, green supply Chain	Manufacturing	Survey (n=47)	Partial least square analysis	Ecological theory, complementarity theory	Coordination
South Korea	Wati & Koo, 2010	IT environmental concerns, environmental management systems, energy-efficiency, emission and reduction actions, green disposal, alternative energy	Telecommunications, information technology	Content Analysis	Chi-square analysis	No specific theory	Awareness of environmental problems, coercive pressures
South Korea	Koo et al., 2013a	Green IT energy-efficiency	Manufacturers	Survey(n=104)	Partial list squares, regression analysis	Reference group theory	Social influence, media influence, perceived enjoyment, environmental problem, saving money, legislative pressure, perceived usefulness, sustainable use

continued on following page

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 2. Continued

Country	Literature Sources	Green IT Type/Area	Industry Type	Research Approach	Data Analysis	Theoretical Frameworks	Significant Factors
Sweden	Bengtsson & Agerfalk, 2011	Sustainable logistics, ordering and work practices	Municipal agency	Canonical action research – Survey	Qualitative data analysis	Actor network theory	Innovation system, market place, regulatory regime
United States	Seidel et al., 2010	Sustainability program (data center, working environment, IT procurement, IT waste disposal, IT applications as low carbon enabler)	IT software solution	Qualitative case study	Qualitative data analysis	No specific theory	Strategy definition, organizational support, motivation, traceability
United Kingdom	Kuo & Dick, 2010	Virtualization, data center consolidation, electronic waste, collaboration technologies, telecommuting, use of reduction of paper use through electronic systems and printer configurations	Across industries	Survey (n=43)	Regression analysis	No specific theory	Technological constraints, cost reduction consideration, organizational capabilities, social responsibility, top management commitment and support, normative pressures, coercive pressures
United States of America	Sayeed & Gill, 2008	Data center consolidation, virtualization, energy-efficiency, IT waste disposal, green procurement, IT application as low carbon enabler	Software and equipment manufacturers, utility company, co-location/ hosting company	Qualitative case study	Inductive analysis	No specific theory	Cost reduction consideration, IT governance, social responsibility, top management commitment and support
United States of America	Sayeed & Gill, 2009	Data center consolidation, virtualization, energy-efficiency, IT waste disposal, green procurement, IT application as low carbon enabler	Software and equipment manufacturers, utility company, co-location/ hosting company	Qualitative case study	Inductive analysis	No specific theory	Strategic target definition, coercive pressures
United Kingdom	Butler & Hackney, 2012	Energy-efficiency, greenhouse gas	Government organization	Qualitative case study	Qualitative data analysis	Institutional theory	Mimetic pressures, coercive pressures, normative pressures
United States of America	Chen et al., 2009	Green IT/IS, product stewardship	Across industries including manufacturing and service industries	Survey (n=75)	Partial least squares, confirmatory factor analysis	Natural-resource-based view, institutional theory	Mimetic pressures, coercive pressures
United States of America	Butler, 2011	Compliance to Product (C2P)	IT manufacturers	Qualitative case study	Qualitative data analysis	Institutional theory	Coercive pressures, mimetic pressures
United States of America	Deng & Ji, 2015	Sustainability	Information technology company	Qualitative	Content analysis	Diffusion of innovation theory, institutional theory, organizational culture theory, resource-based view, natural-resource-based view	Relative advantage, technological complexity, compatibility, top management support, greening organizational culture, strategic intent, mimetic pressures, coercive pressures, normative pressures

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

APPENDIX B

Table 3. Summary of Green IT adoption practices and processes in BPO organizations

Area	Practices and Processes	BPO A	BPO B	BPO C
IT Procurement	Guidelines and Objectives	Sustainable purchasing program	Green purchasing program	Smart sustainability program
	Assessing Supplier Capacity, Costs and Benefits	Supplier and product approaches to sustainable purchasing.	Leasing Model with major consideration in reducing total cost of ownership	Supplier and product approaches to sustainable purchasing.
	Introducing Environmental Standards in Procurement	Products or service compliant to environmental standards	Eco-labelling and certifications with lower carbon emissions, Suppliers commitment environmental management systems	Highest environmental benefits and lowest supply chain footprint
	Skills and Competencies	Supply chain expertise is available	Experienced SP staff and decentralized training and special roles	Centralized purchasing with skilled staff and improvements by focus-group.
	Awareness and Education	Collaborative learning with suppliers and internal stakeholders	Continues education of supply chain staff is majority priority.	Capitalize son experienced supply chain staff and in-house capacity trainings.
	Challenges and Opportunities	Compliances to contract and procurement standards and risks exposure to supply chain processes	Limited local suppliers conforming to environmental standards	Rewards and incentive programs
	Technology Support	Availability of end to end procurement and logistics systems	Availability end-to-end web based purchasing system	Availability end-to-end web based purchasing system
	Assessment, Monitoring and Evaluation	Quantitative process improvement goal and CQIs using LCA approach.	Electronic Product Assessment Tool (EPEAT), Supplier-Driven performance evaluation,	Supply performance management systems.
Working Environment	Guidelines and Objectives	Energy-conscious workplace, Occupational Health Safety Administration (OHSA)	Good housekeeping in workplace environment with energy-consciousness.	Limited guidelines on greening work environment, uses traditional office acceptable use policy
	Energy-Efficient Computing Devices	80% energy-efficient desktops, 20% laptops, Thin-client solutions, Central power management system	80% energy-efficient laptops for FBU, Use of intelligent energy and power management software, Hardware based power saving features, Consistent preventive maintenance, Restrictions in PC setup configurations, PC monitoring systems to monitor compliance of users	Use of power management features with energy-efficient desktop and laptop computers, Use of screen mirroring systems to monitor compliance, Considerable use of energy-efficient UPS to manage electrical faults and losses
	Consumables, Printers and Support Software	Use of multifunction devices, Remanufactured and recycle consumables, toner saving solutions, print management software to control printing of unnecessary documents	85% multifunction printing devices 15 single function, Use of service printers through leasing model, Use of print management service to control printing	Limited printing devices, highly discourage printing “think before you print”, No print management used, Minimize use of consumables
	Office Design, Setup and Lighting Systems	Use of LED lighting systems for energy-efficiency and savings.	Sectoral arrangement for small group lighting zones, Use of efficient lighting systems	Energy-efficient lighting systems provided by building owners but no adaptive sensor based lighting, Provisions to monitor temperature using building management systems, Provisions for natural light in some areas

continued on following page

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 3. Continued

Area	Practices and Processes	BPO A	BPO B	BPO C
Working Environment	Awareness and Education	Power shut off during non-working hours and weekends, Communication of utility expense, consumptions and savings, Eco-Warriors to act as champions in energy-efficiency program, Partners education program	Communication of environmental benefits and practices in working environment, Trainings on EMS, Facilitate idea generation through suggestion scheme	Lack of communication plan to better understand green working environment
	Challenges and Opportunities	Full implementation of intelligent lighting systems, Constraints in physical space set due to leasing agreements, Incorporation of green office and building standards in office design and setup, Use of alternative source of energy	Constraints in physical space set due to leasing agreements, Continuous environmental education for new hires not familiar with energy-saving practices, No communication plan on IT asset power consumption reports, No rewards and incentive systems in place, Incorporation of green job roles and responsibilities in HR	Increasing number of employees in functional areas became a challenge in monitoring compliances, Use of automation tools for real-time monitoring of EES, Updating of network equipment and inventory, Fully engage new hires provided with training plans, Attitude and resistance to green work practices, Full participation of all employees in EMS education, Limited control over temperature and heating systems due to leasing agreements
	Technology Support	Use of HVAC with real-time monitoring systems.	Use of HVAC systems to heat and cool only when necessary	Use of responsibility matrix to ensure full ownership and responsibility in IT asset use and other work environment goals
	Assessment, Monitoring and Evaluation	45% reduction of carbon footprint in work place environment, Use of separate utility for IT power usage, Use of green workplace score card, Strong collaboration with implementing agencies and stakeholders	No-energy audits and limited energy-saving outcomes tracking; No evidence of historical compliance, No further analysis conducted of practices; Challenge to develop an inventory model for EEC plans. Property managers were not fully engaged in planning EEC activities.	Use of automation tools for real time monitoring of EECS, Monitoring reports were underutilized-no further analysis to measure effectiveness of the programs, Lacks work environment and energy audits and reporting plans
IT Applications as Low Carbon Enabler	Guidelines and Objectives	Digitization of all work and business practices	Digitization is major priority in all business activities.	Digitization with employee-focused office at home program.
	IT Applications/Software as Low Carbon Enabler	Majority of business activities are supported by IT applications and other digital technologies to minimize resource use	Paper-less business activities supported by IT applications and related tools, Use of collaboration tools to easily manage business docs and increase interaction among stakeholders, dedicated software for special business functions, Paper-less transaction processing	Resource conservation through IT applications
	Communication Support, Travel Reduction and Telecommuting	Unified communication systems to provide efficiency and reduce travel requirements, Implementation of virtual meetings and web-conferences, Provisions for telecommuting – home based work programs	Compressed work week (10 hrs a day instead of 8 hours, alternate Friday vacation), Work at home through in-house developed CloudSource platform	Provisions for telework to reduce travel need and expenses, Use of self-service kiosks in HR processing
	Leadership, Awareness and Education	Consistent delivery of green IT education among employees and new entrants/hires, Regular communication of updates on practical tips on green IT through LMS and email, Online forum on green IT to allow sharing and collaboration, Formation of small groups to act as "eco-warriors" to handle environmental activities, Presentation of winning green IT ideas in learning forums and meetings.	Regular communication of organization's environmental compliances, Use of LMS to discuss resource intensive business activities	Use of knowledge management system (KMS) to cascade updates on green IT and related services. Strategic alignment of employees training towards full understanding of green IT at various levels.

continued on following page

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 3. Continued

Area	Practices and Processes	BPO A	BPO B	BPO C
IT Applications as Low Carbon Enabler	Challenges and Opportunities	Lack of detailed discussion on individual contributions to green IT work practices; Lack of quantitative analysis on the extent of engagement of employees in green IT work practices.	Started individual training plans for employees to cover various green IT skills and competencies, however, Lack of explicit discussion on how employees' initiatives must be supported; New hires need further green IT education to reduce negative attitude towards green IT; No rewards and incentives program to increase individual energy-saving initiative; Improving security and IT governance.	Decentralization of office locations to improves proximity and accessibility of resource for employees.
	Technology Support	Ready and updated IT infrastructure and life-cycle to support business activities, Technological expertise is available in all technology support and integration programs.	Partial dependence to suppliers/ vendors tools, established IT unit for in-house custom applications.	Strong dependence of the organization suppliers/vendors technologies, Optimization of IT services
	Assessment, Monitoring and Evaluation	Regular conduct of environmental impact analysis to monitor costs and benefits of business activities, recognition of employees as "value-creators" for outstanding contribution aligned to green IT	Lesser work flows performed manually and standardized business practices.	Continues quantitative business process improvements, Review of job roles to align IT in green IT goals and objectives.
IT End of Life Management	Guidelines and Objectives	3R (Reduce, Reuse, Recycle)	IT asset replacement program with suppliers by means of leasing model	3R (Reduce, Reuse, Recycle), Supplier take-back program
	Disposal Practice	3R program is major priority to reduce IT asset disposal with supplier take-back program.	Supplier take-back program and disposal through TSD facility are major priority.	3R program is a major priority to reduce IT asset disposal
	Reduce, Reuse, Recycle (3R Program), Donation, Remarketing, Trade-Ins	Optimal stock levels are maintained, Reassignment or redeployment of existing computers to other business units, Donation of computers to social enterprise, Reuse of consumables is 95%.	Remarketing of used component parts through TSD facility, Reassignment or redeployment of existing computers to other business units	Reassignment or redeployment of existing computers to less critical job roles, Donation of computers to social enterprises
	Raising Awareness and Education	Encourage employees to attend to environmental programs, 5S checklist - Japanese culture of housekeeping, 3R education program	Safety guidelines in 3R program, No formal training in ITELM activities, Small groups called as Employees Conserving Our Earth (ECOE) Squad – to encourage participation in environmental programs	EMS awareness trainings, Continuous in-house training and education in 3R program.
	Challenges and Opportunities	No rewards and incentive program, Logistics of disposal to lessen risks, which will emit carbon and other gasses, Few certified fully integrated e-waste management company, No regulatory framework is dedicated for e-waste management in the country	Increase financial value from ITELM, Insufficient training plans for 3R program.	No clear direction from the managers as to how other stakeholders should be fully involved in the 3R program including property owners and building managers.
	Technology Support	Use of asset replacement and inventory management software for monitoring of IT asset	Readily available inventory management software for IT asset monitoring and movement	Recycling manager application provided by Cloud Blue
	Assessment, Monitoring and Evaluation	Life-Cycle Assessment (LCA) – Waste Reduction Model (WARM), ROI, Audit activities conducted by PEZA	No further analysis conducted to verify reduction of carbon foot print as a result of ITELM activities, TSD is subjected to accreditation and regulatory compliances and no performance management scheme	Life-Cycle Assessment (LCA) to assess full product life-cycle

continued on following page

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 3. Continued

Area	Practices and Processes	BPO A	BPO B	BPO C
Data Centers Consolidation, Virtualization and Cloud Computing	Guidelines and Objectives	Energy-efficiency in data center equipment and operations	Energy-efficiency in data center equipment and operations	Greening data center guidelines
	Consolidation and Rationalization, Virtualization and Cloud Technologies	Intelligent refreshing, Single-storage network for efficiency in data collection, real-time monitoring of data center equipment power usage, temperature and moist control automation	Virtualized servers and cloud based systems for new IT services	Consolidation and rationalization programs to reduce data centers, equipment and carbon footprint
	Skills, Competencies, and Education	Availability of data center operation expertise, Supplier–driven trainings and special IT certifications are available for employees	Data center expertise are sourced out from IT vendors, Industry-Driven trainings and certifications provided	Availability of financial funding for continuous development of data center experts, Supplier-driven skills and knowledge are passed to in house IT data center experts, Strong pool of expertise in virtualization and cloud based technologies
	Challenges and Opportunities	Multi-vendor management in maintaining different Service Level Agreements (SLA) resulting in poor reliability, performance and scalability	Infrastructure complexity driven by SLAs in connectivity, storage and software, Quality of services by IT vendors and technology integration	Data security and privacy, Systems monitoring and performance
	Technology Support	Energy-efficiency in design and operation is a major priority in power and data center equipment	Efficient temperature and humidity, and power equipment, enhancement of air flow management, Use UPS and HVAC systems	Full dependence with supplier and vendor technologies in data center, Energy-efficiency in IT data center equipment, Cost and savings are major priority in updating data center facility
	Assessment, Monitoring and Evaluation	Real-time PUE and DCiE are used to monitor energy savings and carbon footprint, Life-Cycle Assessment for full product-life cycle management	Monitoring of data center energy use and consumptions, Business continuity is a major priority, Provisions for ISMS for security management, No further analysis on environmental impacts of data center operations	Life-Cycle Assessment, Leadership in Energy and Environmental Design to monitor energy-consumption and reduce carbon footprint.

APPENDIX C

C.1. Company A

Company A is well-known information technology and business processing outsourcing firm. It is a multi-national company that has established its presence in the Philippines since 1992. It has approximately 40,000 employees and five delivery centers in the National Capital Region with annual sales of USD 30 billion. It has more than 25, 000 people in its IT services department who are primarily responsible for software development, project support and maintenance activities. It serves two types of customers, local and foreign customers. Foreign customers are typically Fortune Global 100 that are mainly served to provide information technology, consulting, digital, and sustainability, while local customers are typically large companies across sectors and government agencies.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

C.2. Company B

Company B is one of the largest business processing outsourcing companies in the Philippines. It has been providing more than 20, 000 BPO jobs since 2003. Overall, 90% of its business comes from the foreign market, serving Fortune 50 clients. It has two major business activities such as business process management and technology catering to banking and financial, mortgage, government, healthcare, insurance, retail, technology, communications, travel and transportation. The revenues were USD 140 million in 2014. Of the 20,000 people, there are approximately 150 people in the IT department.

C.3. Company C

Company C is large IT supply chain expert of the leading global technology brands in the world. Since its establishment in 2009, it has approximately employed 18, 000 people proving supply chain services, retail, and support services. It represents approximately 1400 suppliers providing support from approximately 21, 000 associates worldwide. It has a significant presence in the Asia-Pacific region. It has been serving approximately 45, 000 customers and a total of 200, 000 in 170 countries. The IT department has around 75 people working on various software developments, sustainability and shared services.

APPENDIX D

Interviews Areas and Questions

In this work, we covered three areas for interviews from each case study. The interview areas (see Table 4) establish understanding and allow more systematical data collection and generate information constituting the enablers, practices and processes views.

To keep the focus on the right direction for data gathering, a set of five levels of questions were developed. These questions are exclusively for the goal of guiding the researchers and giving organization to the interview sessions and not to be given to the participants. In essence, the main goal of the protocol questions is to facilitate the interviewers in gathering data concerning Green IT adoption in the BPO area by presenting five levels of questions in each case study. Using these key questions as a rough structure, we allowed in the interviews for further follow-up inquiries in order to gain a deeper understanding of the subject matter or to clarify an individual response. These have been summarised in Table 5.

Table 4. Interview areas

Interview Areas	Description
General Background	General information on each organization, taking into account the size of the organization, hierarchy, nature of organization etc.
Technical Information	To gather information on Green IT and relating issues, to identify Green IT adoption solutions, to explore the enablers for Green IT adoption
Business Information	To identify practices and process, phases concerned and examine how Green IT adoption can be useful for the BPO organizations.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 5. Questions

Question No.	Questions
1	What are the enablers applied by case organization that influences decision-making regarding Green IT adoption?
2	What are the enablers associated with Green IT adoption?
3	What are the practices and processes associated with Green IT adoption?
4	What are the benefits, requirements, and barriers associated with Green IT adoption?
5	What are the evaluation criteria used by the case organization for evaluating integration technologies and Green IT solutions?

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 7
Green Supply Chain Management Model for Sustainable Manufacturing Practices

Surajit Bag
Tega Industries South Africa Pty Ltd, South Africa

Neeraj Anand
University of Petroleum and Energy Studies, India

Krishan Kumar Pandey
O.P. Jindal Global University, India

ABSTRACT

The purpose of this chapter is to identify the dimensions of green supply chain and their impact on manufacturing practices. In this study, the authors used two extended strategies. First thorough review of literature was done considering articles from reputed journals. Second the factors identified from literature review was further refined through experts by forming a problem solving group consisting of seven experts from the manufacturing sector. These factors were used to develop the green supply chain management model using Interpretive structural modeling. Further MICMAC analysis was used to identify the driving and dependence power of the factors. The results of the analysis are very encouraging. Finally, the authors have presented the relationship management strategy for sustainable manufacturing practices.

INTRODUCTION

The paradigm shift of policies towards green economy is forcing manufacturers worldwide to consider the green initiatives seriously. There is need for the companies especially manufacturing companies to take a proactive approach rather than reactive approach. According to UNEP (2011) report, global manufacturing sector accounts for 35% of the total electricity consumed worldwide and responsible

DOI: 10.4018/978-1-5225-7915-1.ch007

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

for 20% of the world's carbon dioxide emissions, which is detrimental to lives on the earth. While the above arguments indicate, that this is the high time for research on green supply chain management and implementation of GSCM practices, especially for developing countries like India which is becoming one of the global manufacturing hubs next to China.

The term "green" is now widely used interchangeably on the more established "sustainability" concept, which points to a more holistic view of environmental, social and economic dimensions. World leading firms including IBM, Dell, HP, Sony, Toyota, Nokia have adopted GSCM as a strategic initiative. A framework is developed which portray the various complex relationships involved in a green supply chain with the aid of interpretive structural modeling (ISM). Before we funnel down to the framework, let us understand the basics of sustainability and green supply chain management, how firms exploit it for gaining competitive advantage, and how to build a contextual framework using ISM methodology.

LITERATURE REVIEW

We have adopted "*Systematic Literature Review (SLR)*" in our paper as suggested by Tranfield et al. (2003). The present section is divided into two stages and its phases.

Stage 1: Planning the Review

Phase 0: Identification for the Need for a Review

The field of Manufacturing and Operations has seen radical changes through the years. It started with the "*The Industrial Revolution*" in the late 1700s, has been through several phases but real challenge emerged in front of manufacturing was its sustainability. The issues that have forced developed economies to shift their manufacturing base to India were cost and other was to put check on greenhouse gas emissions. However the approach of these developed economies was questionable. Shifting the location of manufacturing hubs is never going to solve problems but there is need for more sustainable solution which can optimize between cost and environment. The search of amicable solution has led to the growth of green supply chain management. In our present work we will discuss theoretical concept used for building a green supply chain management model. We will review latest research works related to evolution of green supply chain dimensions, green supply chain as a source of competitive advantage.

Phase 1: Preparation of a Proposal for a Review

In this section we will identify reputable journals which publishes potential works related to green supply chain and its related areas.

To begin with green supply chain management it's very important to understand "Green Manufacturing" and its dimensions. Though there are lot of definitions and arguments, but from various literatures it can be derived that during manufacturing or production, lot of wastes are generated in the form of solid, liquid and gas, which are harmful to earth and to lives supported by the earth. In order to minimize the harmful effect of these wastes, innovative manufacturing practices to be deployed which is blend of technology, culture, leadership and policies, at economical cost so that firm should not be overburdened with excessive cost of production which force them to outsource which is the present scenario in the western part of the world.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Phase 2: Development of Review Protocol

We decided initially to review all published work. In order to eliminate our biasness towards any work we reviewed all possible articles published in past fifteen years in reputed journals related to green supply chain management, sustainable manufacturing & related concepts so that we do not end up with sketchy literature or irrelevant literature.

Stage 2: Conducting a Review

Phase 3: Identification of Research

We reviewed over 100 articles related to SSCM, green manufacturing, strategy & methodologies.

Based on review, we have derived two important questions which will further drive our investigation.

Green Supply Chain Management

In the present section we have highlighted some of the respected studies carried out by past researchers in the area of green supply chain management.

We must understand the concept of supply chain management before piercing down into green supply chain management (GSCM). Within each organization, the supply chain includes all functions involved in receiving and filling a customer request. These functions include, but are not limited to new product development, marketing, operations, finance, distribution and customer service. A supply chain is dynamic and involves the constant flow of information, product and funds between different stages.

If we look back into the history, we see that before 1780 during the Agrarian era supply chain type was ‘standard’ and firm characteristics used to be small, organic, horizontal hierarchy and depended on quality of product to sell. Between 1780 and 1960 it was the era of Industrial revolution where a major change took place and the standard supply chain type shifted towards lean with expansion in size, variety, complexity and diversity. After 1960, the post industrial revolution phase witnessed another sea change globally and the trend shifted from lean to agile, hybrid and presently green, (Nelson et al, 2009).Thus the journey of SCM theory development has started long back and is still evolving.

Sarkis et al., (2011) has documented about various organizational theories applied to GSCM related study such as Complexity theory, Ecological modernization theory, Information theory, Institutional theory, Resource based view, Resource dependence theory, Social network theory, Stakeholder theory, and Transaction cost economics. Some of the selected studies have been presented in Table 1.

Some examples to show the impact of green practices on supply chains are evident in Table 2.

It is clear that green supply chain has attracted attention of top global companies. Green practices are being used presently by these companies in some form or other. Companies are focusing mostly in reduction of natural resources, reuse of material and energy recovery program. This is really working like wonder and can potentially stop tons of green house gases in entering the atmosphere. Moreover, these companies are significantly saving costs across the supply chain. Ongoing, company-wide sustainability program has generated significant environmental and financial benefits. Commitment to reduce fuel and electricity use is a good approach to protect scarce natural resources. Converting to eco friendly operations has resulted in increase in production tenfold while reducing manufacturing costs. This has also attracted more customers due to enhanced customer satisfaction.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 1. Literature review on green supply chain management (GSCM)

Author(s), Year	Objective of Study	Key Findings	Variables Identified
Brandenburg et al. (2014)	To understand and review mathematical models focusing on environmental/social factors in the forward supply chains.	Major publications and models were found in a limited set of six journals (JCLP, IJPR, IJPE, TRE, EJOR & DSS). AHP, ANP and LCA were commonly used tool for developing the models.	Environmental; Social and Economic dimensions
Mirhedayatian et al. (2014)	To propose a novel network DEA model for evaluating the GSCM in the presence of dual role factors, undesirable outputs and fuzzy data.	The proposed model can be easily computerized so as to serve as a decision making tool in decision making.	Cost of quality; Supplier flexibility; Carbon dioxide emission; Satisfaction; Facility technology level
Suering (2013)	To review research on quantitative models for green or sustainable supply chains.	Different kinds of models are applied in this area but the social dimension is not taken into consideration. On the modeling side there are three popular methods: Equilibrium models, MCDM & AHP.	Environmental; Social and Economic dimensions
Zhu and Lai (2013)	To develop and empirically test a theoretical model.	The research contributes to the literature on institutional theory in corporate environmental practices.	Institution pressure: Coercive, Normative, Competitive
Reefke and Trocchi (2013)	To develop a framework to facilitate a balanced approach to performance measurement for SSCM.	A scorecard design customized for sustainable supply chain is proposed along with the development and implementation process.	Cost savings; Profit; customer satisfaction; quality management
Liu et al. (2012)	To integrate green marketing and SSCM.	Development of a new hub and spoke integration model. Drivers: Improve company's sustainable supply chain capabilities; reach green customers before competitors; government regulations; green customers demand; community expectation.	Products; Promotion; Planning; Process; People and Project
Hoejmose et al. (2012)	To understand the general engagement with GSCM in both B2B & B2C supply chains.	Firms in B2B market is generally less engaged with green practices compared to firms in B2C markets. Developing Trust with supply chain partners and top management commitment is a crucial GSCM driver among firms in B2B markets.	Trust; Top management commitment
Ageron et al. (2012)	To develop a Sustainable Supply Management framework.	External pressures have positive impact on the development of SSM; Waste reduction programmes have greater impact on greening supply chains; MNC & SMEs' have differential impact on SSM; Financial barriers have more impact on SSM; Top management support is a critical success factor in SSM; Key benefits such as customer satisfaction, supplier innovation, quality & capacity have greater positive impact on SSM.	Top Management Commitment; Govt. regulatory requirements; Quality; Flexibility; Waste Reduction; Clean Programs; Reducing carbon footprint; Financial costs; ROI; Green Investments; Customer Satisfaction; Innovativeness
Bose and Pal (2012)	To investigate the influence of GSCM initiatives on stock prices of firms.	Firms observe greater positive change in stock price by undertaking green initiatives. Firms with high R&D expenses show strong positive impact. Early adopters of GSCM show greater positive impact.	R&D; Size of firm; Stock prices
Dekker et al. (2012)	To review research on green logistics.	The review highlighted the contribution of operations research to green logistics	Mode choice; Intermodal transport; Equipment choice and efficiency; fuel choice and carbon intensity
Chaabane et al. (2012)	To present a generic mathematical model to assist decision makers in designing sustainable supply chains over their entire life cycle.	The model can serve as a tool that facilitates the understanding of optimal SC strategies under different environmental policies.	Economic: Cost; revenue; taxes; transfer Environmental variables: Carbon footprint; Raw material use; Energy use; Social variables: Noise; pollution
Dubey and Bag (2013)	To explore sustainable manufacturing practices that improves environmental and business performance.	Green Purchasing, SRM, Green logistics and regulatory norms are positive determinants of firm business performance and Environmental performance.	Green Purchasing; SRM; Green logistics and Regulatory norms
Gunasekaran and Spalanzani (2012)	To bring important issues related to sustainable business development in both manufacturing and services sector.	Developed a framework for sustainable development along with strategies, techniques and tools.	Sustainable Product and process design; sustainability in supply operations; sustainability in production operations; sustainability in distribution operations; sustainability through reverse logistics
Gimenez et al. (2012)	To analyse the impact of environmental programmes on each dimension of the triple line.	Internal environmental programmes have a positive impact on the three components of the triple bottom line. Social initiatives have a positive impact only on two components: social and environmental performance.	Environmental; Social and Economic performance; Internal and external action programs
Hassisni et al. (2012)	To review literature on sustainable supply chains from 2000-2010.	Based on the findings authors have developed a framework for sustainable supply chain metrics.	Market Forces; Policy& Regulations; Science& Technology; Product Development; Process Capability; Sourcing& Operations; Logistics; Marketing &PR; Social issues
Barari et al. (2012)	To provide integrated and holistic conceptual framework that combines the practical aspects of green supply chain with the objective of profit maximization.	A strategy set have been designed based on the game theory approach that promises maximum economic benefit.	Green tax; green burden

continued on following page

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 1. Continued

Author(s), Year	Objective of Study	Key Findings	Variables Identified
Kang et al. (2012)	To establish the framework for strategy development to construct the sustainable supply chain.	Identified the factors leading to SSCM.	Leadership for knowledge sharing; Innovation of product and process
Wang et al. (2011)	To provide a multi objective mixed integer formulation for the supply chain network design with environmental concerns.	The model can be effectively used in the strategic planning for green supply chain.	Demand and Supply of Product; Carbon dioxide emission; capacity of facility; environmental investment cost; environmental protection; Transportation cost; Handling cost for products
Wu and Pagell (2011)	To understand how organizations balance short term profitability and long term environmental sustainability when making supply chain decisions under uncertainty.	Factors contributing to the uncertain decision environment are: Uncertainty about environmental outcomes & future regulation, the saliency of each environmental issue to multiple stakeholders, lack of visibility and influence in one's supply chain.	Operating principles; Technical standard
Gupta and Desai (2011)	To review the current state of academic research in sustainable supply chain management.	Authors developed an integrative framework summarizing the existing literature under four broad categories: strategic considerations, decisions at functional interfaces, regulation and government policies, integrative models and decision support tools.	Product design and product life cycle; Regulation and government policies
Azevedo et al. (2011)	To investigate the relationships between green practices and supply chain performance.	A conceptual model of the relationships between green practices and SC performance was developed.	Environmental friendly practices in purchasing; Environmental collaboration with suppliers; Minimizing waste; Environmental collaboration with customers; Reverse logistics
Pereira (2009)	To understand how Information Technology can foster information management and help sort out supply chain problems.	IT must be used to develop strategies to make supply chains more robust and resilient.	Information Technology
Longo and Mirabelli (2008)	To present an advance modeling approach and a simulation model and provide a decision making tool for supply chains.	An advance model is proposed based on programming code, tables and event generators and provides the user with a simulator capable of high efficiency for executing simulation runs.	Inventory Control; Lead Time; Demand Intensity; Demand variability
Linton et al. (2007)	To prepare a background to better understand current trends in the area of sustainable supply chains.	Research on Sustainable supply chain is still at an infant stage. It has strong links with government policy.	Product life extension; Product design; Recovery process at end of life.
Zhu and Sarkis (2004)	To determine the economic and environmental relationships of GSCM practices among Chinese firms.	Significant win-win opportunities exist for Chinese firms practicing GSCM. Strong relationship exists between GSCM practice and positive economic performance.	Commitment of GSCM from senior managers; Total quality environmental management; Environmental compliance and auditing programs; Supplier relationship; green design
Croom et al. (2000)	To conduct literature review.	Lack of theoretical work in the field as compared to empirical based studies	Sourcing strategy; attitude and commitment to collaborative improvement program

Table 2. GSCM practices

Companies	Green Supply Chain Practices
Wal-Mart	Focused on green packaging; Reduction in packaging costs and reduction in carbon dioxide emissions
Nestle	Eco friendly product packaging and focus on source reduction, re-use, recycling, and energy recovery
Heinken	Conservation of Natural resources and energy savings
Environmental Lubricants Mfg. Inc.	Technological up gradation to improve productivity and eco friendly manufacturing process
Bank of America	Eco-friendly operations and recycling program
General Electric's	Development of green products
Dupont	Green operations and lowering emissions of airborne carcinogens and greenhouse gases
Starbucks	Green operations, use of recycling paper cups and protecting environment
Coca-Cola	Focus on three environmental goals: water stewardship, sustainable packaging, and climate & energy protection
Toyota	Development of hybrid vehicle. Saving natural resources
Honda	Developed fuel efficient cars
Dell	Recycling program
Hewlett Packard	Owning and operating "e-waste" recycling plants

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Use of alternate source of energy such as solar panels, CNG is widely used by manufacturers. The step toward more sustainable operations has drastically lowered emissions of airborne carcinogens and greenhouse gases. Another company has also gone a step ahead by appointing an ex-Greenpeace head as an advisor to the board. And this company successfully reduced greenhouse gas emissions. Top companies has also partnered up with many environmental organizations, such as Conservation International and the Earthwatch Institute, in efforts to do right for the communities it operates in. Waste-elimination is now in the corporate philosophy to make the operations more eco-friendly than ever.

Lanxess and China Petroleum and Chemical Industry Federation (CPCIF) joined hands to present the Green Rubber Day on December 2nd, 2013 at the China World Summit in Beijing. Among other topics, Green Rubber Day dealt with the subject of high-performance tires, also known as "green tyres". The use of these tyres can help significantly to reduce rolling resistance, which is the friction that tires encounter when rolling. A tire's rolling resistance is a major factor in a vehicle's fuel economy. Using a high-performance tire that has been produced with state-of-the-art rubber can decrease the fuel consumption of a car by as much as half a liter per 100 kilometers – and consequently reduce the emission of carbon dioxide by 1.2 kilograms.

Few Definitions on Green Supply Chain Management (GSCM)

- Schrettle et al. (2014) defined GSCM as a "tool which helps to position a company from strategic viewpoint".
- Gunasekaran and Spalanzani (2012) defined GSCM as "an organizational philosophy which provides competitive edge to an organization".
- Ali and Govindan (2011) defined GSCM as "an organizational philosophy to reduce environmental risks".
- Zhu et al. (2008) defined GSCM as "adoption of eco friendly practices considering internal environmental management, green purchasing, cooperation with customers, and eco design for developing corporate and operational strategies for the firm's environmental sustainability".
- Seuring and Muller (2008) defined GSCM as "the management of material, information, and capital flows as well as cooperation among companies along the supply chain while taking goals from all three dimensions of sustainable development" which are derived from customer and stakeholder requirements".
- Carter and Rogers (2008) defined GSCM as an "integration of environmental dimensions with traditional supply chain network".
- Srivastava (2007) defined GSCM as "integrating environmental thinking into supply chain management, including product design, material sourcing and selection, manufacturing processes, delivery of the final products to the consumers, and end-of-life management of the product after its useful life".
- Vachon and Klassen (2006) defined GSCM as a "strategy, which assists to reduce wastages in supply chain network".
- Kogg (2003) defined GSCM "the set of supply chain management policies held, actions taken and relationships formed in response to concerns related to the natural environment with regard to the design, acquisition, production, distribution, use, re-use and disposal of the firm's goods and services".

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- Sarkis (2003) defined GSCM as a "combination of the activities of an environmental dimension and reverse logistics".
- Gilbert (2000) defined GSCM as an "integration of environmental criteria with traditional supply chain network by redesigning purchasing policies and involving suppliers in the entire procurement process".
- Beamon (1999) defined GSCM as "utilizing the supply chain between a central company and a cooperating company, to support the company with knowhow of eco management practices and development of clean manufacturing techniques".
- Narshiman and Carter (1998) defined GSCM as "involving the procurement strategies that reduced the use of materials in addition to recycling and reuse."
- Godfrey (1998) defined GSCM as "organizational practices that continuously monitor the environmental impact of a supply chain and improve the performance."

Based on the above definitions the authors propose GSCM definition as "integrating the green dimensions into the traditional supply chain management so that the product will impose reduced environmental impact during its entire life cycle. It is the set of clean and hygienic practices which starts right from the product design stage and flows through all activities of the supply chain such as procurement, manufacturing, packaging, transportation and end of life management. Firm's internal resources mediate the relationship to external forces and its adoption. It improves the organizational performance and is the source of competitive advantage to sustain in the turbulent business environment."

Green Supply Chain Management (GSCM) Dimensions

- **Internal Environmental Management (IEM):** IEM includes Top management commitment, Cross functional cooperation for environmental improvements, Total quality environmental management, Environmental compliance and auditing programs, ISO 14001 certification, Environmental management system.
- **External Environmental Management (EEM):** EEM includes Green Purchasing, cooperation with customers for cleaner production, green packaging and eco-design.
- **Investment Recovery (IR):** IR includes sale of excess inventories, sale of excess capital equipment.
- **Eco-Design:** Eco design includes design green products for reuse, recycle and recovery of material and energy. Design eco friendly products to reduce health hazards of human beings.

Green Supply Chain Management (GSCM) as a Source of Competitive Advantage

A respected work has proved that environmental management is partially an extension of advanced manufacturing practices, continuous improvement and supplier management (Yang et al., 2010). Therefore GSCM can be regarded as a mechanism through which sustainability can be achieved leading to manufacturing competitiveness.

GSCM improves firm performance by improving Agility, Adaptability and promotes Alignment:

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- **Improves Agility:** Firms adopting GSCM practices can react fast to any changes in customer demand than competitors and hence better positioned in the market.
- **Improves Adaptability:** Firms can achieve better flexibility and can lead to innovative processes and continuous improvement.
- **Promotes Alignment:** Better alignment of business process is achieved by those firms practicing GSCM.

Theoretical Discussion on Antecedents of Green Supply Chain Management (GSCM)

The key drivers of GSCM are regulatory pressures and market pressures. In developed countries government has framed environmental policy and guidelines to provide environmental solution to the manufacturers. With globalization and the increased number of countries entering the W.T.O. has led to increased GSCM practices. Several studies have mentioned how foreign firms such as Toyota and Ford have encouraged and motivated their Chinese suppliers in adopting green practices. In European Union they have a policy (WEE) for disposing waste electrical and electronic equipment after the end of their life so as to reduce the harmful effects.

Cap and trade legislation for GHG emission is applicable for manufacturers across European Union, U.S and Australia. Aberdeen group survey (2013) reports that 50% of the companies are planning to redesign their entire supply chain in order to be more sustainable and 80% of them have to comply with new environmental policies. As a result companies face new challenges and adopt best technologies to meet their legal obligations.

Companies can earn carbon credits through one of the mechanism such as Emission trading system and carbon trading or contribution to climate change technology fund.

In an effort to reduce the GHG emissions globally the carbon trading markets were first introduced under the Kyoto Protocol, known as the United Nations framework convention on climate change (UNFCCC).

Market pressures play a vital role in driving firms to adapt GSCM. Foreign customers demand environment friendly product and services from their suppliers globally including India. Foreign customers conduct strict environmental audit of their Indian suppliers before placing the orders as they demand environmental friendly goods, (Mitra, 2004). GSCM can be used as an environmental tool to improve the environmental image with in the business arena and enhancing export sales. Suppliers and community stake holders also influence GSCM adoption.

Supporting the GSCM project requires tremendous support from the top management to highlight that the project is really important and will receive proper attention from the members of the organization. Lack of resources and financial support will lead to failure of the GSCM project. It is interesting to note that top management commitment leads to success of GSCM project. Firms having proper environmental policy are always ahead and the success rate of GSCM adoption are high. Top management must motivate junior managers and ensure that every employee within the organization is aware of the environmental policy, (Zhu et al., 2005).

Several studies on GSCM were conducted in Chinese context. Without environmental awareness it is difficult to implement green practices. Regulatory, competitive, and marketing pressures led to increased environmental awareness and are the drivers of GSCM, (Zhu et al., 2005). Chinese manufacturers have taken proactive measures in closing the supply chain loop by adopting GSCM practices. GSCM can be used as an environmental tool to improve the environmental image and gain competitiveness within

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

the international business arena, (Zhu et al., 2008). Greening any supply chain involves imbibing environmental principles in the design and operations of supply chain. A background of environmental principles for achieving eco efficiency and building of environmentally friendly organization system have been presented and emphasis is put on application of such principle in life cycle of product (Tsoulfas & Pappis., 2006).

It is very important for any practicing manager to understand the links between GCSM practices, environmental and economic performance for successful GSCM implementation. Environmental pressure act as a driver for successful GSCM practices. Market and regulatory pressures help organization to improve environmental pressures which are believed to influence eco design and green purchasing. Manufacturers facing higher regulatory pressure tend to implement green purchasing and investment recovery. Competitive pressure significantly improves the economic benefits from adoption of different GSCM practices (Zhu et al., 2007).

Computer parts' manufacturers in Thailand have adopted Environmental Management Systems (EMS) due to strict environmental regulations and export Pressure (Seksan et al., 2010).

Environmentally and socially responsive supply chains are in the early adoption stages in Indian automobile industry and actual implementation lacks a holistic approach (Shukla et al., 2009). Major Indian manufacturing firms feel that there is lack of awareness of environmental issues which is a challenge and biggest perceived barrier to adopting GSCM is that it is not cost effective (Bhateja et al., 2011).

Important factors to implement GSCM in Indian manufacturing industry are innovative green practices, awareness level of customers; supplier motivation; technology advancement and organization adoption, organization encouragement, quality of human resources, IT enablement, top management commitment, Government support policies, International Environmental agreements (Luthra et al., 2012). External factors affecting GSCM are Environmental regulations, suppliers, consumers and community stakeholders. GSCM practices can enhance the environmental, operational and financial performance of firms.

Research Questions

- What are the key GSCM factors and the nature of relationship between them in context to Indian manufacturing sector?
- Can a GSCM model be developed for the Indian manufacturing sector?

Research Objectives

Literature review has given a direction to identify the research gaps and to develop the below two specific research objectives for the present study are as follows:

- To identify the key factors influencing GSCM practices and the underlying relationships in context of Indian manufacturing sector.
- To develop a GSCM model for the Indian manufacturing sector.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

METHODOLOGY

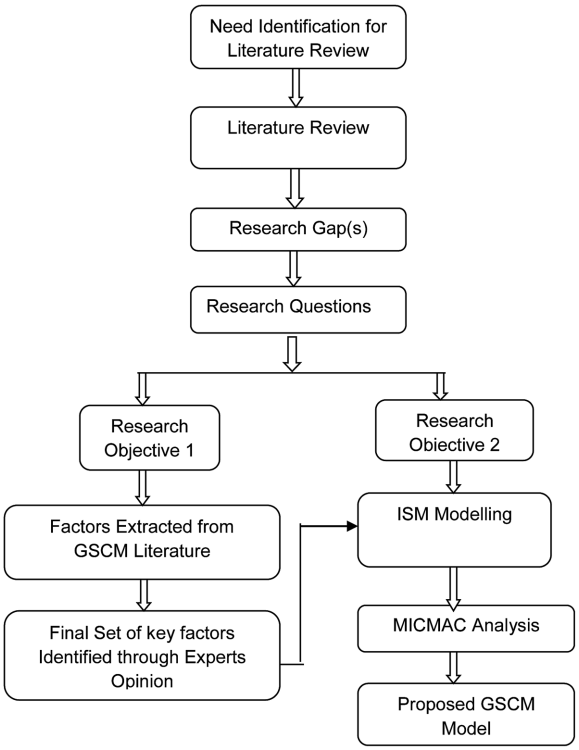
This section discusses on theoretical model development. The purpose of research methodology is to present the research design that will be used to conduct the research for this study. Based on the synthesis of literature review and experts' opinion from industry; the key factors influencing GSCM practices have been identified. GSCM model has been developed by using ISM technique which was further refined using MICMAC analysis (See Figure 1).

Interpretive Structural Model (ISM)-Based Methodology

ISM is a proven and popular methodology for understanding relationships among specific items that define a problem. ISM is useful to achieve the objective in presence of large number of directly and indirectly related elements and complex interactions among them which may or may not be expressed in a proper manner. ISM plays a vital role in this kind of situation and helps in understanding a structure within a system. The ISM model depicts the structure of a complex problem in a carefully designed pattern.

ISM has been used in the past by several researchers due to multiple benefits which have been mentioned in Table 3. It guides and records the results of group response on complex issues in an efficient and systematic manner, (Source: Attri et al., 2013; Warfield 1994; Warfield 1974). ISM has been applied in different areas of the supply chain starting from purchasing to production and logistics management. Sushil (2012) have contributed in the ISM literature by providing directions to interpret the links in ISM using the tool of interpretive matrix.

Figure 1. Research process flow chart



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 3. Review on ISM application

Author and Year	ISM Application
Hawthrone and Sage (1975)	Higher education program planning
Sage (1977)	Modeling complex situations
Jedlica and Meyer (1980)	Exploring factors involved in a cross cultural context
Saxena et al (1992)	Determining the hierarchy and class of elements in cement industry
Mandal and Desmukh (1993)	Vendor selection
Kanungo et al (1999)	Developing an IS effectiveness framework
Ravi and Shankar (2004)	Explore reverse logistics barriers
Jharkaria and Shankar (2005)	Enablers of IT implementation in SC
Ravi et al. (2005)	Indentify key reverse logistics variables
Faisal et al. (2006)	Modeling the enablers for supply chain risk mitigation
Thakkar et al. (2006)	Integrated approach with ISM and ANP to develop a balanced scorecard
Singh and Kant (2008)	Knowledge Management
Subramanian et al. (2010)	Buyer Supplier relationship
Diabat et al. (2012)	Modelling various supply chain risks
Gorane and Kant (2012)	Modelling supply chain management enablers
Khan and Haleem (2013)	Technology Management enablers
Dubey et al. (2014)	Flexible Manufacturing Systems
Dubey et al. (2014)	Modelling Antecedents of Innovation

The Steps Interpretative Structural Modeling

There are six basic steps under ISM and these have been presented in Figure 2.

DATA ANALYSIS AND FINDINGS

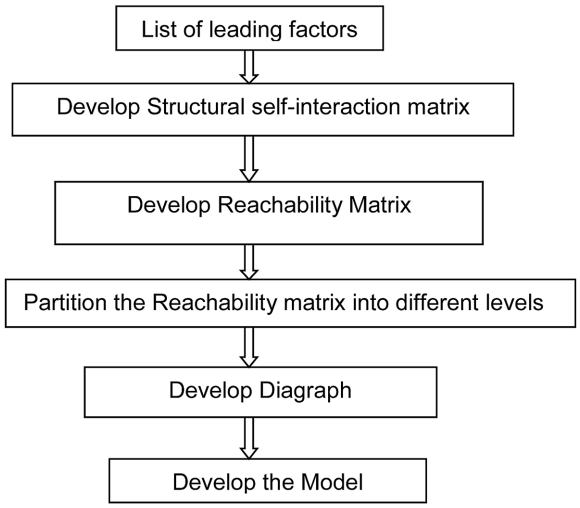
In this step the contextual relationship between elements with respect to the pairs of elements is examined. To investigate the relations between ten elements, a questionnaire was developed. The questionnaire was sent to ten referees, who are working in the position of senior management in manufacturing sector. The questionnaire was tested for content validity. Content validity primarily depends on an appeal to the propriety of content and the way it is presented (Nunally, 1978). The instrument developed in this study demonstrates the content validity as the selection of measurement items was based on both, an exhaustive review of the literature and detailed evaluations by senior managers during pre-testing.

List of Leading Factors

The green supply chain management literature was thoroughly reviewed. As a result of the review, 20 factors were found to be influencing green supply chain management processes. A problem-solving group was formed comprising seven experts from industry who are also members of CII. The group was asked

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 2. Flowchart for the ISM Methodology



to analyze the listed factors, take out the repeated ones and rearrange the list including the ones thought to be valid in relation with Indian context. The first tour resulted with reducing each of the factors to 17. Through the second tour 12 and the third tour total 10 factors were determined.

The ten key factors shown in Table 4.

Developing the Structural Self-Interaction Matrix (SSIM)

For developing SSIM, the below symbols have been used to denote the direction of relationships between variables (i and j) (Table 5):

V: i lead to j but j does not lead to i
A: i do not lead to j but j lead to i
X: i lead to j and j lead to i
O: i and j are unrelated to each other

Develop Reachability Matrix

The SSIM has been converted into a binary matrix i.e., the rechability matrix (Table 6) by substituting V, A X and O by 1 and 0. The substitutions of '1' and '0' have been done as below:

1. If the (i, j) entry in the SSIM is V, then the (i.j) entry in the rechability matrix becomes '1' and (j,i) entry becomes '0'
2. If the (i, j) entry in the SSIM is A, then the (i.j) entry in the rechability matrix becomes '0' and (j,i) entry becomes '1'
3. If the (i, j) entry in the SSIM is X, then the (i.j) entry in the rechability matrix becomes '1' and (j,i) entry also becomes '1'

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 4. Final set of key factors with items are listed

SL No	Factors	Items
1	Top Management Commitment	Well defined environmental policy of Company
		Employee awareness about the firm's environmental policy
		Top management support to environmental programs
		Top management approval to special funds for investment in cleaner technologies
		Positive attitude of senior managers towards green practices
		Senior managers motivate and support new ideas received from junior executives
		Employees recognition for innovative ideas
2	Regulatory Pressures	Regional pollution control board pressures to adopt green practices
		Government regulations to control pollution level
		Strict monitoring by Pollution control board
		Green practices decrease incidence of penalty fee charged by pollution control board
3	Market Pressures	Company focus on Export sales
		Foreign customers sensitivity towards green practices
4	Supplier Relationship Management	Environmental criteria for supplier selection
		Environment collaboration with suppliers
		Technological integration with suppliers
		Training and educating suppliers in implementing ISO 14001
		Environmental audit for suppliers
5	Total Quality Environmental Management	Total Quality Environmental Management implementation
		Green practices promote product quality
6	Green Technology Adoption	Company focus on green design of products
		Wastage reduction from green design
		Real time information available any point of time by using Information technology infrastructure SAP/ERP
		Usage of alternate source of energy
		Process optimization to reduce wastage
		Eco friendly packaging
		Reduction of emission of Green House Gases by use of clean technology
7	Profit	Green practices improve firm's profit
8	Market Share	Green practices improve firm's market share
9	Reduction in Carbon emission	Green practices Reduce solid waste generation
		Effluent meets CPCB norms by converting into green operations
		Green practices reduce environmental accidents & hazards
		Green practices decrease of cost of raw materials
		Green practices reduce the inventory levels
		Green practices reduce cost for energy consumption
10	Customer Relationship Management	Green practices improve customer satisfaction
		Firm recover end of life products from customers
		Customers appreciate eco friendly products

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 5. Structural self-interaction matrix (SSIM)

	X	IX	VIII	VII	VI	V	IV	III	II	I
I	V	V	V	A	V	V	A	A	O	
II	V	V	V	A	V	V	O	A		
III	V	V	V	A	V	V	A			
IV	O	O	V	X	O	V				
V	O	V	V	A	A					
VI	V	V	V	A						
VII	O	O	V							
VIII	O	V								
IX	O									
X										

Table 6. Reachability matrix

	I	II	III	IV	V	VI	VII	VIII	IX	X	Driving Power (Y)
I	1	0	0	0	1	1	0	1	1	1	6
II	0	1	0	0	1	1	0	1	1	1	6
III	1	1	1	0	1	1	0	1	1	1	8
IV	1	0	1	1	1	0	1	1	0	0	6
V	0	0	0	0	1	0	0	1	1	0	3
VI	0	0	0	0	1	1	0	1	1	1	5
VII	1	1	1	1	1	1	1	1	0	0	8
VIII	0	0	0	0	0	0	0	1	1	0	2
IX	0	0	0	0	0	0	0	0	1	0	1
X	0	0	0	0	0	0	0	0	0	1	1
Dependence Power (X)	4	3	3	2	7	5	2	8	7	5	

4. If the (i, j) entry in the SSIM is O, then the (i.j) entry in the rechability matrix becomes ‘0’ and (j,i) entry also becomes ‘0’

Level Partitioning

The final reachability matrix obtained in Table 6 is now partitioned into different levels. After the first iteration, the variable classified to level 1 are discarded and the partitioning procedure is repeated on the remaining variable to determine the level 2. These iterations are continued until the level of each variable has been determined. The results for iterations 1 to 7 are shown in Tables 7-13.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 7. Level partitioning (iteration 1)

Variables	Reachability Set	Antecedent Set	Intersection Set	Level
1	1,5,6,8,9,10	1,3,4,7	1	
2	2,5,6,8,9,10	2,3,7	2	
3	1,2,3,5,6,8,9,10	3,4,7	3	
4	1,3,4,5,7,8	4,7	4,7	
5	5,8,9	1,2,3,4,5,6,7	5	
6	5,6,8,9,10	1,2,3,6,7	6	
7	1,2,3,4,5,6,7,8	4,7	4,7	
8	8,9	1,2,3,4,5,6,7,8	8	
9	9	9	9	*Level1*
10	10	10	10	*Level1*

Table 8. Level partitioning (iteration 2)

Variables	Reachability Set	Antecedent Set	Intersection Set	Level
1	1,5,6,8	1,3,4,7	1	
2	2,5,6,8	2,3,7	2	
3	1,2,3,5,6,8	3,4,7	3	
4	1,3,4,5,7,8	4,7	4,7	
5	5,8	1,2,3,4,5,6,7	5	
6	5,6,8	1,2,3,6,7	6	
7	1,2,3,4,5,6,7,8	4,7	4,7	
8	8	1,2,3,4,5,6,7,8	8	*Level 2*

Table 9. Level partitioning (iteration 3)

Variables	Reachability Set	Antecedent Set	Intersection Set	Level
1	1,5,6	1,3,4,7	1	
2	2,5,6	2,3,7	2	
3	1,2,3,5,6	3,4,7	3	
4	1,3,4,5,7	4,7	4,7	
5	5	1,2,3,4,5,6,7	5	*Level 3*
6	5,6	1,2,3,6,7	6	
7	1,2,3,4,5,6,7	4,7	4,7	

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 10. Level partitioning (iteration 4)

Variables	Reachability Set	Antecedent Set	Intersection Set	Level
1	1,6	1,3,4,7	1	
2	2,6	2,3,7	2	
3	1,2,3,6	3,4,7	3	
4	1,3,4,7	4,7	4,7	
6	6	1,2,3,6,7	6	*Level 4*
7	1,2,3,4,6,7	4,7	4,7	

Table 11. Level partitioning (iteration 5)

Variables	Reachability Set	Antecedent Set	Intersection Set	Level
1	1	1,3,4,7	1	*Level 5*
2	2	2,3,7	2	*Level 5*
3	1,2,3	3,4,7	3	
4	1,3,4,7	4,7	4,7	
7	1,2,3,4,7	4,7	4,7	

Table 12. Level partitioning (iteration 6)

Variables	Reachability Set	Antecedent Set	Intersection Set	Level
3	3	3,4,7	3	*Level 6*
4	3,4,7	4,7	4,7	
7	3,4,7	4,7	4,7	

Table 13. Level partitioning (iteration 7)

Variables	Reachability Set	Antecedent Set	Intersection Set	Level
4	4,7	4,7	4,7	*Level 7*
7	4,7	4,7	4,7	*Level 7*

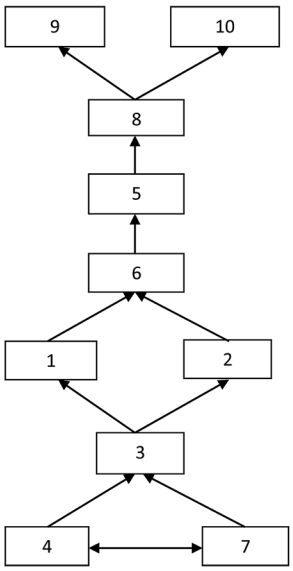
Diagraph

From the final Reachability Matrix and level partitions, the structural model is generated by means of nodes and lines of edges. If there is a relationship between the factors j and i, this is shown by an arrow which points from i to j. This graph is called digraph (see Figure 3).

The analysis yields an ISM hierarchy in which Market share and Profitability is at (level 1); reduction in carbon emission (second level); Green technology adoption (third level); Total quality environmental management (fourth level); SRM & CRM (fifth level), Top management commitment (sixth level), Regulatory and market pressures (bottom level).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 3. Diagraph



ISM Model

The resulting ISM model is presented in Figure 4.

MICMAC Analysis

MICMAC analysis Matrice d' Impacts croises multiplication appliqué an classment (cross-impact matrix multiplication applied to classification) is abbreviated as MICMAC. The objective of MICMAC analysis is to analyze the drive power and dependence power of factors. Based on the drive power and dependence power the factors have been classified into four factors: autonomous factors, linkage factors, dependent and independent factors (see Figure 5 and Table 14).

The MICMAC graphical representation is shown in Figure 5.

Interpretation of MICMAC Analysis

Cluster 1: Autonomous Factors

These factors have a weak drive power and weak dependence power. In this cluster we do not have any factors.

Cluster 2: Dependence Factors

These factors have a weak drive power but strong dependence power. In this cluster we have three factors, i.e., 5 (Market Pressures), 8 (Carbon Emissions Reduction), 9 (Market Share) and 10 (Profit).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 4. ISM Model

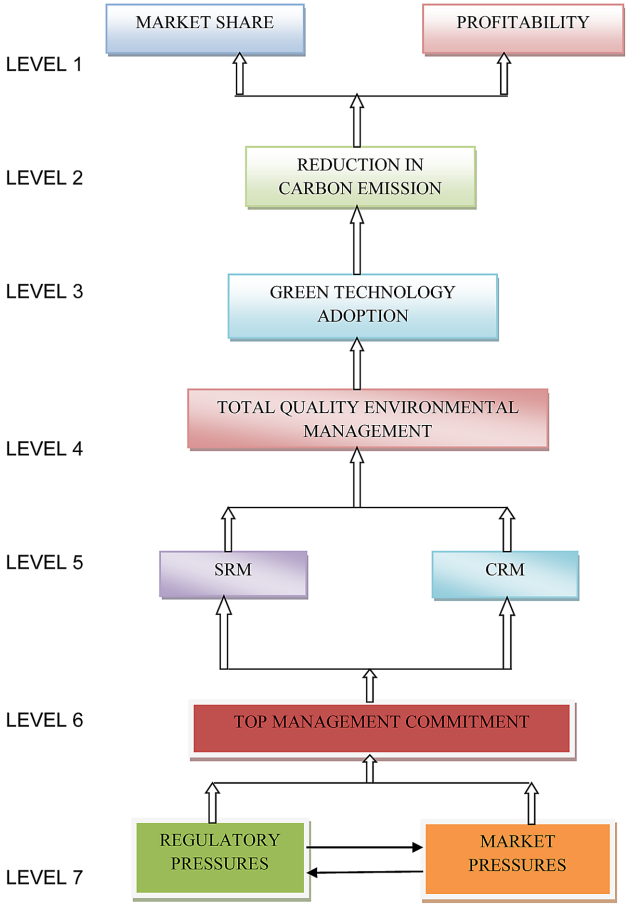
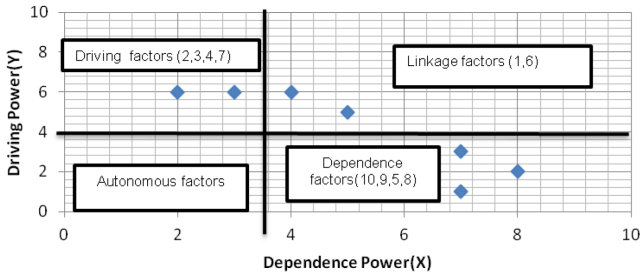


Table 14. Position coordinates of identified factors

Factors	Dependence Power(X)	Driving Power(Y)
1	4	6
2	3	6
3	3	8
4	2	6
5	7	3
6	5	5
7	2	8
8	8	2
9	7	1
10	5	1

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 5. MICMAC graphical representation



Cluster 3: Linkage Factors

These factors have a strong drive power as well as strong dependence power. In this cluster we have two factors, i.e., 1(Supplier Relationship Management) and 6 (Green Technology Adoption).

Cluster 4: Driving Factors

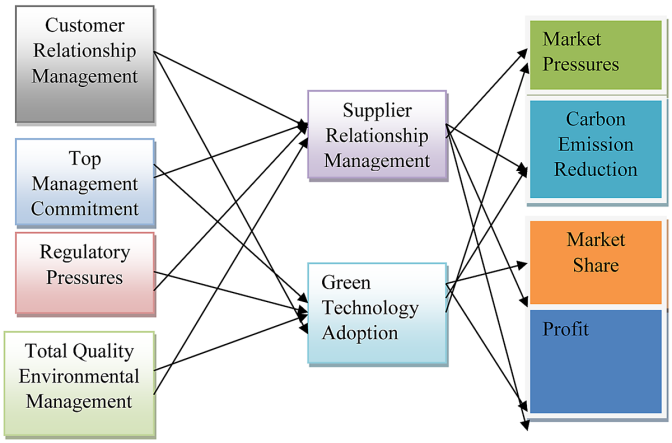
These factors have a strong drive power but weak dependence power. In this cluster we have four factors, i.e., 2 (Customer Relationship Management), 3 (Top Management Commitment), 4 (Regulatory Pressures) and 7 (Total Quality Environmental Management).

We have developed appropriate research methodology to develop contextual relationship among identified factors using expert's opinion. We developed ISM model and have further refined the ISM model using MICMAC analysis in order to understand the characteristics of identified factors.

Based on ISM and MICMAC analysis we propose the below model as shown in Figure 6.

The proposed GSCM model depicts the Driving factors (Customer Relationship Management), (Top Management Commitment), (Regulatory Pressures), (Total Quality Environmental Management); Linkage factors (Supplier Relationship Management) and (Green Technology Adoption) and Dependence factors (Market Pressures), (Reduction in Carbon Emissions), (Market Share) and (Profit).

Figure 6. Conclusive GSCM model



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

CONCLUSION

- Present study provides a systematic approach in developing a structural GSCM model for manufacturing sector. The ISM model has identified a hierarchy of factors for better decision making and building a clean system with minimum environmental impact.
- The ISM Model yields a hierarchy in which Market Share and Profitability is at level 1 (the top level) followed by Reduction in carbon emission (level 2), Green technology adoption (level 3), Total quality environmental management (level 4), Supplier relationship management and Customer relationship management (level 5), Top management commitment (level 6), Regulatory pressures and market pressures is at bottom level (level 7).
- Four factors are identified as driving factors and four factors as dependent factors using MICMAC analysis. Also there are two linkage factors but no autonomous factors emerged from the analysis.
- Customer relationship management, Top management commitment, Regulatory pressures and Total quality environmental management have been analyzed as driving factors. The driving factors play a vital role in successful GSCM practices. They condition the rest of the system and are called independent variables or drivers.
- The dependent factors characterize desired objectives for achieving success and identified from the analysis are Market pressures, Reduction in carbon emission, Market Share and Profit. These attributes are weak drivers but strongly dependent.
- Linkage factors are very sensitive and unstable. Any action on these factors will trigger an effect on other factors and also a feedback on themselves. Supplier relationship management and Green Technology adoption have emerged as the linkage factors.
- Based on the data analysis authors propose Relationship strategy for developing sustainable supply chain management in a manufacturing firm. Relationship strategy is based upon cooperation and collaboration with suppliers and customers.
- Buyer firms which practice supplier collaboration approach integrates procurement with other functions and achieve higher level of discipline and successful implementation of environmental certifications. Collaborative planning and information sharing helps to identify the strengths and weakness of suppliers. In this process it will be easy to educate suppliers and also pressurize for environmental certification. Collaboration and partnership develops innovation and enhances green practices.
- Cooperation leads to better understanding, Joint decision making, sourcing alternate/recyclable packaging material at economic costs, cost reduction. This creates more confidence and builds green culture within the organizational system.
- Relationship building improves company's image, gain competitive advantage, more value addition and ultimately happy customers.
- Relationship strategy leads to waste reduction, Lowers environmental costs and more profitability.
- The model presented in this study may enable management and decisions-makers involved in manufacturing companies to identify and classify the enablers that have either strong dependence or strong driving power or both strong dependence and driving power that enhances the process of GSCM practices.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

SOLUTIONS AND RECOMMENDATIONS

Focus in Customer Relationship Management

There are no shortcuts to improving customer experience and driving GSCM practices. The need of the hour is to embrace GSCM practices in order to suit business goals and objectives in manufacturing sector.

CRM solutions and services that can demonstrate how the evolution of marketing, sales, customer service, customer analytics and data management processes can drive successful interaction and collaboration across customer and partner channels.

Customers are always curious about interesting organizational practices which benefit society and environment. If there is a new creative solution to a problem, that creates net positive value for customers, then certainly it will be attractive to customers. Customers will expect low risks involved in the organizational offerings.

Strong Leadership and Commitment of Top Management

Greening success is driven by dynamic leaders. In large sized manufacturing organizations greening is driven by these leaders in a more professional manner than smaller sized manufacturing organizations. Top management should prepare GSCM policy and create awareness among all employees.

Focus on Total Quality Environmental Management

Firms today are experiencing increased demands for enhanced social responsibility from investors, activists, regulators and consumers. These demands go beyond product quality, which was the focus of the total quality movement of the 1980s, and now encompass other areas, such as, responsible environmental management. Indian manufacturing firms are progressively making organizational changes to integrate the environment into their production decisions and are shifting from a regulatory driven, reactive approach to a proactive and beyond-compliance strategy towards environmental management

External market and regulatory considerations, such as the desire to improve a firm's image with customers and regulators, earning good-will with regulators and the anticipation of future regulations is associated with the adoption of TQEM.

Organizational change in the form of Total Quality Environmental Management leads firms to adopt pollution prevention practices, after controlling for the effects of various regulatory pressures and firm-specific characteristics.

There Is No Single Formula for Reducing Carbon Emissions

Every organization must chart its own greening course. Green practices, the subject of green supply chain management, and even the central objective can vary a lot from organization to organization. Organizations have different opportunities for greening, vary in resources, institutional pressures and different leaders available, each with their own innovative ideas, who do green practices distinctively. The greening strategies are unique in details across organizations. It is seen that organizations progress with green practices through standardized measurement and data capturing protocols. Reducing carbon

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

emissions requires a sustained and focused effort. Organizations must form a cross functional team and proceed with the action plan for implementing GSCM in a holistic way. It takes long to adopt GSCM practices and therefore organizations must monitor progress on a periodic basis to understand the progress. In summary the differences in structure, size, availability of resources and market opportunities exists across organizations, which means the details of green practices are diverse.

Green organizations drive greening among their supply chain partners in the entire network. Greening organizations alter product design with emphasis on green design and waste disposal protocol to facilitate reuse and recycle in order to close the supply chain loop; this is simply to reduce environmental impact during the stages of product life cycle., i.e. from birth to the end of its useful life.

A set of ISO standards, ISO 14040 and ISO 14044, has been established and manufacturers should therefore make sure that the work in question is performed in accordance with these ISO standards.

Green Organizations Help to Increase Profitability

Green practices improve quality and lower wastages which results in significant savings and improved profitability. Green firms switch to low carbon energy sources to reduce carbon emissions. This reduces the market pressures and government pressures. The enhanced brand image of the organization helps to increase in sales volume with lower input costs. Hence GSCM is the path to achieve sustainability for those aspiring to become world class organizations in the future.

Systematically Green Necessitates an Organization to Be Competent at SRM

With fierce competition, changes in market dynamics such as emergence of GSCM practices and raw material price volatility, procurement professionals in the manufacturing firms are looking for better visibility across supply chain to control costs. Supplier innovation has also become key, with procurement looking towards suppliers for new raw materials that aid in product development. Organizations that aspire to be green must emphasis on supplier relationship management. Suppliers should be provided training and education so as to implement EMS and ISO 14001. Care should be taken to ensure suppliers follow the policy strictly. Organizations that are high on SRM have a strong sense of discipline, and focus on value creation.

Greening Can Become Fully Embedded in an Organization's DNA Sequence

The promotion of Green technologies has been included in the draft strategy for the manufacturing sector prepared by the Department of Industrial Policy & Promotion (DIPP), Ministry of Commerce and Industry. Greening must be embedded within the organization system so that it flows normally through the arteries and produce desired results. Organizations with strong Information Technology (SAP/ERP) setup help to develop it more systematically. Proper MIS is generated which gives 360 degree view of the organization in terms of producing the correct production related wastage report, energy savings, and activity based costing report etc. Managers and decision makers must understand the links of the GSCM model clearly before adopting implementing the system. This leads to the development of green culture and set of behaviors, until ultimately, holistic approach is expected as a part of each activity.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Green Is Not Free: It Requires Investment in Training and Development

Organizations aspire to be green must be prepared to take risks, and a tolerance for efforts that fetches failure. Since at the initial stage it involves financial risks therefore proper training of human resources is required so as to develop a culture that undertake risks. Further investment in clean technologies and best practices is necessary which will fetch long term benefits. Focus on maximizing energy efficiency potential by replacing obsolete, inefficient equipments and adopting best available technologies is vital for organizations who aspire to develop competitive edge in the market.

Greening Helps Organizations to Attract and Retain Talents

Talented human resources at all levels are attracted to progressive organizations since these organizations do world class practices. Hence green practices support reputational advantages and help in enhancing the brand image. Greening is associated with high employee motivation, low employee turnover and ultimately, labour market success.

FURTHER RESEARCH DIRECTIONS

Like every methodology ISM also suffers from certain limitations since it is purely based on the opinion of experts and qualitative in nature. To eradicate the limitations of present research we propose to validate the model empirically in other sectors using Exploratory factor analysis and further test using regression analysis using SEM packages such as AMOS/LISREL.

REFERENCES

Ageron, B., Gunasekaran, A., & Spalanzani, A. (2012). Sustainable supply chain management: An empirical study. *International Journal of Production Economics*, *140*(1), 168–182. doi:10.1016/j.ijpe.2011.04.007

Ali, D. (2011). An analysis of the drivers affecting the implementation of green supply chain management. *Resources, Conservation and Recycling*, *55*(6), 659–667. doi:10.1016/j.resconrec.2010.12.002

Attri, R., Dev, N., & Sharma, V. (2013). Interpretive Structural Modeling (ISM) approach: An overview. *Research Journal of Management Sciences*, *2*(2), 3–8.

Azevedo, S., Carvalho, H., & Machado, C. V. (2011). The influence of green practices on supply chain performance: A case study approach. *Transportation Research Part E, Logistics and Transportation Review*, *47*(6), 850–871. doi:10.1016/j.tre.2011.05.017

Bag, S. (2013). Designing the Green Supply Chain Strategies for Indian Manufacturing Firm. *International Journal of Supply Chain Management Systems*, *2*(1), 8–18.

Bag, S., & Anand, N. (2012). Green Procurement practices and its impact on organization performance: A conceptual framework of Indian manufacturing sector. *UPES Management Review*, *1*(2), 3–11.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Barari, S., Gaurav, A., Zhang, C., Mahanty, B., & Tiwari, M.K. (2012). A decision framework for the analysis of green supply chain contracts: An evolutionary game approach. *Experts Systems with Applications*, *39*, 2965-2976.

Beamon, B. M. (1999). Designing the green supply chain. *Logistics Information Management*, *12*(4), 332-342.

Bhateja, A. K., Babbar, R., Sarbjit, S., & Sachdeva, A. (2012). Study of the critical factor finding's regarding evaluation of green supply chain performance of Indian scenario for manufacturing sector. *International Journal of Computational Engineering& Management*, *15*(1), 74–80.

Bhatja, A. K., Babbar, R., & Zhu, Q. (2011, July). Study of green supply chain management in Indian manufacturing industries: A literature review cum an analytical approach for the measurement of performance. *International Journal of Computational Engineering& Management*, *13*, 84–99.

Bose, I., & Pal, R. (2012). Do green supply chain management initiatives impact stock prices of firms? *Decision Support Systems*, *52*(3), 624–634. doi:10.1016/j.dss.2011.10.020

Brandenburg, M., Govindan, K., Sarkis, J., & Seuring, S. (2012). Quantitative models for sustainable supply chain management: Developments and directions. *European Journal of Operational Research*, *233*(2), 299–312. doi:10.1016/j.ejor.2013.09.032

Caniels, M. C. J., Gehrsitz, M. H., & Semeijn, J. (2013). Participation of suppliers in greening supply chains: An empirical analysis of German automotive suppliers. *Journal of Purchasing and Supply Management*, *19*(3), 134–143. doi:10.1016/j.pursup.2013.02.005

Carbon Trust. (2006). *Carbon Footprint in the supply chain: The next step for business*. Report No. CTC616. Carbon Trust London. Retrieved from: https://www.carbontrust.com/media/84932/ctc616-carbon-footprints-in-the-supply-chain.pdf

Carter, C. R., & Rogers, D. S. (2008). A framework of sustainable supply chain management: Moving toward new theory. *International Journal of Physical Distribution & Logistics Management*, *38*(5), 360–387. doi:10.1108/09600030810882816

Chaabane, A., Ramudhhin, A., & Paquet, M. (2012). Design of sustainable supply chains under the emission trading scheme. *International Journal of Production Economics*, *135*(1), 37–49. doi:10.1016/j.ijpe.2010.10.025

Chen, M.K., Wai, T-W. & Hung, T-Y. (2012). Component selection system for green supply chain. *Experts Systems with Applications, 39*, 5687-5701.

Cho, D. W., Lee, Y. H., Ahn, S. H., & Hwang, M. K. (2012). A framework for measuring the performance of service supply chain management. *Computers & Industrial Engineering*, *62*(3), 801–818. doi:10.1016/j.cie.2011.11.014

Croom, S., Romano, P., & Ginnakis, M. (2000). Supply chain management: An analytic framework for critical literature review. *European J. of Purchasing & Supply Management*, *6*(1), 67–83. doi:10.1016/S0969-7012(99)00030-1

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Dekker, R., Bloemhof, J., & Mallidis, I. (2012). Operations research for green logistics –An overview of aspects, issues, contributions and challenges. *European Journal of Operational Research*, *219*(3), 671–679. doi:10.1016/j.ejor.2011.11.010

Diabat, A., Govindan, K., & Panicker, V. V. (2012). Supply chain risk management and its mitigation in a food industry. *International Journal of Production Research*, *50*(11), 3039–3050. doi:10.1080/00207543.2011.588619

Dubey, R., & Bag, S. (2013). Exploring the dimensions of sustainable practices: An empirical study on Indian manufacturing firms. *International Journal of Operations and Quantitative Management*, *19*(2), 101–124.

Dubey, R., Singh, T., Ali, S. S., & Tiwari, S. (2013). Contextual relationships among antecedents of truck freight using ISM and its validating using MICMAC analysis. *Int. J. Logistics and Systems Management*, *20*(1), 42–58. doi:10.1504/IJLSM.2015.065963

Dubey, R., Sonwaney, V., Aital, P., Venkatesh, V., & Ali, S. S. (2013). Antecedents of innovation and contextual relationship. *Int. J. Innovation and Research*, *9*(1), 1–14. doi:10.1504/IJBIR.2015.065950

Gimenez, C., Sierra, V., & Rodon, J. (2012). Sustainable Operations: Their impact on the triple bottom line. *International Journal of Production Economics*, *140*(1), 149–159. doi:10.1016/j.ijpe.2012.01.035

Godfrey, R. (1998). *Ethical purchasing: Developing the supply chain beyond the environment.* In T. Russel (Ed.), *Greener Purchasing: Opportunities and Innovations* (pp. 244–251). Sheffield, UK: Greenleaf Publishing. doi:10.9774/GLEAF.978-1-909493-03-2_20

Gunesekaran, A., & Spalanzani, A. (2012). Sustainability of manufacturing and services: Investigations for research and applications. *International Journal of Production Economics*, *140*(1), 35–47. doi:10.1016/j.ijpe.2011.05.011

Gupta, S., & Desai, P. O. D. (2011). Sustainable supply chain management: Review and research opportunities. *IIMB Management Review*, *23*(4), 234–245. doi:10.1016/j.iimb.2011.09.002

Hassini, E., Surti, C., & Searcy, C. (2012). A literature review and a case study of sustainable supply chains with a focus on metrics. *International Journal of Production Economics*, *140*(1), 69–82. doi:10.1016/j.ijpe.2012.01.042

Hervani, A. A., Helms, M. M., & Sarkis, J. (2005). "Performance measurement for green supply chain management" Benchmarking. *International Journal (Toronto, Ont.)*, *12*(4), 330–353.

Hojmose, S., & Brammer, S. (2012). Green supply chain management: The role of trust and top management in B2B and B2C markets. *Industrial Marketing Management*, *41*(4), 609–620. doi:10.1016/j.indmarman.2012.04.008

IPCC. (2007). *Climate change 2007: The physical science basis*. Retrieved 1 December 2013 from: <http://www.ipcc.ch/pdf/assessment report/ar4/wg1/ar4-wg1-spm.pdf>

Kang, S.-H., Kang, B., Shin, K., Kim, D., & Han, J. (2012). A theoretical framework for strategy development to introduce sustainable supply chain management. *Procedia: Social and Behavioral Sciences*, *40*, 631–635. doi:10.1016/j.sbspro.2012.03.241

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Khan, J., & Haleem, A. (2013). An integrated ISM and Fuzzy MICMAC approach for modeling of the enablers of Technology Management. *Indian Journal of Applied Research*, *3*(7), 236–242. doi:10.15373/2249555X/JULY2013/74

Kogg, B. (2003). Greening a cotton-textile supply chain. *Greener Management International*, *43*(September), 53–64.

Linton, J., Klassen, R., & Jayaraman, V. (2007). Sustainable supply chains: An Introduction. *Journal of Operations Management*, *25*(6), 1075–1082. doi:10.1016/j.jom.2007.01.012

Liu, S., Kasturiratne, D., & Moizer, J. (2012). A hub and spoke model for multi dimensional integration of green marketing and sustainable supply chain management. *Industrial Marketing Management*, *41*(4), 581–588. doi:10.1016/j.indmarman.2012.04.005

Longo, F., & Mirabelli, G. (2008). An advance supply chain management tool based on modeling and simulation. *Computers & Industrial Engineering*, *54*(3), 570–588. doi:10.1016/j.cie.2007.09.008

Luthra, S., Kumar, V., Kumar, S., & Haleem, A. (2011). Barriers to implement green supply chain management in automobile industry using interpretative structural modeling technique-An Indian perspective. *Journal of Industrial Engineering and Management*, *4*(2), 231–257. doi:10.3926/jiem.2011.v4n2.p231-257

Manuj, I., & Mentzer, J. T. (2008). Global supply chain risk management strategies. *Int. J. Physical Distribution & Logistics Management*, *38*(3), 192–223. doi:10.1108/09600030810866986

Mirhedayatian, S. M., Azadi, M., & Sean, R. F. (2014). A novel network data envelopment analysis model for evaluating green supply chain management. *International Journal of Production Economics*, *147*, 544–554. doi:10.1016/j.ijpe.2013.02.009

Mitra, S. (2004). Managing Environmental Issues in Supply Chains. In B. S. Sahay (Ed.), *Emerging Issues in Supply Chain Management, IIM Calcutta working paper series* (pp. 60–68). Macmillan.

Narasimhan, R., & Carter, J. R. (1998). *Environmental supply chain management*. Arizona State University.

Nelson, D. M., Marsillac, E., & Rao, S. S. (2012). Antecedents and Evolution of the Green Supply Chain. *Journal of Operations and Supply Chain Management*, 29 – 43.

Pereira, J.V. (2009). The new supply chain's frontier: Information management. *Int. J. of Information Management, 29*, 372-379.

Reefke, H., & Trochhi, M. (2013). Balanced scorecard for sustainable supply chains: Design and development guidelines. *International Journal of Productivity and Performance Management*, *62*(8), 805–826. doi:10.1108/IJPPM-02-2013-0029

Sarkis, J. (2003). A strategic framework for Green Supply Chain Management. *Journal of Cleaner Production*, *11*(4), 397–409. doi:10.1016/S0959-6526(02)00062-8

Sarkis, J., Zhu, Q., & Lai, K. (2011). An organizational theoretic review of green supply chain management literature'. *International Journal of Production Economics*, *130*(1), 1–15. doi:10.1016/j.ijpe.2010.11.010

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Schrettle, S., Hinz, A., MaikeScherrer-Rathje, M. & Friedli, T. (2014). Turning sustainability into action: Explaining firms' sustainability efforts and their impact on firm performance. *International Journal of Production Economics, 147*(A), 73–84

Seksan, P., Ninlawan, C., Tossapol, K., & Pilada, W. (2010). The implementation of green supply chain management practices in electronics industry. *Proceedings of the International Multi Conference of Engineers and Computer Scientists*.

Seuring, S., & Muller, M. (2008). From a literature review to a conceptual framework for supply chain management. *Journal of Cleaner Production*, *16*(15), 1699–1710. doi:10.1016/j.jclepro.2008.04.020

Shukla, A. C., Deshmukh, S. G., & Kanda, A. (2009). Environmentally responsive supply chains: Learning from the Indian auto sector. *Journal of Advances in Management Research*, *6*(2), 154–171. doi:10.1108/09727980911007181

Srivastava, S. K. (2007). Green supply chain management: A state of the art literature review. *International Journal of Management Reviews*, *9*(1), 53–80. doi:10.1111/j.1468-2370.2007.00202.x

Storey, J., Emberson, C., Godsell, J., & Harrison, A. (2006). Supply chain management: Theory, practice and future challenges. *International Journal of Operations & Production Management*, *26*(7), 754–774. doi:10.1108/01443570610672220

Suering, S. (2013). A review of modeling approaches for sustainable supply chain management. *Decision Support Systems*, *54*(4), 1513–1520. doi:10.1016/j.dss.2012.05.053

Sushil. (2012). Interpreting the Interpretive Structural Model. *Global Journal of Flexible Systems Management, 13*(2), 87-106.

Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a methodology for developing evidence-Informed management knowledge by means of systematic review. *British Journal of Management*, *14*(3), 207–222. doi:10.1111/1467-8551.00375

Tsoulfas & Pappis. (2006). Environmental principles applicable to supply chain design. *Journal of Cleaner Production*, *14*(18), 1602.

UNEP Report. (2011). Retrieved from http://www.unep.org/greeneconomy/greeneconomyreport

Vachon, S., & Klassen, R. D. (2006). Extending green practices across the supply chain: The impact of upstream and downstream integration. *International Journal of Operations & Production Management*, *26*(7), 795–821. doi:10.1108/01443570610672248

Wang, F., Lai, X., & Shi, N. (2011). A multi-objective optimization for green supply chain network design. *Decision Support Systems*, *51*(2), 262–269. doi:10.1016/j.dss.2010.11.020

Warfield, J. N. (1974). Structuring complex systems. Columbus, OH: Battele Memorial Ins.

Warfield, J. N. (1994). *A science of generic design: Managing complexity through systems design*. Iowa State University press.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Warfield, J. N. (1999). Twenty laws of complexity: Science applicability in organizations. *Systems Research and Behavioral Science*, *16*(1), 3–40. doi:10.1002/(SICI)1099-1743(199901/02)16:1<3::AID-SRES241>3.0.CO;2-F

Whetten, D. A. (1989). What constitutes a theoretical contribution? *Academy of Management Review*, *14*(4), 490–495. doi:10.2307/258554

Wu, Z., & Pagell, M. (2011). Balancing priorities: Decision-making in sustainable supply chain management. *Journal of Operations Management*, *29*(6), 577–590. doi:10.1016/j.jom.2010.10.001

Yang, C. L., Lin, P. S., Chan, Y., & Sheu, C. (2009). Mediated effect of environmental management on manufacturing competitiveness: An empirical study. *International Journal of Production Economics*, *123*(1), 210–220. doi:10.1016/j.ijpe.2009.08.017

Zhu, Q., & Sarkis, J. (2004). Relationships between operational practices and performance among early adopters of green supply chain management practices in Chinese manufacturing enterprises. *Journal of Operations Management*, *22*(3), 265–289. doi:10.1016/j.jom.2004.01.005

Zhu, Q., & Sarkis, J. (2007). The moderating effects of institutional pressures on emergent green supply chain practices and performance. *International Journal of Production Research*, *45*(18-19), 4333–4355. doi:10.1080/00207540701440345

Zhu, Q., Sarkis, J., & Geng, Y. (2005). Green supply chain management in China: Pressure, practices and performance. *International Journal of Operations & Production Management*, *25*(5), 449–468. doi:10.1108/01443570510593148

Zhu, Q., Sarkis, J., & Lai, K. (2013). Institutional based antecedents and performance outcomes of internal and external of green supply chain management practices. *Journal of Purchasing and Supply Management*, *19*(2), 106–117. doi:10.1016/j.pursup.2012.12.001

Zhu, Q., Sarkis, J., Lai, K., & Geng, Y. (2008). The role of organizational size in the adoption of green supply chain management practices in China. *Corporate Social Responsibility and Environmental Management*, *15*(6), 322–337. doi:10.1002/csr.173

KEY TERMS AND DEFINITIONS

GSCM: GSCM can be defined as integrating environmental thinking into supply chain management, including product design, material sourcing and selection, manufacturing processes, delivery of the final products to the consumers, and end-of-life management of the product after its useful life.

ISM: Interpretive Structural Modelling is a proven and popular methodology for understanding relationships among specific items that define a problem.

Sustainability: SSCM is defined as an efficiency of utilizing the finite resources and achieve flexibility to changeable business environment.

This research was previously published in Green Supply Chain Management for Sustainable Business Practice edited by Mehmood Khan, Matloub Hussain, and Mian M. Ajmal, pages 153-189, copyright year 2017 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 8
Green Customer Satisfaction

Violeta Sima
Petroleum-Gas University of Ploiesti, Romania

Ileana Georgiana Gheorghe
Petroleum-Gas University of Ploiesti, Romania

ABSTRACT

This chapter aims to identify those factors that determine green consumer satisfaction, having as the emerging point the definition of consumer behavior and the concept of sustainable development. The authors propose a new approach of the dimensions of the evaluation model for customer satisfaction including a new one, called The Green Dimension. An important goal is identifying the drivers of the consumer purchasing. The authors identify three main specific levels of the green dimension of customer satisfaction. They are related to: Company, Product/Service, and Price. Then some considerations regarding an integrated approach of strategic mix from a 'green' perspective are presented. According to the U.S. consultancy Boston Consulting Group, in order to obtain a Green Advantage, companies should enhance their strategic mix, taking into consideration green planning, green processes, green product and green promotion. The authors add two more elements, namely people and eco-efficiency, resulting "The Green Strategy Mix".

INTRODUCTION

Green Economy involves the use of natural resources, energy and new technologies together with cleaner production methods in order to promote economic growth and create new jobs. To implement this concept, we need to create new models of sustainable consumption and production, which does not force the ecosystem.

In order to operationalize the Green Economy concept, the three aspects of sustainable development (environmental, economic and social) should be incorporated. Obtaining a multi-dimensional outcome changing consumption patterns will require a multi-prong strategy focusing on demand, meeting the basic needs of the poor people, and reducing wastage and the use of finite resources in the production process.

DOI: 10.4018/978-1-5225-7915-1.ch008

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

In order to implement the green economy at the national level it is required close involvement of consumers and producers, along with the implementation of the main measures proposed and adopted by the national and international governing bodies.

Green economy requires changing consumer habits.

In order to assess consumer satisfaction it is important to know the degree to which they are willing to pay extra for green products and services. This chapter is a theoretical approach to this problem.

The authors identified three main specific levels of the green dimension of customer satisfaction. They are related to: Company, Product/Service, and Price.

The objective of this study is to highlight the links between green satisfaction and the three mentioned elements but also the transformations they bring in consumption patterns.

BACKGROUND

The concept of satisfaction has been subject of study for many researchers. However, satisfaction is still difficult to be defined, as Oliver asserted in 1997 in his book, "Satisfaction: A Behavioural Perspective on the Consumer" (p. 13). Thus, although satisfaction seems to be a widely known concept, when a definition is required it is difficult to obtain.

The subject of this thesis is to reveal multiple senses of customer satisfaction emphasizing the Green Dimension (Sima & Gheorghe, 2009).

Customer satisfaction is subject of study not only for scholars, but also for companies. The purpose of this analysis is very pragmatic, namely to determine its maximizing in order to increase customer loyalty. To achieve this, it is essential to identify key factors which determine customer behaviour.

Although in the literature of specialty there is widely accepted opinion that satisfaction represents a response to consumption related experiences (Yi, 1990; Anderson, Fornell & Lehmann, 1994; Oliver, 1997; Giese, & Cote, 2000), it has a wide range of definitions and assessment ways (Peterson & Wilson1992; Giese, & Cote, 2000).

A customer who has achieved a high level of satisfaction will be tempted to repeat the purchase, thus becoming loyal. The final effect will be the customer retention (Zairi, 2000). Moreover, he will be prompted to provide positive recommendations to other potential customers. On the contrary, a dissatisfied customer will give up in the future buying the product or service or even he will return it. Another possibility to reduce dissonance is also searching for information that confirms the high value of the product or service (Kotler, 2000).

In research studies for satisfaction more operationalizations of satisfaction were used (Westbrook, & Oliver, 1981; Hausknecht, 1990; Peterson, & Wilson, 1992; Wirtz, & Lee, 2003). Thus, Hausknecht (1990) listed 34 measures, including measures of behaviour (namely, behaviour registrations, such as number of complaints about the main product) and self-report measures (namely, survey items, such as rating scales).

Also, the marketing studies showed that customer satisfaction depends on the specific psychological construction such as reliability, quality, customer loyalty, commitment, word-of-mouth and image, and customer profitability. It has been shown that quality and reliability are required by satisfaction, which in turn is necessary for customer loyalty and customer profitability (Yi, 1990; Anderson et al., 1994; Oliver 1997; Verhoef, 2001; Hennig-Thurau, Gwinner & Gremler, 2002).

The meaning of the concept is context-specific satisfaction (Giese & Cote, 2000).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

As a result of a learning process which can be developed only in the presence of a permanent client, who asks repeatedly for a particular product, brand or company, in order to meet a specific need, as a form of attachment to the benefits provided by the company, static vision of the satisfaction resulted from the client-producer relationship, has been replaced gradually and improved by cumulative satisfaction paradigm.

Satisfaction refers to the fact that a particular feature of a product or the product itself offered a "pleasurable level of consumption-related fulfilment, including levels of under or over fulfilment" (Oliver, 2006, p.13).

According to Rust and Oliver "consumer satisfaction can be seen as the consumer's fulfilment response." (1994)

In 2001 Parker and Matthew referred to the existence of two complementary approaches of the concept of consumer satisfaction, namely satisfaction as a process and respectively satisfaction as a result of consumption experiences.

In 1977 and two years later, in 1979, Olson and Oliver asserted that in terms of process, customer satisfaction can be defined as an assessment of the significance of what was received and what was expected. Vavra, in 1997, emphasized that perceptual, psychological and assessment processes determine consumer satisfaction.

The approach as a result of consumer satisfaction is defined as a final state resulting from the consumption experience. This condition may be the result obtained without comparing expectations (Oliver, 2006) or a cognitive state obtained as a result of comparing the expected and actual performance or cost comparison of rewards and anticipated consequences (1997, p.4).

In marketing literature two main groups of models evaluation of consumer satisfaction can be identified:

- Models that put in relation the concept of customer satisfaction with concepts such as quality, value, and loyalty behaviour complaints. These models have an essential role at the level of organizational policy. Thus, they provide strategic context for designing a marketing research on consumer satisfaction.
- Models based on the constructs of the customer satisfaction concept such as the discrepancy between expectations and actual results, attribution, equity, affect, and regret. These models allow proper operationalization of measurements of customer satisfaction providing appropriate constructs.

In order to measure consumer satisfaction in a broad range of organizations indexes have been developed. Thus, at national level, customer satisfaction index (CSI) is used in order to measure how companies and organizations are able to satisfy customer needs. The CSI Model is also used for comparing the services and products within a sector. Most countries have developed their own customer satisfaction indexes. The first such model was the national Swedish customer satisfaction barometer (SCSB), developed in 1989, which was to include 31 major industries the Sweden. This model used perceived value and single measure of customer expectations (Fornell, 1992). In 1992, in Germany, was introduced Deutsche Kundenbarometer (DK), who in 1994 also includes 31 industries.

In USA American Customer Satisfaction Index (ACSI) is being used since 1994. This model takes into account both the field of production as well as the field of public area. Thus, seven economic sectors, nearly 40 industries, 200 private sector companies and two local public services are taken into account.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Customer satisfaction index is calculated by taking into account proportional role of three categories of variables, namely: overall satisfaction, satisfaction expectations and satisfaction with the organization "ideal".

A model used in EU to assess customer satisfaction is European Customer Satisfaction Index (ECSI) Model. This is an econometric model that links customer satisfaction index with a set of causal latent variables (such as customer expectations and customer perceptions about quality and value), being based on verified theory of consumer behaviour modelling. It aims to determine the perceived quality and the company image to customers and customer loyalty.

Kristensen et al. (2000) described it as "a structural equation model with unobservable latent variables ... that link customer satisfaction to its determinants and, in turn, to its consequence, namely 'trust' and 'repurchase intention".

Customer satisfaction study aims at four main aspects, namely:

1. Identifying the means of measuring customer satisfaction.
2. Finding the ratio of the number of satisfied clients and the total number of customers.
3. Identifying key indicators for the satisfaction assessing.
4. Finding the evolution of the level of customer satisfaction.

In order to answer those questions, the relationship between actual performance and desired performance must be considered. The Bender Model (1991) and The Rapp Model (1995), cited by Schneider emphasize five dimensions to be considered when assessing customer satisfaction:

1. Technical quality of the product,
2. Reputation quality,
3. Service quality,
4. Quality of personal relationships,
5. Price perception.

According to Meyer-Waarden (2004), satisfaction is an essential element for modelling customer purchasing behaviour, based on three categories of variables:

1. Cognitive variable;
2. Affective variables;
3. Co-native variables.

In the beginning, pro-environmental models started from the premise that between environmental knowledge and concern about this there is a direct linear relationship, leading to pro-environmental actions as a consequence (Kollmuss & Agyeman, 2002).

Ottman (1993) defined "environmental consumerism" as a reaction of the consumers, who, noting environmental problems, increasingly buy more eco-friendly products, gradually abandoning classic products. The stated purpose is to protect "themselves and the planet".

Thus, marketers should address this category of products similarly to the target market (Ottman, 2006), because consumers look for them, especially (Pickett, 2008).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Consumers claim to be well informed about the benefits of the products they intend to purchase. In doing so, marketers must consider this aspect in establishing the communication strategy and use instruments which best matching with the beliefs and behaviour of consumers, determining thus interest for the product (Kilbourne, 1995).

Ottman (1993) defines green consumers as "those who actively seek and support those products satisfy their needs that are having less impact on the environment". Besides that, Macdonald, S. et al. (2006) say that all consumers are potential green consumers, because when a consumer has the opportunity to choose between two products that satisfy the same need, he will prefer to buy green products.

If gender is taken into account, it was found that there is no a "significant relationship between women and men and green behaviour" (Kreidler and Joseph, 2009). However there are studies which showed that women are generally more concerned about the environment being more willing to buy green products (Mainieri et al., 1997).

If the geographic region is taken in consideration, it is demonstrated on the basis of consumer surveys that across Europe consumers express concern for the environment. Thus, they look for eco - friendly products and services, being at the same time willing to pay more for environmental features. This obvious serious concern of the European consumers for green products has led over 90% of European multinationals to adopt programs of environmental sustainability (Peattie & Crane, 2005).

People can be induced to adopt green consumption model if additional benefits, cost effective or environmentally friendly solutions are offered (Ottman, 1993).

In marketing literature is shown by research (Pickett, B. J., 2008) that product perception is influenced by situational variables and social reference groups. Also, there are studies which show that many of the consumers perceive organic products having high price and low quality (Mendleson, 1994; Ginsberg, and Bloom, 2004).

Gupta, S.et. al. (2009) referred to the „green buying behaviour". Thus, he showed that the concern for the environment and about pollution, willingness to recycle, and to pay more for environmentally friendly products form this behaviour. Many studies on this topic have been performed starting from the analysis of the willingness of the consumer to pay more for green energy (Wiser, 1998; Hansla et. al., 2007).

Marketers may contribute to change consumer behaviour by emphasizing benefits and desired features of the products in the messages communicated by the producing companies to their potential customers. In relational marketing "long term benefits" of the product are submitted, leading to attract and retain consumers for long periods (Antonies & Raaij, 1998).

Thus, consumer behaviour can be shaped by emphasizing relative advantages of eco-friendly products in comparison with those products which create environmental damages (Peattie, 2001).

Related to this, Ottman (1993) stated that consumers can be the emotionally motivated to get involved because they want to differentiate themselves from other members of society or in their groups.

Another issue taken into consideration by the American scientist J. Ottman is the period of life when certain purchasing and consumption behaviours are induced. Thus she stated that „habits are decided early in life" (1993). The conclusion is that consumers will take more favorable to environment decisions if environmental education will start early.

Instead, Peattie (2001) believes that to form such habits, companies should be those that should get involved. Thus in the early stages of forming purchasing habits, they should use some systems to reward customers.

Mass media is another factor that can contribute decisively to the the formation of buying habits. This, as a stakeholder (Ottman, 1993) and opinion promoter, can effectively convey environmental information.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

However, practice has shown that consumers tend to become suspicious in some cases when companies put too emphasis on the environment in their communication systems.

The label is another factor to be taken into account in substantiation of the decision to purchase (Chase & Smith, 1992). The label may highlight specific environmental information that can contribute to an attitude of buying a eco - friendly product.

In other words, we can say that a system of environmentally friendly communicating system can lead to a favorable attitude to green products (Baldwin, 1993).

It follows from the above that the companies need to pay great importance to developing long-term strategies (Darling et. al., 2009).

There are a number of studies that have shown that environmental issues have become important issues for the population. This, also, led to changes in purchasing and consumption behaviour. Thus, consumers become more aware of environmental issues, giving more time for the prospection stage, seeking, primarily those energy efficient products. These behavioural patterns suggest the intention of engaging in a green consumer behaviour (Roberts, 1996; Kalafatis et. al., 1999). However, the explanation may come from increased energy prices.

Factors which consumers take into account in substantiation the purchasing decision, ultimately support marketers when they design the marketing mix. Thus, if environmental factors are considered, sustainability goals can be more easily pursued. In order to achieve these objectives criteria of compatibility of the ecosystems with production systems should be considered. In this respect, Fuller stated that „Customers need to learn to base purchasing decisions not only on how well the products meet the individual needs but also on how these products affect the natural environment" (1999).

Regarding the evaluation of the substantiation of the decision to purchase, Ottman, J. (1993) stated that the products or services are evaluated not only in terms of "performance and price", but also on the "social responsibility of manufacturers".

Consumers tend to repeat purchase in those cases where post-purchasing evaluation gives them satisfaction (Wood & Neal, 2009).

Thus, the concept of customer loyalty is related to environmental concerns and decisions having an impact on them.

IMPLICATIONS OF THE SUSTAINABLE DEVELOPMENT IN CONSUMER BEHAVIOUR

Sustainable Development: Frame for Sustainable Consumption

Sustainable development offers a frame for communities for an efficient use of the resources, in order to create new commercial activities, to protect and improve the life quality, to create new commercial activities which consolidate their economy. It can help to create a healthy community, which can sustain even the actual generation, and the next one. The concept of the environmental degradation unplumbed from the economic growth by eco-efficiency promotion and by interpretation of the high standards of environmental protection as a challenge to innovation, new markets and new business development, if we take into consideration the fact that a healthy environment is essential to ensure welfare and quality of life.

Sustainability principle designates the gear of three dimensions – ecology, economy and social sphere. Mixing up the consumer behavior with the ecological dimension of sustainability is very important.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Economic development and social welfare are possible on long term, only in a well-established frame which involves nature as a vital element. The economic and social aspects are important in order to make ecology becoming feasible: ecological manufacturing and consumption are elements that can be realized only if consumer is able to afford them and if both are realized under acceptable social guidance. 30-40% of the environmental problems are based directly or indirectly on some prevailing consumption models (Using UBA, 1997, p. 1).

In this context, new strategies must propose a way for the sustainable development:

- Taking into account the quality and preservation of the environment and natural resources as essential elements of the sustainable development;
- Management of the manufacturing flow, so that, taking into consideration the finite character of resources, to facilitate and encourage reutilization and recycle at an optimum level, in order to avoid loses and depletion of natural resources;
- Modification of the plain society concordant to confined character of the natural resources, so that their consumption or use to be not made in another's detriment, so that exploitation by a generation of the natural resources to not confine consumption possibilities of the future generations.

Environmental policies components must endorse regulatory sphere, but also of the consumers and producers.

Components of the environmental policies must endorse regulatory sphere, but, also, changes in producers and consumers behavior and of the whole civil society, by financial measures and resorts. Problems of Know How transfer and communication in the environmental area must be added to those above mentioned.

The regulatory policy tools must be chosen so that they outcrop a matched mix of their, adapting them for specific application situations. They include:

- Persuasion policy, which assumes promotion of the ecological technologies and research, awareness and education and use of market mechanisms;
- Information transfer policy encompasses tools for social communication - education, mass-media and public relation – meaning informational systems affordable for public.

Traditional policies pursuing minimization of the environment harmfulness, policies having as main goals demand satisfaction with a minimum input are added in manufacturing area, production policies with a minimum output of wasted resources and, also changes in the demand profile.

Nowadays, urban environment became more and more crowded especially by increasing the frequency of the transportation activities. Urbanities specialists are highly concerned with problems of the territorial use. Planning of the territory use needs to be closely correlated with regulatory for activities of the transportation services, which must accurately reflect costs of the needs of environment rehabilitation and social costs of maintaining or development of the transportation infrastructure.

A more deepened knowledge of the premises of consumption structuring for other goods and services, is, also, necessary, as a response of the multitude of needs expresses by different consumers' categories. For instance, option for replace an old product with a new one can be underlined by many motivations – that the old one can't be mended, that the new one has superior properties, that there is a use for periodic

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

shopping. Emergency of the consumerism era, in occidental countries, was possible just as a complexity of the consumption behavior of modern people and his leaning to newness (Stanciu, M., 2006).

Paper is a consumer good, which manufacturing depends, essentially of the exploitation of wooded lands. Paper consumption, clearly reflects level of civilization and economic development for a country. But the industry of cellulose and paper is not only the biggest wood consumer in the world, but, also the third industry in the world in respect of the financial results, being, in the same time among the first ten most polluting industries. Therefore, in the next 50 years there is expected a hundred percent increasing of demand for cellulose and paper, according to The National Institute of Statistics of Romania, 2004. But, by the other hand, there are still over a billion of illiterate people and over 100 millions of children who don't yet benefit of primary school education.

Generally, encouraging of goods and services demand, mass-media and advertising industries play a decisive role. Mainly, advertising industries affect consumers' motivations, having a decisive role for consumption structuring and modelling of the concepts regarding goods and services. Some recent studies of the consumption habits sustain that manufacturing response for some consumption needs can become more sustainable, by encouraging the tacking up some services destined to contribute to the raising of sustainability of the goods already purchased, instead to encourage purchasing of new goods. These kinds of practices lead to diminishing pressure of the extractive industries to the environment that can lead to a new conceptualization of the life quality increasing. Also, some recent analyses of companies affirmed that consumers' loyalty for a brand seems to be more encouraged by a bid for services destined to extend the life of the goods in use and less by encouraging of the purchasing new products.

Sustainable consumption and manufacturing models represents an important determinant for the environmental problems at every level, from the local level to the global level. For this reason, a main object in Agenda 21 (The World Conference in Rio de Janeiro, 1992) was Changing Consumption Patterns. Sustainable consumption represents a very wise area, requesting an interdisciplinary approach. The change of the consumer behavior is a process involving many social groups: ménages, which represent the biggest group of consumers, authorities, economy, educational institutions, NGOs and many others.

A change of the consumers' behavior means primarily a fundamental transformation of the values and life style. The change of the thinking and acting kind of the consumers can't be imposed by the authorities. The emergence of new and durable traditions in consumers' behavior requests a wise informing and consulting campaign. As regards of the consumer, goods and transportation ways must become more transparent, price of the ecological true need to be clearly expressed and those alternatives for the environment protection must be as soon as possible shown.

AREAS OF ACTIVITY OF THE SUSTAINABLE CONSUMPTION

Question about the concrete measures for the implementation of the sustainable behaviour regarding consumption appears only in a second stage. A very important role was allotted for areas as:

- Avoiding of the waste products accumulation;
- Energy and water consumption;
- Mobility;
- Feed;
- Reuse of the objects.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

In order to attain a sustainable growth, material consumption of the industrialized countries must be diminish. This is possible because in the last period goods having a low content of raw material was introduced in market, for the automobile industry, for the equipment industry and for that of the wrapper. There are motives for which a decrease of the material and energy consumption doesn't necessarily lead to a diminution of the total consumption. Thus, increasing total quantity of the used merchandise cancel savings obtained in technology of their realization. Secondly, motivation for producers to realize ecologic goods is related mainly with economic interest, which operationalizes the new sustainable technologies. The classic case is represented by the fridge with low energy consumption, but more expensive than the conventional one. Another solution for the sustainable consumption consists of realization of goods having long term of working. This is only a part of the new approach, which imposes a new vision to merchandise, according consumers' needs.

There are many problems: it is not clearly how the consumers are prepared to accept prises of the ecologic goods. A strict legislation in this area imposes serious pressures to the economic agents.

They began to understand that not only attention paid to different goods separately seen. This imposes a new approach, named metabolic, which approach the whole anthropic system.

Also, they began to understand that the attention paid to different goods separately seen is not sufficient.

Some specific studies showed the ecologic impact of the services, building concept of services efficiency meaning to offer a maximum result for consumers by use a minimum quantity of raw materials and energy. The most important feature of this concept consists of the fact that in our days, satisfaction is generated not only by the products, but even by services which they provided. In other words, products offered represent only tools for services obtaining.

Implications to the Elementary Processes Which Define Consumer Behaviour

All the same, consumer behaviour is influenced by numerous variables acting tightly. Consumers' behaviour is influenced by many factors:

1. **Direct Observable Influences:**
    a. Demographic factors.
    b. Economic factors.
    c. Factors specific for the marketing mix.
2. **Endogenous Influences:**
    a. Perception.
    b. Information/learning personality.
    c. Motivation.
    d. Attitude.
    e. Exogenous influences.
    f. Family.
    g. Membership group.
    h. Reference group.
    i. Social class.
    j. Culture.
    k. Sub-culture.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

In the last two decades, social analyses, focused on goods and services consumption of the occidental people changed significantly, as regards ideatics and general sense of the message, leaving pro-consumerist messages for those anti-consumerist.

Some papers published after 2000, underlined a new criticism current in the area of consumption patterns in occidental area, highlighting more clear tendencies of some social categories, to engage in activities less oriented to consumption. Some authors, as Zavestoski (2002), Schor and Holt (2000) or Hamilton and Mail (2003) was concerned even to initiate market studies for anti-consumeristic attitude or for return to some extremely simple consumption practices, protective with maintaining the environmental ecologic equilibrium. There are analysts of the consumption patterns like Lunt & Livingstone (1992) or Humphery (1998), who study a new orientation of the consumers – to limit satisfaction of the consumption needs by different good and services markets, as a consequence of the highly critic attitudes.

Perception

The most important feature of perception is the fact that is selectivity, as being complementary for needs, because of the consumers' features.

A useful concept is just a difference indistinguishable, for instance, in cases of price increasing motivated by different factors, such as green tax. If the increasing of price doesn't exceed the difference just indistinguishable, it is possible that demand for a specific good to be not affected.

The Need of Comprehensive Regulations

The ecological manufacturing and sustainability can gain a certain influence against consumers' decisions, but the price still represents the key variable. All researchers agree this. Nobody will pay, for instance, fourfold for a fridge just for its low energy consumption. Central administrations need to establish specific regulations, to recommend minimal prices for the unfriendly goods for the environment, in order to make certain the fact that they are not cheaper than those being friendly for the environment. These could increase consumers trust.

Feelings and Emotions Consideration

There is a real potential in this area, for instance that demonstrated by the success of some brands in cosmetic industry. Companies should recognize opportunities and gains generated by the sustainable goods and shouldn't only pertain to risks and costs.

Another example in this area is represented by the fact that some studies demonstrated that those advertisings which highlight the fact that the good had in sight doesn't encompass children' work, are irritating for consumers, because they assume a priori that manufacturing is correctly from the point of view of the policies. Furthermore, terms like children exploitation have negative connotations and can cause damages to the positive experience of goods or its purchasing, irrespective of context.

In marketing terms, it is vital, the fact that green goods meet their goals, this making consumer fell that do the right things.

Selection of the consumers' perceptions is much influenced by their attitudes in the moment of their reception.

Consumers' expectations are closely linked to the process of perceptual selection, implying them percept goods and their performances from the point of view of the benefits they expect to obtain. Market

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

researches show that consumers consider first personal benefits and not these for the environment. For instance, in a supermarket consumers don't wonder first: Do I the right thing buying this? But: If I will buy this, it will be good for me? Thus, they are ready to pay more for this kind of goods. And only after that, they consider that the good must be manufactured in ecological conditions.

Reasons can play an essential role, too, in perceptual selection, being known the fact that people perceive good related their needs and desires. An intense need determines a person to ignore some perceptions and select only those are related to these satisfaction.

Information

Perception is firstly, related to the awareness/learning process, which represents an ensemble through people know goods.

In awareness process, specialists pay attention to information sources.

Researches upon consumers' behaviour and attitudes in last decades showed a real interest of them for problems of environmental harmfulness. But there is still a long distance from attitude to their transformation in practices. In real life, consumers almost don't possess information about present and future effects of consumption decisions to environment or to other people.

In the same time, consumers manifest their decisions in a world where merchandise already are in last processing stage a major change being hard to obtain. The observed changes in consumer behaviour can be seen only in tight areas; they must be supported by strong awareness campaigns in order to become dominant market behaviour being significant for producers. But there is another dike: market is already saturated by advertising messages that increase chances that these campaigns be fast forgotten.

Generating important changes will occur only after a radical change of consumers' attitude. This requests a redesigning of prices policies in order that non-harmful for the environment goods to be chosen and opposite policies to be punished. These request other policies for consumers' information. A study performed in 1990 by Winkler and Voller identified a correlation between consumers' attitude and environmental impact of goods. This correlation was revealed related domestic energy consumption which decreased in those countries where ecological attitude increased, Holland, Germany, Denmark, and Sweden.

Attitude

Attitude was accepted more and more as a multidimensional concept, as a syndrome of constant reactions against social objects (WBCSD, 1996).

An interesting fact is that, in fact, consumers are not concerned directly in reducing energy consumption, but in a specific choice about buying daily goods. Consumers take decisions when use or discard concrete goods. This means that concrete manifestations of these mental attitudes need to be analysed.

Globally, specific studies identified phenomena of take-over consumption models from developed countries by the developing countries; there is a problem regarding this because first habits related goods having most important impact against environment (cars, steel, and electricity), whilst consumption models for less harmful goods are less convincing. Though, solution consists of modelling consumption attitudes.

Care for environment protection is confronted with interest for personal satisfaction obtaining.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Investments for Sustainability

Transparency and accessibility of goods and producers are essential both for consumers and stakeholders. Many companies accomplish increasingly sustainability criteria. A specific degree of this criteria knowledge can determine consumers of the goods they offer to identify themselves with these companies' values.

Motivation

Motives have a broad multidimensional character, being built between biologic and social, between internal manifestations and knowledge, between subjective necessity and values as reference system, between objects and their linkages with people. Because of these they can't be reduced only at a determinant factor. In order to design an efficient marketing policy, it is important to concern that motives are learnt and they have stability in time, being hardly changeable.

Effective Behaviour

Effective behaviour is not an autonomous process, though it can be studied relatively independent; it is a specific resultant of a system constituted of the above-mentioned elementary processes.

Avant-Gardist Demand

There are practically demonstrations of the fact that avant-gardist demand establishes trends which involve most of the consumers. In this respect, female consumers play a decisive role as follows they manifest much more responsibility and involvement in buying acts. They stand on utility, longevity and social or ethical standard.

THE GREEN DIMENSION OF THE MODEL OF CUSTOMER SATISFACTION

Drivers of the Green Dimension of the Model of the Assessment of Consumer Satisfaction

Reality has shown that proactive, long term, visionary strategies, companies bring more benefits for companies than those based on classical management based on traditional resources. The companies concern for the environment represents, from this perspective, an opportunity. Thus an organization will gain a competitive ecological advantage over the competition ecological if it is "better" than this, in terms of environmental issues, at least in a specific area.

The companies' interest for environment first appeared in campaigns for social responsibility inspired by the multinationals model. The adoption of "green" strategies has been boosted, too, by environmental regulations in certain areas.

In the current context, economic organizations are evaluated not only in terms of economic performance, but also in relation to their contributions to economic and social development of the community. Thus, the concept of social responsibility (SR) emerged. WBCSD World Business Council Sustainable Development) defined corporate social responsibility as "the Continuing Commitment by business to

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

contribute to economic development while improving the quality of life of the workforce and Their Families as well as of the community and society at large" (WBCSD Business Solutions for a sustainable world). Thus, SR aims to help companies to become actively involved in local community life, enabling them to assume roles as global citizens and local neighbours in a fast-changing world. Such programs have become, genuine marketing tools designed to bring image benefits for their proposers. Corporations acquire "human face" is more than just products and services (Sima & Gheorghe, 2007).

"More green means cheaper." Investment in "green products" is manifested as an eco-trend in business. Some players have already intuited this trend and began to pay attention to this segment.

Companies that make the step to launch organic products want to achieve consumer awareness by associating their image with clean products, but they also look for new customers.

People want an ecological approach to everyday life, but they seek, primarily, personal gain, which can be transposed into incentives and facilities.

On the one hand, green customers and the public generally are more aware to the ecological behaviour of organizations and to their social involvement.

On the other hand, organic products and environmental activities are not easily accepted by a large part of the audience, especially by the one who does not have a strong and clear ecological awareness.

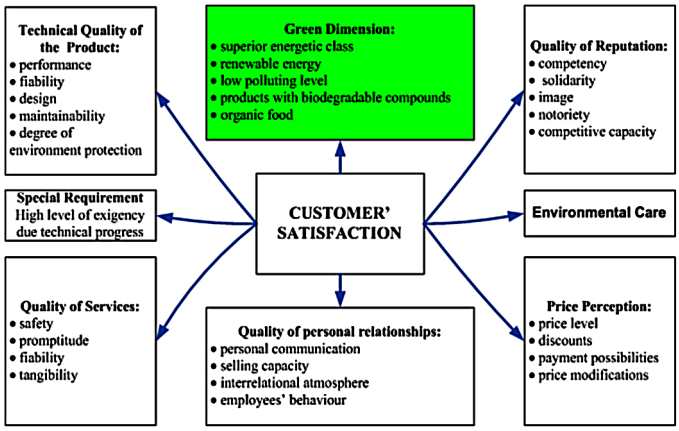
The degree of concern for the environment has increased significantly, so that environmental problems have come to represent now an essential factor in making consumer decisions.

The items presented above have led us to take into account a new category, in modeling and evaluation of customer satisfaction, which the authors have called Green Dimension. (Figure 1).

ECSI model was the starting point. In relation to the determinants of ECSI model, green dimension can be justified at least by a few elements namely:

- In terms of *image*, green dimension can be expressed in the concept of Corporate Social Responsibility. CSR activities of a company provide benefits at two levels: the social level and the company level. The social benefits are related to the welfare and the public interest. In terms of benefits of the company, at least four issues are to be mentioned, namely:

Figure 1. A new model of the assessment of customers' satisfaction
Source: Sima, 2010.



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- Possibility of differentiation over the competition and achieving brand loyalty. There are studies which have shown that when consumers have to choose between similar products, their preferences are turning to those brands perceived as being "responsible". Thus:
  - 70% of European consumers believe that the responsibility of a company is important in the decision to buy a product or service (MORI 2000)
  - 86% of Americans were inclined to change a brand in favour of another similar, but involved in a social cause (2004 Cone Corporate Citizenship Study).
- Improving the company reputation. Currently, companies' success depends directly on the trust given them by the authorities, media, partners and the community in which it operates. On the other hand, if a company demonstrates its responsibility to the community, the related to reputation benefits have immediate consequences. Thus:
  - 61% of opinion leaders around the world are willing to recommend the products of a responsible company (The Insightpoll.com Opinion Elite Panel 2004),
  - 84% of Americans believe that social responsibility is important when they think about the companies they agree to see operating in their community (2004 Cone Corporate Citizenship Study.
- Increased sales and market share of the company
- Attracting and retaining valuable employees.

- In terms of *perceived value*, The Green Dimension may be considered in many respects. Thus, in Romania, Daedalus Consulting and Green Report conducted the first quantitative Romanian research on environmental issues. The result of the survey was published in February 2008 and showed a high willingness of Romanian people to pay more for green products. Compared to values at international level, almost 90% of Romanian citizens have expressed willingness to pay more for environmentally friendly products. After Romania, according to the TGI survey the highest availability was recorded in Brazil, India and Mexico. Countries that were not subjected to the rigors of environmental discipline are top ranking. This result can be explained by the fact that those countries, not having the costs experience of these measures, have a higher receptivity to them. Thus a few results are noticeable:
  - Over 73% of respondents are willing to pay more for organic food.
  - Over 49% of respondents are willing to pay more for renewable energy.
  - Over 36% of respondents are willing to pay for products with biodegradable compounds. (Daedalus Consulting, Green Thinking, prepared for Green Report, 2008)
- In terms of customer expectations, The Green Dimension can be primarily expressed by their expectations about the energy efficiency of products, meaning that they seek products operation of which does not require high energy consumption. Also, customers have expectations regarding low emission of pollutants. A good example is the case of passenger cars, for which the level of the paid taxes is inversely proportional to the emissions level. It appears, therefore, that customer expectations related to green product features are primarily determined by the pragmatic attitude of the new consumer.
- Regarding perceived quality of the green products, the green dimension can be recognized in the low polluting level of the eco-friendly products, due to the use of new production technologies.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Specific Issues of the Green Dimension for Customers Satisfaction

People seek personal benefit rather than an ecological approach of the everyday life. Beyond awareness, the ecological approach should be assumed by consumers (Sima, V., Gheorghe, I.G., 2009).

The question arises is: How strong is consumer interest in environmental issues?

Based on the results recorded in The 2009 BBMG Conscious Consumer Report: Redefining Value in a New Economy, Raphael Bemporad, co-founder of BBMG, said that brands would be able "to close the green trust gap" if they would take into account new customer expectations, which evaluates acquisitions "based on both value and value" (BBMG Conscious Consumer Report: Redefining value in a new Economy, June 2009, p.34). Thus, they have to provide performance products that match consumers' goals; with acceptable prices that for them.

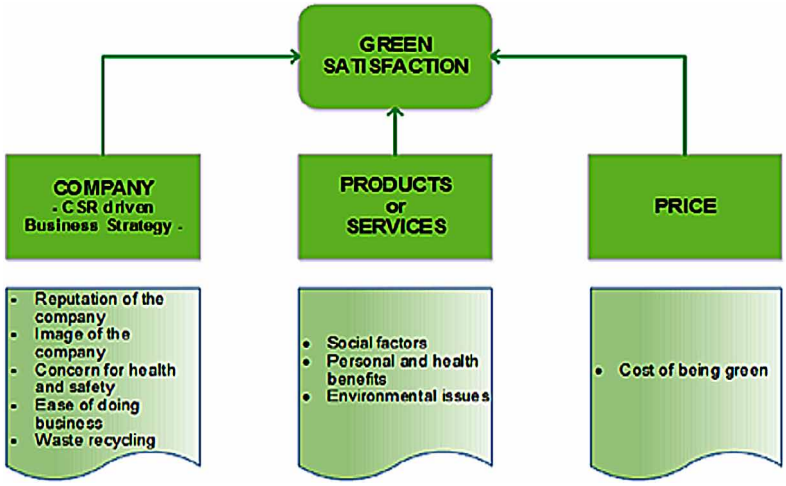
Taking into account the above, we can identify three specific levels of customer satisfaction green dimension, namely (Figure 2):

- Company;
- Product/Service;
- Price.

The Company Level: Consumers Reward Those Brands Which Are Based on the Best Practices of the Company

In addition to the classical requirements such as economic performance, quality management and communication policies, a modern assessment of a company is also considering specific issues such as the organization's involvement in the social life of the community. Modern organization as a legal entity - has primarily, duties to society.

Figure 2. Tree of customer satisfaction for the green dimension
Source: Adapted after Sima and Gheorghe, 2009.



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Customer satisfaction is considered by Scott M. Smith as "a reflection of the expectations and experiences that the customer has with a product or service".

Evaluation of products and services is actually made following customer expectations. They are found in the rules of performance that reflects accepted environmental standards set by the business environment, other companies, industries, and even organizational and national culture. The most effective strategic approach seems to belong to those companies that have adopted social responsibility and sustainable development as a business philosophy. Integrating social and sustainability principles in their operation provides long-term value for the shareholders through practices that are, in fact, satisfactory to all stakeholders. Social Responsibility was developed by taking into account environmental and social opportunities as business opportunities. In this respect, the strategic capacity of organizations is adapted in order to efficiently exploit such opportunities.

The new consumer is increasingly more concerned about his image that reflects the image of his suppliers. Therefore, their reputation becomes, in turn, increasingly more important to the consumer. Thus elements which are subject of social responsibility activities such as concern for health and safety as well as customer requests, ensuring environmental conservation, supporting philanthropy, come to be positioned in the core of companies concern. The result of such strategic approach is to eliminate barriers of communication with the customer, such as mistrust, negative perceptions, lack of information, low availability, leading, ultimately, to increase sales of environmentally sensitive products. The importance of each factor varies by product, industry and geographic area.

The 2009 BBMG Conscious Consumer Report: Redefining Value in a New Economy has found that 77% of American consumers agree that "can make a positive difference by purchasing products from socially or environmentally responsible companies".

The Product/Service Level: Consumers Are Looking for "Green" Features of the Products and Services

Climate changes seem to be those that have drawn attention to environmental issues in the greatest extent. At the same time rising energy prices is another factor that appears to significantly influence the buying decision. Thus, the consumers are getting more and more interested, firstly, in products of high energy efficiency classes. At the same time the low level of environmental damage may represent an important factor in decision of purchasing. The conclusion is that, firstly, the personal benefits are tracked and only after that the ones affecting the environment.

The most popular and demanded "green products" are:

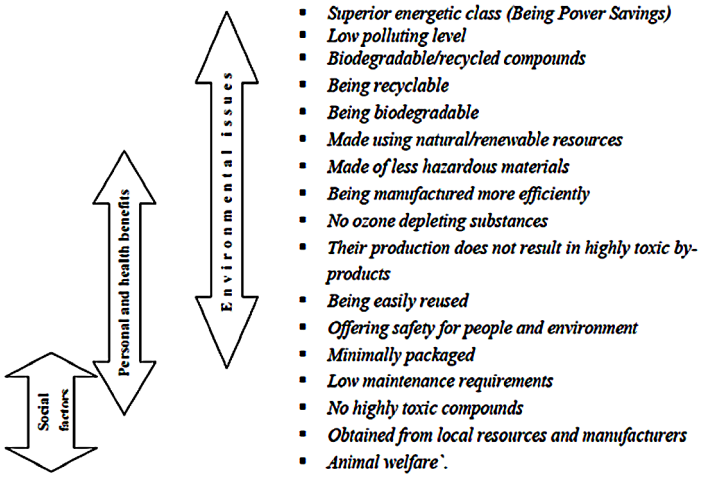
- Organic food.
- Renewable energy.

But in addition, other important ecological features of the products / services may be considered to represent important factors in purchasing decisions: "superior energetic class, low maintenance requirements, low polluting level, biodegradable/recycled compounds, no highly toxic compounds, being easily reused, recyclable or biodegradable etc." (Sima & Gheorghe, 2009).

Thus, in terms of involvement in purchasing decisions, environmental issues can be classified in three categories, namely: environmental issues, personal benefits and social factors (Figure 3).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 3. Green satisfaction sources
Source: Sima and Gheorghe, 2009.



The Price Level: Consumers' Willingness to Pay More for "Green Products/Services"

There are numerous studies conducted all over the world that show the green procurement volume is increasing, but the question that arises is: Are the consumers willing to pay more for green?

A McKinsey survey of 1,000 consumers in Europe and the United States performed in 2012, showed that many people would pay more, but only up to a point (Miremadi et. al., 2012). The study took into account acquisitions in the automotive, building, electronics, furniture, and packaging categories. Between 70 and 80 percent of the respondents said they would pay an additional 5 percent for a green product if it is at the same level of performance as a non-green alternative. But as the premium increase first, willingness to pay decreases.

The "historical" reluctance to pay a bonus for ecological products is reduced as consumers associate the responsibility for protecting the environment to their health and other direct benefits.

The core of this internal belief system is ecological value.

Ecological value can be explained by implicit or explicit philosophy of desired value and it may be placed as a behavioral variable within the system of values.

THE GREEN STRATEGY MIX: A NEW HOLISTIC APPROACH

Two international studies, conducted in 2009 (Sustainability in the 2009 Recession and Green Brands Survey 2009) showed that the recession has not lowered the interest in 'green' products or services, quite the contrary. Worldwide consumers associate ecologic products with the idea of reducing consumption and saving, despite the fact that the main barrier for purchasing of these products is the perception that their price would be higher than that of the classic ones.

In January 2009, the Boston Consulting Group presented the results of a study entitled "Capturing the Green Advantage for Consumer Companies". The aim of this study was to discover if and how

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

consumer attitudes towards green products and services has been affected by the economic crisis. The conclusion was that during the crisis, consumers remained interested in organic products. Determinants of this behavior were represented by the benefits that eco-friendly products have, on the one hand, upon the environment and, on the other hand, at the personal level. As a conclusion, BCG advised companies on how to respond to consumer expectations regarding environmental protection being, in the same time, able to reach, their business targets.

It should be noted that the study was conducted in a gray period, characterized globally by uncertainties, among others, regarding the appropriateness of investing in new environmental strategy.

As a concrete result of the study a best practice guide for the company was drawn up.

In this guide advices for companies were offered, divided into four categories, based on which companies can meet consumer requirements on environmental protection and their business objectives. The four categories are:

1. Planning,
2. Process,
3. Product, and
4. Promotion.

From our point of view, "the green products and services are designed, manufactured, priced and promoted by people for people" (Sima & Gheorghe, 2009). This approach has led us toward a holistic approach of green satisfaction, according to which people and their double the role of producers and consumers should be in the same time considered.

Some analysts say that for companies, there is only one thing which is more important than environmental initiatives, namely the ability to communicate it to consumers.

Thus, in terms of green strategy, we consider that a fifth element can be added, namely the People.

Another observation we had regard was that the eco-efficiency represent a production principle requested by the green products. It refers to less polluting production systems used to produce goods and services which have a lower environmental impact, which better corresponding with customer needs, being, thus, more competitive.

Starting from this, the authors, also, integrated Eco - Efficiency into a mix strategy that they named "The Green Strategy Mix" (5P+EE) (Figure 4).

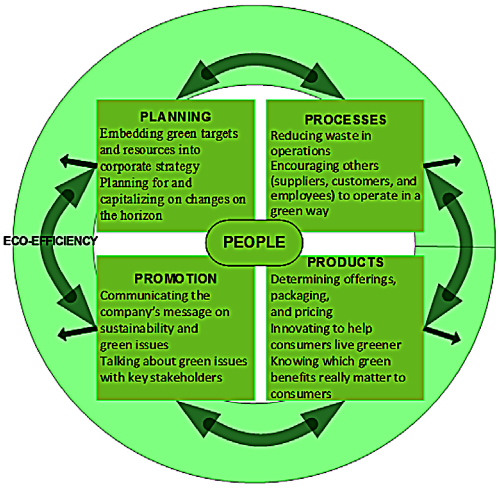
- Planning Strategy;
- Processes Strategy;
- Product Strategy;
- Promotion Strategy;
- People Strategy;
- Eco-Efficiency Strategy (Sima & Gheorghe, 2009).

The first four was highlighted by the Boston Consulting Group into a recent study, aiming to assess green attitudes and shopping behaviors. They call them *The Four Ps of Green Advantage.*

Being "green" has become a business plan itself. Producers attempt to differentiate the competition and gain a large share of the market. There is a "green" competition, in which each company tries to

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 4. The 'Green Strategy Mix'
Source: Sima and Gheorghe, 2009.



move forward, aiming to move forward having regarded the continuous growth of the customer preferences for 'green' products.

Nowadays, producers, not just consumers, seem to show a wave of interest in the environmental aspects of the business, because they realized that eco-environmental production methods and can be profitable. So we can say that in a comprehensive approach, the strategic mix can be improved.

Given the continued growth of customer preferences for 'green' products, the existence of a product having a less impact on the environment, in the company's portfolio, it is often better in terms of quality and marketing.

Being "green" has become a business plan itself.

SOLUTIONS AND RECOMMENDATIONS

Four main determinants of population's attitude towards the green dimension can be identified:

1. Phenomena with negative environmental effects;
2. Activities to protect environment;
3. Willingness to save and motivation for it;
4. Willingness to pay extra for green products and justification for it.

Phenomena With Environmental Impact

According to the above mentioned study conducted by Daedalus Consulting in Romania in 2008, atmospheric pollution and deforestation are considered to have the highest environmental impact (Over 84% of respondents placed this issues on the first and second place). Respondents considered that pollution can be greatly influenced by each of us.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

These two results seem to be in a relationship of interdependence that can be verified in future research through correlation analysis.

Genetically modified foods are ranked third, nearly of the above mentioned two categories.

Regarding how respondents considered that they might influence each of these phenomena, it can be observed that in all cases the population is considered largely unable to act.

Activities for Environment Protection

As regards activities for the environmental protection, there is a clear correlation between the activities about which respondents say they have performed over the past 12 months and those who declare that they intend to undertake in the next 12 months.

There is also an increase of approximately 10% of those who declare that they intend to be involved in such activities in future, which may suggest a tendency to declare rather to act or to reflect the behavioural changes induced by economic recession.

Willingness to Save and Justification for It

Regarding products that respondents say they save, the most name energy (over 70%). On the second place they considered water (60%).

Regarding the reasons for showing this kind of attitude, most respondents stated that they try to reduce costs (85%) and only 13% say they care about environment.

This shows serious problems in society and requires a deep study in order to identify determinants of this behaviour to improve.

"Green Products" and Willingness to Pay More for Them

The products were grouped into three categories: organic food, renewable energy and products with biodegradable compounds.

Organic foods are outlined of these, almost three quarters of the respondents (73.1%) saying they were willing to pay higher amounts. About a half (49.1%) were willing to pay more for renewable energy and almost a third (36.3%) for products with biodegradable components.

And this result match to the behavioural pattern mentioned above, showing that for Romanian people care for the environment not prevail, but rather care for them.

A mismatch occurs when respondents are asked to respond if they are willing to pay more for "green products". On this question, nearly two-thirds affirmative answer, and if we add them those who are in partial agreement, we achieve a percentage of over 84%. This response comes, however, contradict the results mentioned above. Thus, this it seems to support, too, the conclusion that the people of Romania are well in words, but less than in facts.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

FUTURE RESEARCH DIRECTIONS

All of these above mentioned elements determine a model of an ecological community, including:

- **Resource Ecology:** Identifying local resources that can be ecologically exploited;
- **Activity Ecology:** Directing investment towards non-polluting activities (ecological agriculture, "clean" technologies, ecological services, ecological tourism etc.) and writing and implementation of local development projects that take into account ecological constraints;
- **Ecological Behavior:** Building awareness within the local community regarding the serious long-term consequences of non-ecological behavior (development of ecological citizenship);
- **Ecological Culture:** Introduction of ecology information in school curricula, as a support for the formation of ecological culture.

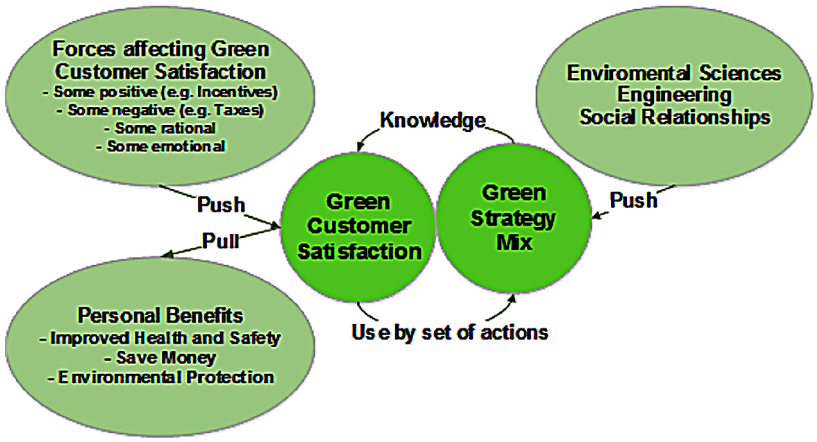
Given the above, we believe that an investigation should be conducted in order to helps us to shape and measure the consumer green behavior. The ultimate goal is to develop a system of indicators which may be used to measure the green satisfaction of the consumers, namely, Green Dimension Index.

The starting point of this research will be the model shown in Figure 5.

CONCLUSION

Operationalizing studying of the needs, values, behaviours, psychology or aspirations of goods and services consumers is a laborious and complex process because every chapter of people consumption as well as market dynamic of every good or service follow specific laws and there are necessary separate investigations for every good or consumption chapter, in order to explain or forecast general or sequential behaviour of the consumers.

Figure 5. Model for Green Dimension index evaluation
Source: Proposed by the Authors.



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Nowadays, there is no exhaustive understood of consumption components or of real motivations for adopting specific consumption practices, even in this area there already are accumulated many studies, observations and methodical researches.

But it was never possible an investigation totally satisfying in respect of the rationality of the consumers, so much the less in respect of the unconsciousness impulses lying the effective consumption behaviour. Anyway, the social and economic theory of consumption mad important steps in respect of the delimitation between rational and emotional motivations of goods and services purchasing.

Changes dynamic in goods and services markets was very high in the last two decades. In those countries having market economies, where profile if demand rapidly changed, these lead to a rapidly change of the offer parameters and default changes of some elements of the research methods and techniques of the consumption patterns.

Adoption of some sustainable practices of consumption involves use of correlated goods and services which answer to satisfaction of basic needs, under conditions of minimization of the natural resources exploitation, avoiding resources waste and polluting emissions, along an entire life-cycle, so that these don't affect life chances of future generations.

Desirable changes of some features of the consumption patterns as follow as new exigency imposed to manufacturing processes involve:

- Promotion of the examination of those consumption patterns which block sustainable development, as well as of the modalities of changing this behaviour, at global level, endorsing especially those people having a consumerist life style.
- Identification of the most efficient policies and tools for break-up the unsustainable consumption/manufacturing patterns, including by information dissemination and ecological alert.
- Performing a more equitable distribution of developing resources inside and between countries.

REFERENCES

Anderson, E.W., Fornell, C., & Lehmann, D.R. (1994). Customer satisfaction, market share and profitability: Findings from Sweden. *Journal of Marketing*, *58*(3), 53-66.

Antonies, G., & Raaij, V. W. (1998). *Consumer behavior: A European perspective*. West Sussex, UK: John Wiley & Sons ltd.

BBMG. (2009). *The 2009 BBMG conscious consumer report: Redefining value in a new economy.* Retrieved from http://bbmg.com/

Bemporad, R. & Baranowski, M. (2010). *Marketing to conscious consumers: Identify, engage and leverage your most passionate customers*. New York: John Wiley & Sons.

Boston Consulting Group. (n. d.). *Publications.* Retrieved from http://www.bcg.com/impact_expertise/publications/files/Creating_People_Advantage_Summary_May_2008.pdf

Chase, D., & Smith, T. K. (1992). Consumers keen on green but marketers don't deliver. *Advertising Age*, *63*(29), 2–4.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Daedalus Consulting. (2008). *Green Thinking*. Prepared for Green Report. Retrieved January 27, 2009 from http://www.green-report.ro/dynamic/studii/sondaje/daedalus-consulting-green-thinking-sondaj-pe-teme-de-mediu-printre-romani---9288.htm

Darling, R. J., Heller, V. L., & Tablada, D. M. (2009). Positioning a firm's initial market offering: A strategic application of a consumer-oriented model. *European Business Review*, *21*(6), 516–530. doi:10.1108/09555340910998814

Fornell, C. (1992, January). A national customer satisfaction barometer: The Swedish experience. *Journal of Marketing*, *56*(1), 6–21. doi:10.2307/1252129

Giese, J. L., & Cote, J. A. (2000). Defining customer satisfaction. *Academy of Marketing Science Review*. www.amsreview.org/articles/giese01-2000.pdf

Ginsberg, J. M., & Bloom, P. N. (2004). Choosing the right green marketing strategy. *MIT Sloan Management Review*, *46*(1), 79–84.

Gupta, S., & Ogden, D. T. (2009). To buy or not to buy? A social dilemma perspective on green buying. *Journal of Consumer Marketing*, *26*(6), 376–391. doi:10.1108/07363760910988201

Hamilton, C., & Mail, E. (2003). *Downshifting in Australia: A Sea-Change in the Pursuit of Happiness* (Discussion Paper No.50). The Australia Institute, Canberra.

Hansla, A., & ... . (2007). The relationships between awareness of consequences, environmental concern, and value orientations. *Journal of Environmental Psychology*, *28*(10), 1–9.

Hausknecht, D. R. (1990). *Measurement scales in consumer satisfaction/dissatisfaction*. Journal of Consumer Satisfaction. *Dissatisfaction and Complaining Behavior*, *3*, 1–11.

Hennig-Thurau, T., Gwinner, K. P., & Gremler, D. D. (2002). Understanding relationship marketing outcomes: An integration of relational benefits and relationship quality. *Journal of Service Research*, *4*(3), 230–247. doi:10.1177/1094670502004003006

Humphery, K. (1998). *Shelf life: Supermarkets and the changing cultures of consumption*. Melbourne: Cambridge University Press.

Kalafatis, S. P., Pollard, M., East, R., & Tsogas, M. H. (1999). Green marketing and Ajzen's theory of planned behavior: A cross-market examination. *Journal of Consumer Marketing*, *16*(5), 441–460. doi:10.1108/07363769910289550

Kantar Media TGI. (n. d.). *Green values.* Retrieved from http://www.tgisurveys.com/knowledgehub/reports/KMR_TGI_Green_Values.pdf

Kilbourne, W. E. (1995). Green advertising: Salvation or oxymoron? *Journal of Advertising*, *24*(2), 7–19. doi:10.1080/00913367.1995.10673472

Kollmuss, A., & Agyeman, J. (2002). Mind the gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research*, *8*(3), 239–260. doi:10.1080/13504620220145401

Kotler, P. (2000). *Marketing management* (10th ed.). New Jersey: Prentice-Hall.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Kreidler, N. B., & Joseph, M. S. (2009). How green should you go? Understanding the role of green atmospherics in service environment evaluations. *International Journal of Culture, Tourism and Hospitality Research*, *3*(3), 228–245.

Kristensen, K., Martensen, A., & Grønholdt, L. (2000). Customer satisfaction measurement at post Denmark: Results of application of the European Customer Satisfaction Index methodology. *Total Quality Management*, *11*(7), 1007–1015. doi:10.1080/09544120050135533

Lunt, P. K., & Livingstone, S. M. (1992). *Mass consumption and personal identity: Everyday economic experience*. Buckingham, U.K.: Open University Press.

Macdonald, S. et al. (2006). Sustainability: Consumer perceptions and marketing strategies. *Business Strategy and the Environment, 15*, 157-170.

Mainieri, T., Barnett, E. G., Valdero, T. R., Unipan, J. B., & Oskamp, S. (1997). Green buying: The influence of environmental concern on consumer behavior. *The Journal of Social Psychology*, *137*(2), 189–204. doi:10.1080/00224549709595430

Mendleson, N. (1994). Environmental marketing business partnering at AFC developing strategic, Environmental Marketing: Critical Success Strategies for Reaching the Green Consumer. In *Proceedings of The 1994 Conference*, pp. 87-103.

Meyer-Waarden, L. (2004). Business Excellence. In C. Brătianu, D. Lixăndroiu, Al. Pop Nicolae, (Eds.), *Proceedings of the International Conference on Business Excellence ICBE*, Braşov, România. Bucureşti: Editura ASE.

Miremadi, M. (2012). *How much will consumers pay to go green?* Retrieved October, 14, 2013 from http://www.mckinsey.com/insights/manufacturing/how_much_will_consumers_pay_to_go_green

Oliver, R. L. (1997). *Satisfaction: A behavioral perspective on the consumer*. New York: McGraw Hill.

Oliver, R. L. (2006). *Customer satisfaction research: The handbook of marketing research*. California: Sage.

Ottman, J. A. (1993). *Green marketing: Challenges & opportunities for the new marketing age*. Chicago: NTC PublishingGroup.

Ottman, J. A., & ... . (2006). Avoiding green marketing myopia. *Issue of Environment*, *48*(5), 22–36.

Peattie, K. (2001). Golden goose or wild goose? The hunt for the green consumer. *Business Strategy and the Environment*, *10*(4), 187–199. doi:10.1002/bse.292

Peattie, K., & Crane, A. (2005). Green Marketing: Legend, myth, farce or prophesy. *Qualitative Market Research*, *8*(4), 357–370. doi:10.1108/13522750510619733

Peterson, R. A., & Wilson, W. R. (1992). Measuring customer satisfaction: Fact and artefact. *Journal of the Academy of Marketing Science*, *20*(1), 61–71. doi:10.1007/BF02723476

Pickett, B. J. (2008). Pro-environmental products: Marketing influence on consumer purchase decision. *Journal of Consumer Marketing*, *25*(5), 281–293. doi:10.1108/07363760810890516

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

PSB Research. (n. d.). *Website.* Retrieved from http://www.psbresearch.com/green_2009.htm#top

PSB Research. (n. d.). *Website.* Retrieved from http://www.psbresearch.com/green_JWT.htm

Roberts, J. (1996). Green consumers in the1990s: Profile and implications for advertising. *Journal of Business Research*, *36*(3), 217–232. doi:10.1016/0148-2963(95)00150-6

Rust, R. T., & Oliver, R. L. (1994). Service quality: insights and managerial implications from the frontier. In R. T. Rust & R. L. Oliver (Eds.), *Service quality: New directions in theory and practice* (pp. 1–19). London: Sage. doi:10.4135/9781452229102.n1

Schor, J. B., & Holt, D. B. (Eds.). (2000). *The consumer society reader*. New Press.

Scott, M. S. (2007). *How to measure customer satisfaction: Satisfaction measurement and theory*. Retrieved May 9th 2008, from http://www.aboutsurveys.com/how-to-measure-customer-satisfaction-satisfaction-measurement-and-theory/

Sima, V. (2010). Motivations for a systemic approach of the innovative strategies for a "green" product. *Petroleum-Gas University of Ploieşti Bulletin. Economic Sciences Series*, *12*(3), 104–111.

Sima, V., & Gheorghe, I. (2009). Eco-Efficiency – A Romanian Perspective. In *Proceedings of the 11th IBIMA Conference, Creating Global Economies through Innovation and Knowledge Management* (pp. 1642-1650).

Sima, V., & Gheorghe, I. (2009). The green strategy mix – A new marketing approach. In *Proceedings of the 13th IBIMA Conference on Knowledge Management and Innovation in Advancing Economies, Analyses & Solutions* (pp. 1344-1347).

Sima, V., & Gheorghe, I. G. (2007). The corporate social responsibility – a modern marketing concept. *Annals of the Oradea University, Fascicle of Management and Technological Engineering*, *6*(14), 2592–2596.

Sima, V., & Gheorghe, I. G. (2009). The Opportunity for a Reconsideration of the Dimensions of the Assessment Model of the Customers Satisfaction. *Communications of the IBIMA*, *9*, 64–68.

Sima, V., & Gheorghe, I. G. (2009). The 'Green Dimension' of Customer satisfaction. In *Proceedings of the 11th IBIMA Conference, Creating Global Economies through Innovation and Knowledge Management* (pp. 1638-1641).

Stanciu, M. (2006). Metode de cercetare a modelelor de consum, Studii şi Cercetări Economice (vol. 42). Bucureşti: Academia Română, INCE, CIDE.

Vavra, T. G. (1997). *Improving your measurement of customer satisfaction: a guide to creating, conducting, analyzing, and reporting customer satisfaction measurement programs*. ASQ Quality Press.

Verhoef, P. C. (2001). *Analysing customer relationships: Linking relational constructs and marketing instruments to customer behavior* (Unpublished doctoral dissertation). Erasmus University, Rotterdam.

WBCSD. (1996). *A changing future for paper*. Retrieved January 19, 2009 from http://pubs.iied.org/pdfs/X136IIED.pdf

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

WBCSD. (n. d.). *Corporate Social Responsibility (CSR).* Retrieved from http://www.wbcsd.org/work-program/business-role/previous-work/corporate-social-responsibility.aspx

Westbrook, R. A., & Oliver, R. L. (1981). Developing better measures of consumer satisfaction: Some preliminary results. In K. B. Monroe (Ed.), *Advances in consumer research* (8th ed., pp. 94–99). MI: Association for Consumer Research.

Wirtz, J., & Lee, M. C. (2003). An examination of the quality and context-specific applicability of commonly customer satisfaction measures. *Journal of Service Research*, *5*, 345–355.

Wiser, R. H. (1998). Green power marketing: Increasing customer demand for renewable energy. *Utilities Policy*, *7*(2), 107–119. doi:10.1016/S0957-1787(98)00005-8

Wood, W., & Neal, D. T. (2009). The habitual consumer. *Journal of Consumer Psychology*, *19*(4), 579–592. doi:10.1016/j.jcps.2009.08.003

Yi, Y. (1990). A critical review of consumer satisfaction. In V. A. Zeithaml (Ed.), *Review of marketing Chicago* (pp. 68–123). American Marketing Association.

Zairi, M. (2000). Managing customer satisfaction: A best practice perspective. *The TQM Magazine*, *12*(6), 389–494. doi:10.1108/09544780010351670

Zavestoski, S. (Ed.). (2002). *Anti-consumption attitudes: Psychology & Marketing, (Special Issue)*. New York: Wiley.

ADDITIONAL READING

Belk, R. W. (1995). Studies in the new consumer behavior. In D. Miller (Ed.), *Acknowledging consumption: A review of new studies* (pp. 58–95). London: Routledge.

Belk, R. W., Devinney, T., & Eckhardt, G. (2005). Consumer ethics across cultures. *Consumption Markets & Culture*, *8*(3), 275–289. doi:10.1080/10253860500160411

Berry, L., Carbone, L. P., & Haeckel, St. H. (2002). Managing the total customer experience. *Sloan Management Review*, (Spring): 85–89.

Burkart, K. (2012). *How to define the "green economy"*. Retrieved at 2013-23-11 from http://www.mnn.com/green-tech/research-innovations/blogs/how-do-you-define-the-green-economy

Cato, M. S. (2009). *Green economics: An introduction to theory, policy and practice*. London: Earthscan.

Graedel, T. E., & Allenby, B. R. (2003). Industrial ecology (2nd ed.). Upper Saddle River, NJ: Prentice Hall.

Grant, J. (2007). *The green marketing manifesto*. John Wiley & Sons.

Gustafasson, A., Johnson, M. D., & Roos, I. (2005). The effects of customer satisfaction, relationship commitment dimensions and triggers on customer retention. *Journal of Marketing*, *69*(October), 210–218. doi:10.1509/jmkg.2005.69.4.210

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Kennet, M., & Courea, E. P. (2011). *Handbook of GREEN ECONOMICS*. The Green Economics Institute.

King, A., & Lenox, M. (2002). Does it really pay to be green? *Journal of Industrial Ecology*, *5*(1), 105–117. doi:10.1162/108819801753358526

Kotler, Ph. (1969). Behavioral models for analyzing buyers, in Dimensions of consumer beahviour, James U.Mc. Neal (ed.), Meredith Corporation, New York.

Lanktree, C., & Briere, J. (1991, January). *Early data on the Trauma Symptom Checklist for Children (TSC-C)*. Paper presented at the Meeting of the American Professional Society on the Abuse of Children, San Diego, CA.

Milani, B. (2005). *What is green economics?* Retrieved from www.greeneconomics.net

Mintzer, M. (Ed.). (1992). Confronting climate change, risks, implications and responses. Cambridge: Cambridge University Press.

Moisander, J. (2007). Motivational complexity of green consumerism. *International Journal of Consumer Studies*, *31*(4), 404–409. doi:10.1111/j.1470-6431.2007.00586.x

National Institute of Statistics of Romania (2004). *Tendinţe Sociale*. Romania: NIS.

Neff, J. (2009). Green-marketing revolution defies economic downturn. *Advertising Age*, *80*(14). Retrieved from http://ecoamerica.typepad.com/blog/2009/04/greenmarketing-revolution-defieseconomic downturn.html

Peattie, K., & Charter, M. (2003) Green Marketing. In M. J. Baker (Ed.), The marketing book (5th ed.) (pp. 726-756). Butterworth-Heinemann.

Peattie, K., & Crane, A. (2005). Green marketing: Legend, myth, farce or prophesy? *Qualitative Market Research*, *8*(4), 357–370. doi:10.1108/13522750510619733

Porter, M. E., & Van der Linde, C. (1995). Toward a new conception of the environment-competitiveness relationship. *The Journal of Economic Perspectives*, *9*(4), 97–118. doi:10.1257/jep.9.4.97

Porter, M. E., & van der Linde, C. (1995). Green and competitive. *Harvard Business Review*, *73*(5), 120–134.

Salzman, M., & O'Reilly, A. (2010), *10 Trends in Mindful Consumption*. Retrieved June 28, 2013 from http://www.thenewconsumer.com/2010/10/29/10-trends-in-mindful-consumption/

Sima, V., & Gheorghe, I. (2008). Eco-efficiency – A Romanian perspective. In *Proceedings of The 11th IBIMA Conference, "Creating Global Economies through Innovation and Knowledge Management*" (pp.1642-1650).

Sima, V. & Gheorghe, I. G. (2014). Analyze of environmental performance in Romania based on Environmental Performance Index. In *Proceedings of International Conference "Sustainable Energy Use And Management" Targu-Jiu,* (pp. 16-19).

Tse, D. K., & Wilton, P. C. (1988). Models of consumer satisfaction: An extension. *Journal of Marketing Research*, *25*(2), 204–212. doi:10.2307/3172652

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Umweltbundesamt (Ed.). (1997). *Nachhaltige Konsummuster und postmaterielle Lebensstile*. Berlin

Voigt, K. (2006). Business sees green in going green (CNN Report).

Wier, M., & Anderson, L. M. (2003). Demand for organic foods: Attitudes, values and purchasing behaviors. *Newsletter from Danish Research Center Farming*, *2*, 1–3.

KEY TERMS AND DEFINITIONS

Green Behavior: A pro-environmental behaviour, people being good administrator of natural resources.

Green Customer Satisfaction: A state which results from the green consumption experience, including: green product satisfaction, companies reputation and image satisfaction, and less harmfulness satisfaction.

Green Dimension: A new category proposed in order to model the customers' satisfaction. The main elements need to be had in sight are: superior energetic class, renewable energy, low polluting level, products with biodegradable compounds, organic food.

Green Product: An ecological product. It's manufacturing process and its use does not generate negative environmental effects.

Green Strategy Mix: A strategic system which integrates Planning Strategy, Processes Strategy, Product Strategy, Promotion Strategy, People Strategy, and Eco-Efficiency Strategy.

Sustainable Consumption: A consumption model which seeks to preserve resources for future generations to be able to satisfy their needs.

Sustainable Development: A concept "that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland Commission, 1987, Report of the World Commission on Environment and Development, United Nations). It includes economic development, social development and environmental protection.

This research was previously published in Green Economic Structures in Modern Business and Society edited by Andrei Jean-Vasile, Ion Raluca Andreea, and Turek Rahoveanu Adrian, pages 61-86, copyright year 2015 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 9
Green Marketing in India:
A Theoretical Perspective

Ajit Kumar Shukla
Mahatma Gandhi Kashi Vidyapith, India

ABSTRACT

Green marketing is the study of all efforts to consumer, produce, distribute, promote, package and reclaim products in a manner that is sensitive or responsive to ecological concerns. As consumers, we simply don't think about it on a day-to-day basis because the message does not surround us. Most of us did not grow up in a resource starved environment and so the implications of wastefulness have had no direct repercussions on our daily lives. We acknowledge the issue is out there and demonstrate concern for what is being done to improve our collective condition but beyond recycling or an interest in non-toxic HH cleaning products, we simply don't have access to green products or services, let alone do we have an understanding for how to evaluate their functionality or benefit- to us or the environment. In the present study narrows down on one specific area and that is to measure the awareness level of the customers with reference to the green marketing.

INTRODUCTION

The term green marketing generally sends shivers down to our spine. Still very much in its nascent years, the term has developed enough baggage to seemingly constrain it to a niche audience. However, all macro trends start in a micro-fashion and green marketing has both a global scientific grounding and non-debatable symbolic characteristics finding it. That is to say that green marketing has a clear and substantive role in driving forward the dialogue and demand for sustainable products and services, which ultimately will influence real change in the marketplace with long term implications for our resource consumption and environmental preservation. Green Marketing refers to holistic marketing concept. It comprises the planning, development and promotion of products or services that satisfy the needs of consumers for quality, output, accessible prices and service, without however a negative effect on the environment, with regard to the use of raw material, the consumption of energy etc.

DOI: 10.4018/978-1-5225-7915-1.ch009

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Prothero & Fitchett (2000) argue that greater ecological enlightenment can be secured through capitalism by using the characteristics of commodity culture to further progress environmental goal. Marketing not only has the potential to contribute to the establishment of more sustainable forms of society but, as a principle agent in the operation and proliferation of commodity discourse, also has a considerable responsibility to do so.

Karna, Hansen, & Juslin (2003) interpret that proactive marketers are the most genuine group in implementing environmental marketing voluntarily and seeking competitive advantage through environmental friendliness. The results also give evidence that green values, environmental marketing strategies, structures and functions are logically connected to each other as hypothesised according to the model of environmental marketing used to guide this study.

Sanjay K. Jain & Gurmeet Kaur (2004) in their study environmentalism have fast emerged as a worldwide phenomenon. Business firms too have risen to the occasion and have started responding to environmental challenges by practicing green marketing strategies. Green consumerism has played a catalytic role in ushering corporate environmentalism and making business firms green marketing oriented. Based on the data collected through a field survey, the paper makes an assessment of the extent of environmental awareness, attitudes and behavior prevalent among consumers in India.

Donaldson (2005) in his study realized in the Great Britain initially concluded that in general the ecological attitude of consumers changed positively. This study reported the strong faith of consumers in the known commercial brands and in the feeble behaviour referring to the "green" claims, which was the main cause behind the consuming failure to interpret their concerns beyond the environment in their behavior.

According to the American Marketing Association, green marketing is the marketing of products that are presumed to be environmentally safe. Thus green marketing incorporates a broad range of activities, including product modification, changes to the production process, packaging changes, as well as modifying advertising. Yet defining green marketing is not a simple task where several meanings intersect and contradict each other; an example of this will be the existence of varying social, environmental and retail definitions attached to this term.

William J. Stanton (1986) manifests, 'Green Marketing is any marketing activity of an institution that is intended to create a positive impact or to lessen the negative impact of a product on the environment in order to capitalize on consumer's concerns about environmental issues. It encompasses everything from using recycled material in making a product to claim on advertising or on package labels.'

Thus, Green Marketing is the movement by companies to develop and market environmentally responsible products. Other similar terms used are Environmental Marketing, Ecological (Eco) Marketing, Eco-centric Marketing, Environmentally Responsible Marketing, and Responsible Marketing.

OBJECTIVE OF THE STUDY

The main objectives of the study are as following:

1. To throw light on the awareness levels of the customer in the various age groups regarding their understanding about green marketing in India particularly in Uttar Pradesh.
2. To elaborate the awareness levels of the customer in the various geographical areas regarding their understanding about green marketing in India particularly in Uttar Pradesh.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

RESEARCH HYPOTHESIS

The following Null hypothesis has been tested as a part of research:

HO1: There is significant difference in the awareness levels of the customers in the various age groups regarding the green marketing.

HO2: There is significant difference in the awareness levels of the customers in the various geographical areas regarding the green marketing.

RESEARCH METHODOLOGY

The study has been exploratory in nature and a sample survey method has been employed for data collection. Primary data is used for the purpose of the study. Research design for this research is planned structure and strategy of investigation conceived so as to obtain answers to research question or objectives and also to control variances. The said study is conducted to understand the behaviour of the customers in Uttar Pradesh while purchasing an environment friendly car and also to understand their willingness to pay more in case the environment friendly car cost more. The scope of the research is limited to environment friendly car in Uttar Pradesh.

Sampling Design

In the present study, all the cars owners or prospective car buyer in Uttar Pradesh is considered as the population. The prospective car owners could be all those people who intend to buy a car in near future or are visiting the car showroom for a test drive or for collecting the information of the cars.

The Sample

The sampling plan used has been consistent with the methodological guidelines provided for conducting survey research in marketing. The stratified random sampling technique was used for the present work. A sample of 500 respondents was selected with the help of stratified random sampling method. The sample has been chosen at selected dealers of cars in big cities e.g. Varanasi, Lucknow, Kanpur, Ghaziabad, Aligarh, Meeruit, Allahabad, Jhansi, Gorakhpur etc. and few small cities i.e. Mirzapur, Gazipur, Ballia, Muradabad, Bareily, Sultanpur, Etawah, Saharnpur, Rampur, Faizabad, Jaunpur etc. in Uttar Pradesh. These included prospective car buyers and people who came to buy their next car. The sample consisted on the basis of demographical variables such as, qualification, and place of stay.

Data Collection Tools

A non-disguised structured questionnaire has been used as the tools for collection of data from the field. It has been designed with utmost care so that accuracy of the work could be high. The five point Likert scale has been used for the research purposes. A pilot study was undertaken first in order to determine whether the questionnaire and the scale is easily understood and responded to by the respondents.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Data Collection Process

A pilot study was also undertaken to pretest the questions in order to determine whether they are easily understood and responded to by the respondents. The automobile dealers were selected in both metros and non-metros as the ideal place for identifying the respondent who would be interested in buying a car. The people who had already owned cars or who are thinking of buying a car and have approached the showroom of a car dealer for buying a car have been considered as potential respondents. Data was collected with the help of the structured questionnaire has been tabulated, analyzed and interpreted using suitable statistical tools including the t test, and simple percentages. Tables have facilitated the representation of the data. The data was analyzed using the SPSS (Statistical Package for Social Sciences) While constructing the questionnaire researcher has made every effort to take the view of the prospective buyers towards the manufacturer. The flow of the questions is from the most general topic about the basic awareness on pollution by automobiles, carpooling, use of public transport etc. to set the flow of the respondent. Customer's expectation from the government is also being measured as a part of the study. Role of the regulator and legislation which can prompt customers to buy EFC is also explored in the questionnaire. The various factors which are important in buying a car have been carefully considered after discussing with the buyers and the sellers in the market place. Customers were expected to rank these factors in the order of their preference. Environment friendly design has also been considered as a factor to understand where this factor stands in the order of the preference while buying the EFC. The reliability of the scale was checked with the sample size as 100, which is 20 percent of the total sample size. All the filled up questionnaires have been screened for completeness and the ones in which responses of all the statements have been complete, were selected for analyses. The questionnaires incomplete in any respect were rejected.

GREEN PRODUCTS AND ITS CHARACTERISTICS

The products those are manufactured through green technology and that caused no environmental hazards are called green products. Promotion of green technology and green products is necessary for conservation of natural resources and sustainable development. We can define green products by following measures:

- Products those are originally grown,
- Products those are recyclable, reusable and biodegradable,
- Products with natural ingredients,
- Products containing recycled contents, non-toxic chemical,
- Products contents under approved chemical,
- Products that do not harm or pollute the environment,
- Products that will not be tested on animals,
- Products that have eco-friendly packaging i.e. reusable, refillable containers etc.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

MARKETING MIX OF GREEN MARKETING

When companies come up with new innovations like eco friendly products, they can access new markets, enhance their market shares, and increase profits. Just as we have 4Ps- Product, Price, Promotion and Place in marketing, we have 4ps in green marketing too, but they are a bit different. They are buttressed by additional Ps, namely People, Physical Evidence, Process, Probe, Politics, Penetration, Plan, Positive Implementation, Priority, Partition, Public Relations, Packaging, Performance, Power, Precedent, Perception, Participation, Profit, Position, Peerless, Productivity and Planet.

1. **Product:** The term is applied to systems and products that save energy directly or indirectly. It describes a product that meets on of these criteria: (1) It has qualities that will protect the environment. (2) It has replaced artificial ingredients with natural ingredients e.g. Organic products, Paperless transactions. The marketer's role in product management includes providing product designers with market-driven trends and customer requests for green product attributes such as energy saving, organic, green chemicals, local sourcing, etc., For example, Nike is the first among the shoe companies to market itself as green
2. **Price:** Green pricing refers to an optional utility service that enables customers of traditional utilities to support a greater level of utility investment in renewable energy by paying a premium on their products via electronics medium. Green pricing takes into consideration the people, planet and profit in a way that takes care of the health of employees and communities and ensures efficient productivity.
3. **Promotion:** A specific type of promotion that is centered around the factors having to do with the environment. Often times the companies that use green promotion also use very environmentally friendly operations and product packaging as well. Green promotion involves configuring the tools of promotion, such as advertising, marketing materials, signage, white papers, web sites, videos and presentations by keeping people, planet and profits in mind.
4. **Place:** Green Place practices and strategies that reduce the environmental and energy footprint of freight distribution. It focuses on material handling, waste management, packaging and transport Green place is about managing logistics to cut down on transportation emissions, thereby in effect aiming at reducing the carbon footprint.

SIGNIFICANCE OF GREEN MARKETING

Green marketing offers business bottom line incentives and top line growth possibilities. While modification of business or production processes may involve start-up costs, it will save money in the long term. For example the cost of installing solar energy is an investment in future energy cost savings. Companies that develop new and improved products and services with environmental impacts in mind give themselves access to new markets, substantially increase profits and enjoy competitive advantages over those marketing non environmental responsible alternatives. Issues like Global Warming and depletion of ozone umbrella are the main for the healthy survival. Every person rich or poor would be interested in quality life with full of health and vigor and so would the corporate class. Financial gain and economic profit is the main aim of any corporate business. But harm to environment cost by sustain business across the

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

globe is realized now though off late. This sense is building corporate citizenship in the business class. So green marketing by the business class is still in the selfish anthological perspective of long term sustainable business and to please the consumer and obtain the license by the governing body. Industries in Asian countries are catching the need of green marketing from the developed countries but still there is a wide gap between their understanding and implementation.

CHALLENGES IN GREEN MARKETING

Need for Standardization

It is found that only 5% of the marketing messages from "Green" campaigns are entirely true and there is a lack of standardization to authenticate these claims. There is no standardization currently in place to certify a product as organic. Unless some regulatory bodies are involved in providing the certifications there will not be any verifiable means. A standard quality control board needs to be in place for such labeling and licensing.

New Concept

Indian literate and urban consumer is getting more aware about the merits of Green products. But it is still a new concept for the masses. The consumer needs to be educated and made aware of the environmental threats. The new green movements need to reach the masses and that will take a lot of time and effort. By India's Ayurveda heritage, Indian consumers do appreciate the importance of using natural and herbal beauty products. Indian consumer is exposed to healthy living lifestyles such as yoga and natural food consumption. In those aspects the consumer is already aware and will be inclined to accept the green products.

Patience and Perseverance

The investors and corporate need to view the environment as a major long-term investment opportunity, the marketers need to look at the long-term benefits from this new green movement. It will require a lot of patience and no immediate results. Since it is a new concept and idea, it will have its own acceptance period.

Avoiding Green Myopia

The first rule of green marketing is focusing on customer benefits i.e. the primary reason why consumers buy certain products in the first place. Do this right, and motivate consumers to switch brands or even pay a premium for the greener alternative. It is not going to help if a product is developed which is absolutely green in various aspects but does not pass the customer satisfaction criteria. This will lead to green myopia. Also if the green products are priced very high then again it will lose its market acceptability.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

STRATEGY FOR GREEN MARKETING

Marketing Strategy decision plays a vital role in designing the low waste product systems that serve as pollution abatement mechanisms.

The marketing strategies for green marketing include:

- Marketing Audit (including internal and external situation analysis)
- Implement marketing strategies
- Develop a marketing plan outlining strategies with regard to 4Ps
- Plan results evaluation
- Challenges ahead
- Green products require renewable and recyclable material, which is costly
- Requires a technology, which requires huge investment in R&D
- Water treatment technology, which is too costly
- Majority of the people are not aware of green products and their uses
- Majority of the consumers are not willing to pay a premium for green products.

PRESENT TRENDS IN GREEN MARKETING IN INDIA

Organizations believe they have a moral obligation to be more socially responsible. This is in keeping with the philosophy of CSR which has been successfully adopted by many business houses to improve their corporate image. Firms in this situation can take two approaches:

- Use the fact that they are environmentally responsible as a marketing tool.
- Become responsible without prompting this fact. Governmental Bodies are forcing Firms to become more responsible. In most cases the government forces the firm to adopt policy which protects the interests of the consumers. It does in following ways:
- Reduce production of harmful goods or by products
- Modify consumer and industry's use and /or consumption of harmful goods; or
- Ensure that all types of consumers have the ability to evaluate the environmental composition of goods.
- A Firm develops a technology for reducing waste and sells it to other firms.

There are many institutions/organizations which are busy to protect environment by various means. Some of them are following:

- **State Bank of India:** SBI is entered into green service known as "Green Channel Counter". SBI is providing many services like; paperless banking, no deposit slip, no withdrawal form, no checks, no money transactions form, All these transaction are done through SBI shopping & ATM cards.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- **Patanjali Ayurved Ltd.:** Patanjali Ayurved Ltd. uses maximum green vegetables and herbs in its medicines and also uses green colour in its packaging to make awareness among the people about environment.
- **McDonald's:** McDonald's restaurants use paper tray, paper glass, paper cup, paper bag during their services.
- **Indian Oil's Green Agenda Green Initiatives:** Indian Oil is fully geared to meet the target of reaching EURO-III compliant fuels to all parts of the country. Major cities will upgrade to Euro-IV compliant fuels by that time.
- **Wipro's Green Machines:** Wipro Infotech was India's first company to launch environment friendly computer peripherals. For the Indian market, Wipro has launched a new range of desktops and laptops called Wipro Greenware.
- **Going Green: Tata's New Mantra:** Tata Motors is setting up an eco-friendly showroom using natural building material for its flooring and energy efficient lights. Tata Motors said the project is at a preliminary stage. The Indian Hotels Company, which runs the Taj chain, is in the process of creating eco rooms which will have energy efficient mini bars, organic bed linen and napkins made from recycled paper.
- **BSNL:** Bharat Sanchar Nigam Limited provides rebate to the customers who make payments via electronic mediums. Thus, BSNL encourages paperless activities.
- **Nike:** Nike is the first among the shoe companies to market itself as green. It is marketing its Air Jordan shoes as environment-friendly, as it has significantly reduced the usage of harmful glue adhesives.
- **CNG in Delhi:** Introduction of Compressed Natural Gas (CNG) in Delhi, was being polluted at a very fast pace until Supreme Court of India forced a change to alternative fuels. In 2002, a directive was issued to completely adopt CNG in all public transport systems to curb pollution.

THE FUTURE OF GREEN MARKETING

There are many lessons to be learned to be learned to avoid green marketing myopia, the short version of all this is that effective green marketing requires applying good marketing principles to make green products desirable for consumers. The question that remains, however, is, what is green marketing's future? Business scholars have viewed it as a "fringe" topic, given that environmentalism's acceptance of limits and conservation does not mesh well with marketing's traditional axioms of "give customer what they want" and "sell as much as you can" .Evidence indicates that successful green products have avoided green marketing myopia by following three important principles:

Consumer Value Positioning

- Design environmental products to perform as well as (or better than) alternatives.
- Promote and deliver the consumer desired value of environmental products and target relevant consumer market segments.
- Broaden mainstream appeal by bundling consumer desired value into environmental products.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Calibration of Consumer Knowledge

- Educate consumers with marketing messages that connect environmental attributes with desired consumer value.
- Frame environmental product attributes as "solutions" for consumer needs.
- Create engaging and educational internet sites about environmental products desired consumer value.

Credibility of Product Claim

- Employ environmental product and consumer benefit claims that are specific and meaningful.
- Procure product endorsements or eco-certifications from trustworthy third parties and educate consumers about the meaning behind those endorsements and eco certifications.
- Encourage consumer evangelism via consumers social and internet communication network with compelling, interesting and entertaining information about environmental products.

DO THIS

We have to use the following activities in our daily routine of life.

- less use of polythene
- crush plastic bottle after use
- use disposable items
- love nature
- save water
- save fuel
- avoid smoking
- many more

CONCLUSION

Green Marketing is a lifestyle change that will help in your business contribution . The study investigates the awareness levels of the customer in the various age groups regarding their understanding about eco-friendly car. The results of study indicate that there is no significant difference in the awareness of the respondents for environment friendly car with reference to the two age groups which was considered in the research. Study also examines the awareness levels of the customer in the various geographical areas regarding their understanding about eco-friendly activities. The results of the study show that customer who responded were either from the big cities or small cities in Uttar Pradesh. There is a significant difference in the awareness level of the customer in big cities and small cities. The results indicate that

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

awareness level of the respondents is higher in big cities as compared to the small cities in Uttar Pradesh for environment friendly activities.

There is a need to increase the awareness levels in small cities metros of Uttar Pradesh by the marketers, media houses, and government. Population wise there exists a big potential in rural districts of the state and if one has to really make the impact of the pollution less than focus should be rural parts. Currently the scene is not very bad from the rural front but before it gets the same level of pollution in the rural Uttar Pradesh, it is suggested that preventive steps to be taken right from now to create the right level of awareness amongst the rural population about the protection of the environment. Marketers concerned with environmental impact may benefit from a better understanding of green marketing strategies and tactics to enable the firm to appeal to a greater extent to consumers with similar concerns.

REFERENCES

Dahlstrom, R. (2011). *Green Marketing, Theory, Practice and Strategies*. Delhi: Cengage Learning India Private Ltd.

Donaldson, R. H. (2005). Green brands. *Greenleaf Publishing*, *24*(8), 14–17.

Hansen, A., & Machin, D. (2008). Visually Branding the Environment: Climate Change as Marketing Opportunities. *Discourse Studies*, *10*(6), 777–794. doi:10.1177/1461445608098200

Henion, K. E. (1976). *Ecological Marketing*. Grid Columbus Ohio.

Karna, J., Hansen, E., & Juslin, H. (2003). Social Responsibility in Environmental Marketing Planning. *European Journal of Marketing*, *37*(5/6), 848–873. doi:10.1108/03090560310465170

Kotler, P., Brown, J., & Makens, J. (2002). *Marketing for Hospitality and Tourism*. Delhi: Pearson Education.

Kotler, P., & Keller, K. L. (2013). *Marketing Management* (14th ed.). Delhi: Pearson.

McDaniel, S W., David H. R (1993). Strategic Green Marketing. *Journal of Consumer Marketing*, 10(3), 4-10.

Ottman, J. A. (2011). *The New Rules of Green Marketing, Strategies, Tools, and Inspiration for Sustainable Branding*. U.K.: Greenleaf Publishing.

Peattie, K., & Crane, A. (2005). Green Marketing: Legend, Myth, Farce or Prophesy? *Qualitative Market Research: An International Journal*, *8*(4), 357–370. doi:10.1108/13522750510619733

Prothero, A. (1998). Green Marketing: The 'Fad' That Won't Slip Slide Away. *Journal of Marketing Management*, *14*(6), 507–513. doi:10.1362/026725798784867680

Prothero, A., & Fitchett, J. A. (2000). Greening Capitalism: Opportunities for Green Community. *Journal of Macromarketing*, *20*(1), 46–56. doi:10.1177/0276146700201005

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Sanjay, K.Jain & Gurmeet Kaur. (2004). Green Marketing: An Attitudinal and Behavioural *Analysis of Indian Consumers, Global*. *Business Review (Federal Reserve Bank of Philadelphia)*, *5*(2), 187–205.

Shukla, A. K. (2013). *Marketing Management* (2nd ed.). Varanasi: Vaibhav Laxmi Prakashan.

This research was previously published in International Perspectives on Socio-Economic Development in the Era of Globalization edited by Saurabh Sen, Anshuman Bhattacharya, and Ruchi Sen, pages 168-177, copyright year 2016 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 10
Eco-Friendly Culpabilities of Modern Corporates on Ecological Marketing: An Overview

Thangasamy Esakki
Poompuhar College (Autonomous), India

ABSTRACT

Modern marketing is consumer-oriented. However, very often, for immediate gains, many corporates surpass the ecological value. Gradually, the importance of ecology is grasped among the corporates in the modern marketing environment. This gave a birth to green marketing which is safe to the consumers and highly profitable to the corporates simultaneously. Thus, a systematic investigation into the emerging phenomena of ecological marketing and the modern corporates' responsibility becomes the need of the hour universally. In this context, the objectives of this study are to present a detailed conceptual framework of Green marketing and its impact on environment, to highlight the Green Marketing initiatives undertaken by the selected modern corporates, encompassing some prominent banking companies, to analyze the benefits accruing out of the eco-friendly responsibilities shouldered by the corporates, and to suggest measures to the corporates to perform better in the context of sustainable marketing.

INTRODUCTION

Before we pronounce about Green Marketing, it is appropriate to understand the term 'Green' in the context of Green Marketing. Green is the indication of purity. It means pure in quality and fair or just in dealing. For instance, if we talk about green advertising, it refers to advertising without an adverse impact on society.

Thus, Green Products are naturally durable, non-toxic, made from recycled materials or minimally packaged. Of course, there are no absolutely green products, for they all utilize energy and resources and create by products and emissions during their manufacture, transport to warehouses and stores, usage and eventual disposal. Hence, the term, 'Green', is relative describing those products with less impact on the environment than their alternatives.

DOI: 10.4018/978-1-5225-7915-1.ch010

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Green Marketing refers to the marketing of products which are environmentally preferable to the consumers presumably. In other words, it is the process of selling products and/or services based on their environmental benefits. Such products may be environmentally friendly in itself or produced/and/or packaged in an environmentally friendly way. Green marketing, thus, incorporates a broad range of activities, including product modification, changes to the product process, packaging changes, as well as modifying the advertising strategy. It concerns with three aspects, viz:

1. Promotion of production and consummation of pure or quality products,
2. Fair and Just dealing with customers, and
3. Protection of ecological environment.

However, it is not very easy define 'Green Marketing' multiple meanings intersect and contradict each other. Green Marketing is also known as 'Environmental Marketing and Ecological Marketing.

GREEN MARKETING AND ITS ORIGIN: CONCEPTUAL FRAMEWORK

The term 'Green Marketing' emerged as an important phenomena during the period 1980-1990. In the year, 1975, the American Marketing Association (AMA) conducted its first workshop on 'Ecological Marketing'. The proceedings of the workshop gave the birth of a book for the first time on Green Marketing entitled 'Ecological Marketing'. The CSR (Corporate Social Responsibility Report) initiated with an ice cream seller Ben & Jerry, supplemented by a greater view on the company's environmental impact.

Subsequently, in the year 1987, the World Commission on Environment and Development defined the sustainable development as meeting ' the needs of the present without compromising the ability of future generations to meet their own need'. Later, it was known as the Brundtland Report which stimulated thinking further on sustainability in every day's activity.

During the past decade, it was witnessed that harnessing consumer power to effective positive environmental change is far easier said than done. The 'Green Consumer' movements in the United States of America (USA) and other country have struggled to reach critical mass and the minds of the forefront shoppers. When public- opinion-polls conducted since 1990 revealed a consistency that a substantial percentage of consumers in the United States confessed a strong willingness to favour environmentally conscious products and companies, consumers' efforts to do so in real life have remained sketchy at best.

Definitions on Green Marketing

- **American Marketing Association:** 'Green Marketing is the marketing of products that are presumed to be environmentally safe'.
- **Polonsky B. (1994):** Defines Green marketing as all activities designed to generate and facilitate any exchanges intended to satisfy human needs or wants, such that the satisfaction of these needs and wants occurs, with minimum detrimental impact on the natural environment'.
- **Pride & Perel (1993): '**Green marketing, also alternatively known as environmental marketing and sustainable marketing, refers to an organization's efforts at designing, promoting, pricing, and distributing products that will not harm the environment'.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- According to *Joel Makower*, a writer on Green Marketing, one of the prominent challenges of green marketing is lack of standards or public consensus about what constitutes 'Green'. Often, companies are highly reluctant to promote their green attributes whereas consumers of cynical about their claims, as being observed in reality.

Attributes of Sustainable Marketing

Green products are those products which are produced through green technology. Such products cause no environmental hazards. In order to conserve natural resources to ensure sustainable development, promotion of green technology and green products is the need of the hour. We may define the green products if they have any of the following characteristics:

- They are originally grown.
- They are recyclable, reusable and biodegradable.
- They are not to be tested on animals
- They contain natural ingredients.
- They have eco-friendly packaging i.e. reusable, refillable containers etc.
- They contain recycled contents, non-toxic chemical.
- They do not harm or pollute the environment.
- They contain only approved chemical and limits.

Green Marketing: Golden Rules and Ethical Issues

The following are the golden rules of Green Marketing:

- **Knowing the Customers:** It is to be ensured that the customer is aware of the issues that the company's products attempt to address.
- **Educating the Customers:** It should be an obligation of a company that it should educate its customers about what a company is striving for to protect the environment and how does it influence it. Or else, the green marketing campaign of a company will go in vain.
- **Ensuring Transparency:** There should a transparency in implementing the company's policies on green marketing. A gap between what a company claims for and what it does should be not too wide. The company should also make environmental-friendly policies consistently without which any green marketing programme will fail in the target market.
- **Assurance to Buyers:** The customers are to be assured that the company will not dilute the quality of the products while attempting to make eco-friendly products.
- **Appropriate Pricing:** If any premium is charged for the eco-friendly products, appropriate pricing strategy should be adopted in such a way that the consumers can afford the price of the product.
- **Customers' Participation:** The company must extend adequate opportunity to its customers in its eco-friendly initiatives by their participation.
- **Meeting Customers' Expectations:** The company must position its products according to the changing tastes and preferences or expectations of its customers while offering green products.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Ethics is about what is right and wrong and who we arrive at such judgement. It deals with questions of absolute values, and their application in the real world. Ethical issues are an important consideration in controlling marketing strategies.

Green Pressure on Business

The Green pressure on a business is outlined as under:

- Pressure for better environmental performance is coming from many quarters.
- Consumers are demanding a better environmental performance from companies – in recent surveys, it has been demonstrated that around three-quarters of the population are applying environmental criteria in many purchase decisions.
- Green pressure groups have increased their influence dramatically.

Challenges of Green Marketing

The following may be considered as some of the key challenges of sustainable marketing:

- Currently, there is no standardization to certify a product as organic. Hence, a regulatory body has to be established to certify as green products. Besides, a Standard Quality Control Board should be vested with the task of granting labeling and licensing.
- Consumers must be educated about the benefits of green marketing and environmental threats. However, it will consume considerable time to reach the masses.
- The companies should not anticipate immediate profits through green marketing which may yield its results in the long run. Therefore, it needs a lot of perseverance and patience for such corporates.
- Normally, the green products are priced high which may create green marketing myopia among the consumers.

It is, therefore, apparent that it is not very easy to adopt green marketing strategy which necessitates constant monitoring to succeed for a firm in its marketing endeavor.

Impact of Green Marketing

As should be clear, there are strong reasons for bringing the environment into the business equation, but the strongest reasons is the consumer. The ‘green consumer’ must be the driving force behind changes in marketing and business practice.

- Green consumption can be defined as the decisions related to consumer choice which involves environmentally-related beliefs.
- There is increasing evidence of the importance of this market.
- Surveys which indicate increased levels of environmental awareness and concern.
- Increasing demand for, and availability of, information on environmental issues, Green product concepts and green substitute products.
- Value is shifting from consumption to conservation.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- Effective PR and marketing campaigns by environmental charities and causes.

The impact of Green Marketing can be realized in the following ways;

- People started demanding green products such as fruits, vegetables, edible items etc.
- Reduction in use of plastics and plastic-based products.
- There is an increase in consumption of herbal products, rather than the use of processed products.
- Increase in use of leaves instead of plastic, jute and cloth bags.
- There is an increase in use of bio-fertilizers.
- Recycling of wastes of consumer and industrial products.
- People prefer to use herbal medicines, natural therapy, and Yoga.
- Strict legislations for protecting forests, flora and fauna, wildlife, etc. from pollution.
- Restrictions on production and use of harmful weapons, atomic tests, etc.
- Increasing emphasis on social and environmental accountability of manufacturers/marketers.
- Strict norms for pollution control.
- 05th June has been declared as the World Environment Day.
- Prevalent legal provisions for restricting duplication or adulteration.
- Setting up of multifarious national and international agencies for constant monitoring of business firms with regard to pollution control and production of eco-friendly commodities.

Green Marketing is needed due to various reasons which include Social Responsibility, Governmental Pressure, Competitive Pressure, Cost Issue, and Opportunity.

Green Marketing Contexts

- Manufacturers of consumer goods may be seen as ‘enemies’.
- Damaging the environment or social institutions to meet consumer demand.
- Producing ‘dirty’ products is increasingly becoming unacceptable.
- Using up scarce and/or environmentally significant raw materials is also an issue.
- Some manufacturers are already making products which contribute to environmental improvements (biodegradable packing, for instance) while large manufacturers are under pressures to act in a socially responsible manner because of their size and social prominence.

Marketing Environment

In general, society is concerned with ecology and the need for preserving the environment from further human pollution. Business and Industry are the leading contributors to the environmental pollution. However, marketers are not accountable and answerable. Packaging is the pollutant feature of marketing. The marketers use packaging to differentiate the brands and buyers’ preferences for butter, cream, cheese etc. They use disposable products also. Since paper napkins replace cloth napkins, this requires disposal. It can be noticed that the disposable drinking cups, beverages etc. add considerably to environmental pollution due to marketing operations.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Marketing and Society

Marketing is no longer an activity confined to the exchange of products and services in the conventional sense. It has become highly versatile with the passage of time. The modern marketing concept may therefore be viewed as a philosophy of service and mutual gain. All marketers may not follow the marketing concept. Business is marketing and in turn marketing is business. A business firm can be considered as an economic institution of society and the businessmen and marketers are the members of society. Their actions and performance are focused on the consumers who are also members of the society. Business is therefore something which has social implication. Society-oriented marketing is a basic necessity rather than the marketing-oriented society. The objectives of the business and the marketing policies of business should be framed in such a way that would contribute liberally to the social well-being. In nut shell, Marketing and Society go hand in hand which are highly inter-reliant.

Influence of Society on Marketing

Political pressures and public opinion are the outcome of pleasure and displeasure of the society. According to Cundiff, "marketers have not often bothered to investigate society's reaction to their marketing practices. Society has often taken the initiative in communicating its displeasure through various forms of social pressure against offenders. The mildest form of social pressure is public opinion aimed at causing the offending marketers to change their ways. When public opinion does not accomplish the desired result, stronger action takes the form of political pressure, with an implied threat of ultimate legal action to force the offender to abide by society's wishes. And the strongest form of social pressure is restrictive legislation outlawing the unpopular product or marketing activities."

Social Responsibility and Sustainability

Green Marketing is founded on two main ideas; one is a response to and responsibility for the community; the other is sustainability. Sustainability involves developing strategies so that the company uses resources at a rate which allows them to be replenished. At the same time, emissions of waste are confined to levels which don not exceed the capacity of the environment to absorb them. In relation to the development of the world's resources, some policies are based on sustainability.

The following benchmarks must unfailingly be maintained in focus:

- Pursue equity in the distribution of resources.
- Maintain the integrity of the world's ecosystems.
- Increase the capacity of human populations for self-reliance.

Social Responsibility of Business

Social Responsibility means an intelligent and objective concern for the welfare of society that limits or prevents corporate behavior from destructive activities-unfair practices. Such destructive activities may be immediately profitable to business but they cannot be tolerated by the society.

These days, modern business is very large and complex, catering to the emerging needs of the national and international markets. It exercises a definite and extensive influence on our economic and social

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

life styles. As a social unit, marketing is responsible to deliver a standard of living and a standard of life-style consumers. Modern business should have the approval of society to function successfully. In the current world, the expectation of a society is much more from business as compared with the past. In fact, society demands quality of life management, integrated business plans and controls are expected to act as instruments of social transformation and such plans are to be implemented for enhancing the social public welfare. Modern business must also demonstrate social awareness or sensitivity and social performance.

Social Criticism of Marketing

In fact, business firms base their marketing decisions largely on immediate profit earning. Philip Kotler states that a firm should earn a satisfactory level of profit, no doubt, but it must also assume its social responsibility as a member of society. Further he says that a firm's profit must be harmonized with society's interest and wellbeing. Most of the companies did not group or embrace the social marketing concept until driven to it by circumstance. If we consider the sale of cigarettes, companies are customarily free to sell cigarettes and smokers are free to buy them.

Regulatory Bodies and Environmental Safety

The following are some of the prevalent regulatory bodies to ensure environmental safety and protection:

- Occupational Safety and Health Act (OSHA).
- Comprehensive Environmental Respond Compensation Liability Act (CERCLA).
- Toxic Substance Control Act (TSCA).
- The Hazardous Materials Transportation Act (HMTA).
- Federal Insecticide, Fungicide and Rodenticide Act (FIFRA).
- Federal Food, Drug and Cosmetic Act, Clean Air Act, Clean Water Act (FFDCA).
- Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

SIGNIFICANCE OF THE STUDY

A study on Green Marketing becomes very important and inevitable due to the following reasons:

- Increasing Production and Business activities are polluting the natural environment. It damages the people, wildlife, crops heavily.
- Optimal and efficient utilization of natural resources becomes inevitable due every growing human needs and wants. It entails the adoption of green marketing.
- Growing interest and concern among the people all over the world on the protection of environment stimulates thinking on green marketing. The consumers started changing their behavior patterns and the corporates also started producing eco-friendly products.
- To capitalize the opportunities and seize competitive advantage.
- To shoulder Corporate Social Responsibilities (CSRs).
- To adopt Green Marketing due to Governmental pressure.
- To emerge out of cost or profit issues.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

LITERATURE REVIEW

Many research studies have been undertaken on green marketing worldwide. Few of them have been presented below;

- Banerji J. & Amit Kumar D. (2014) have undertaken a study on Green Marketing: Necessity as well as Opportunity for Industries in current era'. Their study found that green marketing requires a lot of researches which should focus more on green corporate image rather than on mere environmental benefits.
- Kandavel D. (2013) has conducted a study on Green Banking Initiatives of the Commercial Banks in India which revealed that the green banks expand their operations rapidly. Hence, prudent and efficient management of such banks for growth become necessary .
- Sahitya U., & Lalwani V. (2014) investigated into 'Sustainability in Indian Banking Industry' whose study concluded that the adoption of green marketing enhances the image of the banks and also protects the environment to ensure overall growth.
- Sara., & Madhumita G., (2014) surveyed on Green Marketing: Companies Urging Towards Green Revolution whose study resulted that many companies have undertaken green marketing initiatives for creating brand image and gaining customers' attention.
- Yadwinder S., (2015) has researched on Environmental Management Through Green Banking': A Study of Commercial Banks in India' and found that the banks should use the information on environment extensively in its operations, credit extension and investment decisions to improve their environmental performance and create long term values.

RESEARCH METHODOLOGY

The present study is based purely on secondary data. It is descriptive in nature. There are 11 modern corporates, including 7 banking companies, 1 Paint Manufacturing Company, 2 IT companies, and Indian Railways taken as a sample for the study. In India, since the Government makes legislations for regulating the green marketing initiatives carried out by the corporates, the Ministry of Forests and Environment has also been taken into consideration for analysis.

The data was collected from the secondary sources which include Government Published documents, internet, books, magazines, journals etc. Then, the collected data was tabulated, edited, and analyzed for interpretations and also for drawing meaningful conclusions therefrom. Based on the interpretations, the responsibilities of the modern corporates have been presented as suggestive measures and recommendations for those corporates to strike a balance between the sustainable marketing and their ecological responsibilities by integrating their goals. Besides, based on their initiatives on green marketing, the anticipated accruing social benefits have also been presented to promote better understanding of the problem in question under this study.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

OBJECTIVES OF THE STUDY

The primary objectives of the study are as under:

- To present the conceptual framework of Green Marketing and its impact on Environment.
- To highlight the Green Marketing initiatives undertaken by the modern corporates, encompassing some prominent banking companies.
- To analyze the benefits accruing out of the eco-friendly responsibilities shouldered by the corporates.
- To suggest measures to the corporates to perform better in the context of sustainable marketing.

ECO-FRIENDLY INITIATIVES OF MODERN CORPORATES: AT A GLANCE

In general, corporates are of different types in nature which are innumerous throughout the world. Their production and marketing objectives do also vary from one to another, be it national or international/ global companies. They may exist and function in any part of the world like human beings, having different organizational structures. However, the purpose of their survival and existence remains the same, irrespective of their products or services what they produce or render in a society. Needless to say that it is not any other objective other than maximization of profit and wealth in the long run. All the business activities are, therefore, triggered upon by all the business corporates towards the objective of achieving their short term and long term goals universally. Many a times, it has been constantly witnessed that many corporates fail to protect the environment while they produce their products or render their services. Ultimately, those products benefit the society on one hand and cause environmental degradation on the other hand which, very often, result in irrecoverable damages to the environment. This indirectly affects adversely the social wellbeing.

Keeping the welfare of the society, the environmental degradation must be prevented and for this reason, all the consumers are being educated worldwide. In every nook and corner of the globe, including India, Governments have been enforcing laws through several regulatory bodies to monitor the green marketing endeavours undertaken by the corporates engaged in production of products or services. Accordingly, the corporates are accountable to change their marketing or service mix in accordance with the dynamic needs and wants of the consumers with green products, without polluting the environment.

As explained above, several modern corporates are undertaking green marketing projects. Here are the few instances of such projects undertaken by the modern corporates, as shown in Table 1.

Table 1 shows that the initiatives undertaken by the different Corporates/Ministry and the benefits accrue to the society in columns 3 and 4 respectively. The column 5 of the above table also reveals their responsibilities of the modern corporates, based on an analysis, so that both the producers and consumers will benefit without environmental degradations. There will be attractive returns to the corporates while ensuring green products to their consumers at affordable rates.

The present study finds from the overall analysis that most of the banking companies are more active in green marketing endeavours as compared with IT or Government companies.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 1. Eco-friendly initiatives of modern corporates

Sl. No.	Name of the Corporate/ Ministry/Department	Nature of Initiative	#Benefits to Society	#Suggestions/Solutions/ Recommendations
[1]	[2]	[3]	[4]	[5]
1.	Forest and Environmental Ministry of India	Ordered to the retail outlets not to provide polythene carry bags unless they are ready to pay for it.	Reduces the use of polythene bags and thereby environment protection is ensured.	Alternative bio-gradable products instead of polythene bags must be put at use. Strict legislations must be enforced.
2.	Indian Railways	• Permitted its customers to travel without printed versions of tickets. • Carrying their PNR numbers on their mobiles or Laptops is sufficient.	• Reduces the cost of printing and wastage of papers. • Eliminates the pollution arising out of dumping the waste printed tickets after use.	More innovative customers' eco-friendly products are to be launched to augment the benefits of green product.
3.	State Bank of India(SBI)	• Introduced Green Channel Counter, paperless banking through ATM cards and SBI shopping. • Launched green banking program in the form of wind project.	• The customers need not use withdrawal forms or cheque books for withdrawal of their deposits in the bank. • It reduces its carbon footprints. • Reduces the dependence on the polluting thermal power.	Product differentiations in the target market, keeping the importance of green marketing in tact, will be of greater use.
4.	IndusInd Bank	Introduced Solar-powered ATMs in Mumbai as a part of its 'Green Office Project'.	• Banks could save 1980 kw of energy annually. • Saved power bills for about Rs.20000/- per annum. • Replaced Diesel Generators with Solar Panels which reduced environmental pollution.	More Green Marketing projects will entail better eco-friendly environment.
5.	ICICI Bank	• Introduced numerous innovative concepts such as deep beneficiation of coal, coal bed methane etc. • Assisted companies to replace the conventional air conditioners with eco-friendly air-conditioners. • Organized sensitization programmes for the institutions, banks, government agencies etc. involved in project planning on issue like bio-diversity, wildlife habitats etc. • Introduced various eco-friendly schemes which include House Financing Schemes, Loan schemes for conveyances etc.	• It ensures conservation of wildlife and natural environment. • It prevents pollution of environment.	More sensitization programmes may be organizer, keeping the environmental responsibilities in view.
6.	Industrial Development Bank of India (IDBI)	• It has an exclusive team working on clean development Mechanism advisory services. • Launched refinance schemes for energy savings projects for small and medium scale sectors.	It ensures clean development and environment protection.	Constant monitoring of green marketing projects will promote the welfare of the community.
7.	Yes Bank	Taken community development initiatives such as clean and green drives, energy efficiency practices, workplace health and safety and development of local disaster management.	• Ensures good health and safety of the people at work place. • Reduces damages of lives and properties during the natural disasters.	Social security measures may be effectively integrated with its business venture profitably for sustainability.
8.	HDFC Bank	• Launched Green Banking by constituting an Environment Management Committee. • Worked on areas like alternate energy sources, watershed management, planting trees, formation of green clubs etc.	• Green Banking initiatives are environment-friendly in nature. • Conserves energy and provides a health environment to the society.	Product and service mix strategy will be more helpful to succeed in its green marketing endeavours.
9.	Bank of Baroda	Adopted environment-friendly systems in the design of the new data centre.	• Provides energy efficient and chiller-based HVAC design. • Ensures temperature monitoring.	Inter and Intra green initiatives promote the wellbeing of the bank and the environment as well.
10.	Kansai Narolac	Worked on removing hazard metals like chromium, mercury, lead etc. from their paints.	Prevents from adverse effects on humans by causing heavy damages to the central nervous system, kidneys, and reproductive systems.	Appropriate Marketing Mix may be designed.
11.	WiproInfotech	• Launched environmentally friendly computer peripherals for the first time in India. • Introduced a new range of laptops and desktops known as 'Greenware'.	It reduces e-waste in the environment.	Continuous market researches will help immensely to strike a balance between profit earning and environmental protection.
12.	*Toyota*	*Launched Prius Hybrid Vehicles*	*Unique style reflects the owner's passion for sustainability.*	*Product Differentiation will attract the consumers in the target market.*

Source: Secondary Data # Inference drawn from Analysis

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

LIMITATIONS AND FUTURE DIRECTIONS OF THE STUDY

The present study has used only secondary data. Overall extensive analysis on the green marketing initiatives undertaken by the modern corporates and their responsibilities, based on the availability of data, is made for drawing conclusion therefrom. Intensive case studies, on each company, will throw more light on their respective green marketing issues. Primary data will add more of its validity and reliability. Amongst innumerous corporates, only few IT companies and banking companies have been taken for the present study. Since the number in the universe containing the prospective corporates is indefinite, the researcher has selected only 11 companies and a single Ministry in India conveniently, based on the availability of data for analysis. This drawback can be overcome by a more detailed investigation by adopting case studies or survey method by using both the primary and secondary data. Under this study, analysis of the phenomenon of green marketing initiatives undertaken by the corporates is made on universal basis. The study touches only the key actions extensively. It does not therefore focus deeper into those initiatives and also on the initiatives of Indian companies in depth as well. All other companies producing consumer goods or rendering services are kept outside the purview of the study. Besides, the production of industrial goods does also adversely affect the environment, and therefore, they are not taken into account, as it is irrelevant to this current study. Further, there is a research gap in the present study in terms of information on green marketing norms, specific government legislations on green products, consumers' consumption patterns, satisfaction etc., along with the detailed analysis on the regulatory bodies of green marketing etc. It would be better a detailed study by analyzing all the aspects of the objectives set in the present study, by integrating the primary and secondary data will yield better results. Thus, the current study will provide more insight into the phenomenon of green marketing and pave a way for future direction for more researches. Further, it will not also fail to add some literature to the existing body of literature on environmental or green marketing.

CONCLUSION

Any business aims at maximization of profit. Modern marketing provides a key to the marketers to tap the profits by producing the products what the consumers want in the target market. Consumer satisfaction will entail good returns to a firm for its survival and growth in the long run. In the process of accomplishing its objective of satisfying the consumers profitably, environmental aspects cannot be ignored by the corporates. Simultaneously, the corporates must act responsibly in protecting the environment in general and the wellbeing of the consumers in particular. In this context, green marketing is the only solution in the contemporary society which will not pollute the environment. Thus, the ecological marketing ensures the charming of the people without harming the environment.

More innovative efforts should be called for achieving the broader goals of green marketing. Such efforts on sustainable marketing should be initiated by the corporates. Their implementation should be followed by strict monitoring by the regulatory bodies, to be established by the Government. Consumers should also be educated accordingly to extend cooperation with the corporates or Government, through suitable sensitization programmes periodically, to reap the benefits of ecological marketing together. Last but not the least, it is concluded that the sustainable marketing will succeed only with the joint responsibilities of corporates, consumers and the government in the days to come.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

REFERENCES

Banerji, J., & Amit Kumar, D. (2014). Green Marketing: Necessity as well as Opportunity for Industries in current era. *International Journal of Commerce, Business and Management, 3*(5).

Kandavel, D. (2013, December). Green Banking Initiatives of the Commercial Banks in India. *SIT Journal of Management*, *3*(2), 213–225.

Sahitya, U., & Lalwani, V. (2014). Sustainability in Indian Banking Industry: A Case Study Approach. *International Journal of Commerce, Business and Management, 3*(1).

Sara, & Madhumita, G. (2014). Green Marketing: Companies Urging Towards Green Revolution. *Asia Pacific Journal of Research*, *1*(13), 132–138.

Yadwinder, S. (2015). Environmental Management Through Green Banking: A Study of Commercial Banks in India. *International Journal of Interdisciplinary and Multidisciplinary Studies, 2*(4), 17-26.

ADDITIONAL READING

Bahl, S. (2012). The Role of Green Banking in Sustainable growth. International Journal of Marketing. *Financial Services & Management Research*, *2*(2), 27–35.

Bhardwaj, B. R., & Malhotra, A. (2013). Green Banking Strategies: Sustainability through Corporate Entrepreneurship. *Greener Journal of Business and Management Studies*, *3*(4), 180–193.

Biswas, N. (2011). Sustainable Green Banking Approach: The Need of the Hour. *Business Spectrum.*, *1*(1), 32–38.

Bonin, J. P., Hasan, I., & Wachtel, P. (2005). Bank performance, efficiency and ownership in transition countries. *Journal of Banking & Finance*, *29*(1), 31–53. doi:10.1016/j.jbankfin.2004.06.015

Gajender, S. (2010). *International Marketing Text and Cases*. New Delhi: Anurag Jain Publishers.

Grundey, D., & Zaharia, R. M. (2008). Sustainable incentives in marketing and strategic greening: The cases of Lithuania and Romania. *Baltic Journal on Sustainability*, *14*(2), 130–143.

Horne, R. E. (2009). Limits to labels: The role of eco-labels in the assessment of product sustainability and routes to sustainable consumption. *International Journal of Consumer Studies*, *33*(2), 175–182. doi:10.1111/j.1470-6431.2009.00752.x

Intini, F., & Kühtz, S. (2010). Recycling in buildings: An LCA case study of a thermal insulation panel made of polyester fiber, recycled from post-consumer PET bottles. *International Journal of Life Cycle Assessment*, *16*(4), 306–315. doi:10.100711367-011-0267-9

Janani, D., & Bindubashini, S. (2012). *New Paradigms of Management – Global Challenges For Managers in the 21st Century* (pp. 145–150). Chennai: Vijay Nicole Imprints Private Limited.

McDaniel, S. W., & Rylander, D. H. (1993). Strategic green marketing. Journal of Consumer Marketing. *MCB UP Ltd.*, *10*(3), 4–10.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Mendleson, N., & Polonsky, M. J. (1995). Using strategic alliances to develop credible green marketing. *Journal of Consumer Marketing MCB UP Ltd.*, *12*(2), 4–18. doi:10.1108/07363769510084867

Mishra, P., & Sharma, P. (2010). Green Marketing in India: Emerging Opportunities and Challenges. Journal of Engineering, Science and Management. *Education*, *3*, 9–14.

Montoro-Rios, F. J., Luque-Martinez, T., & Rodriguez-Molina, M.-A. (2008). How Green Should You Be: Can Environmental Associations Enhance Brand Performance? *Journal of Advertising Research*, *48*(December), 547–563. doi:10.2501/S0021849908080525

Sharma, N. (2011). CSR Practices and CSR Reporting in Indian Banking Sector. *International Journal of Advanced Economics and Business Management.*, *1*(2), 58–66.

Thombre, K. A. (2011). New Face of Banking: Green Banking. *Indian Streams Research Journal.*, *1*(2), 1–4.

KEY TERMS AND DEFINITIONS

Corporation: It is a business that is legally independent from its members. It may incur or pay debt, negotiate contracts, sue and be sued. It ranges in size from local retails stores to Ford Motor Company or the General Electric, the nation's largest corporation.

Environmental Pollution: It is the undesired spread of toxic chemicals into the aquatic and terrestrial habitats of the world. There are different types of pollution, usually named for the location that has become polluted.

Environmental Responsibility: It refers to the social responsibility or duty that a company has to operate in a way that it protects the environment.

Green Marketing: It refers to all the activities designed to generate and facilitate any exchanges intended to satisfy human needs or wants, such that the satisfaction of these needs and wants occurs, with minimum detrimental impact on the natural environment. It is also called as 'Ecological Marketing.

Marketing: It is the study and management of exchange relationships.

Marketing Environment: It refers to the factors and forces that affect a firm's ability to build and maintain successful relationships with customers.

Marketing Mix: It is a set of tools or actions or tactics that a company uses to promote its brand or product in the market. 4Ps make up the typical marketing mix – Price, Product, Promotion and Place.

Service Marketing Mix: It is also known as an 'Extended Marketing Mix' which is an integral part of service blue print design. Three additional marketing mix components needed are people, process and physical evidence. It is also called as '7Ps of Marketing Mix'.

Sustainable Marketing: It is the idea that the goods should be marketed in such a way that ensures that the future generations are not impacted.

This research was previously published in Green Marketing and Environmental Responsibility in Modern Corporations edited by Thangasamy Esakki, pages 164-182, copyright year 2017 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Section 2

Development and Design Methodologies

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 11
Consumer Values and Green Products Consumption in Malaysia:
A Structural Equation Modelling Approach

Brahim Chekima
Universiti Malaysia Sabah, Malaysia

ABSTRACT

To impede environmental deterioration and promote a more sustainable economy, one solution is to shift consumption from conventional to green products. However, inadequate information on how to promote consumers' green behavioral intention is slowing the growth of green markets and has become a barrier for when developing segments and communicating strategies for effective promotion of green products, in countries like Malaysia where the trend is new. This study attempts to examine consumers' green purchase intention motivational drivers and determine the moderating effect of education levels, gender and income. Structural Equation Modeling (SEM) technique was used to evaluate the causal model. The results suggest that cultural values and environmental advertising are the main influence in building green purchase intention while environmental knowledge is not significantly related. It also indicates that gender and education level have a significant positive moderation effect while income is not. The discussions and implications of these findings are further elaborated.

INTRODUCTION

Rapid economic development, unsustainable consumption and the increasing global population have direct negative impacts on the environment. This has led to alarming environmental degradation and natural disasters (Selles, 2013). Hoornweg et al., (2013) revealed that municipal solid waste (MSW) alone, one of the most important by-products of the urban lifestyle, is growing faster than the rate of urbanization. In the earlier global report of over 100, 000 cities surveyed in 2012, they warned that the generated global solid waste is expected to double by 2025, from over 3.5 million tons per day in 2010 to more than 6 million tons per day by 2025, with the amount expected to exceed 11 million tons per

DOI: 10.4018/978-1-5225-7915-1.ch011

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

day by the year 2100. Inevitably, it resultes in n increase for the overall estimated cost of dealing with the waste from $ 205 billion per year in 2010 to $ 375 billion by the year 2025. The mentioned alarming facts clearly suggest that a transformational change in consumer consumption toward more environmentally friendly consumption is essentially necessary. The adaptation of sustainable consumption does not only save the environment, it also saves and reduces the costs associated with the usage of conventional products (Chekima et al., 2016).

Godelnik (2012) in his study explained that despite the fact that consumers' spending witnessed an increase, including spending for green products, the market share remained to be very small. Even though millions of people have adopted sustainable consumption in 2012; the shift has a very minor reflection in within the overall economic activity. In the following year the estimated market share for green products was less than 4% (Gleim et al., 2013). For the past few years, environmental issues along with green consumption became the focus of the public and the media and more importantly it is the focus of green marketing research field. Researchers, producers, and marketers have been focusing their energy in searching for factors that encourage and motivate consumers to buy green products. While this gives an opportunity for marketers to venture into a new category of green products to increase and maximize profits via the expansion of their market share, they struggle to develop and communicate effective strategies to stir the consumers' purchase intention towards the buying of green products.

In attempt to tackle the issue facing green products and their market share, a number of studies have been conducted out over the last 20 years to identify the factors that promote pro-environment behavior among consumers (Wu et al., 2015; Chekima et al, 2015), however the focus was mainly on marketing strategies rather than consumer behavior. Without an in-depth understanding of consumer behavior in the green product category it becomes almost impossible to develop effective marketing plans and strategies (Tseng & Hung, 2013). Based on previous studies and the mentioned alarming condition of the environment, along with the position and market share of green products, the main objective of this study is to investigate and identify some of the factors that influence and motivate consumers' intention to purchase green products based on the theory of planned behavior (TPB) by Ajzen (1985). Additionally, based on the authors' best knowledge, very few existing studies focused on the influence of cultural values, environmental advertising and particular demographic characteristics on green products purchase intention. The Theory of Planned Behavior which has been advanced by Ajzen is widely accepted and adapted as a robust model for predicting green intention and actions. The study in hand focuses on purchase intention, for intention has broader implications and often does have a positive impact on individuals' actions (Schlosser et al., 2006; Ajzen & Driver, 1992).

For the last two decades cultural components have been acknowledged to have an impact on individual's behavior in the market ((Vicente-Molina et al., 2013; Chekima et al., 2016; Kim et al., 2002; Yaveroglu & Donthu 2002). Culture has a strong influence on consumer behavior and is a fundamental determinant of a person's desire (Kotler, 2003). Similarly, Strizhakova and Coulter (2013) further suggest that culture can encourage pro-environment behavioral and ultimately encourage green purchasing intention. It is explainable that culture is dynamic and plays an important role in shaping attitude and behavior. Soyez (2013) concluded that the main drivers of eco-friendly behavior are attitude and norms, with the latter inclusion of individuals' cultural values. However, little research focused on investigating its effectiveness to form a positive attitude and encourage consumers' intentions to buy green products. Thus, by integrating and investigating the role of cultural values (man-nature orientation and long-term orientation), this study will bring new insights and grasp the existing gap relates to the effects of cultural influence on consumers' intention to purchase green products. Additionally, understanding these

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

cultural values/orientations will help us understand the motivation of individual behaviors along with their decision-making and social atmosphere within and across cultures.

This research contributes to the understanding of the examined motivational factors of consumer purchasing intention. The findings of this research are also anticipated to provide a useful reference for the producers and marketers of green products to further develop appropriate marketing strategies and plans to communicate and promote green products effectively. This research may also pave the way for future studies to replicate such a model with an additional variables or share certain findings with care by the countries in the region (Southeast Asia countries) with which Malaysia shares several aspects of culture, economics, politics and geography.

The chapter proceeds with a literature review presenting a summary of research findings surrounding the variables examined in this study such as green purchasing intention, environmental knowledge, man-nature orientation, long-term orientation, environmental advertising and demographic characteristics. Following an overview of the methodology, the findings and discussions are presented. Finally, the chapter closes with implications and limitations/directions for future research.

LITERATURE REVIEW

Green Purchase Intention and Underpinning Theory

Purchase intention is one of the pillars that make the process of buying a whole. Newberry et al. (2003) observed that purchase intention is a frequent tool engaged to anticipate consumers' purchase behavior. O'Keefe (2002) affirms that behavioral intention is the most suitable aspect for predicting the actions of individuals under many conditions including the green market. In the same line of definition, Spears and Singh (2004) and later Peter and Olson (2008) elucidated the purchase intention as a conscious decision to make an effort to purchase a particular product. Aligned with the general purchase intention definition, Nik Abdul Rashid (2009) defines green purchase intention as the probability and willingness of individuals in their purchase consideration to give preference to green products compared to conventional products. The green purchase intention is described as a distinct kind of environmentally friendly behavior that individuals perform to express their concern to environment. Furthermore, green purchasing intention was confirmed as a proxy for the actual green purchasing behavior (Ramayah et al., 2010) and an accurate measure of future sales (Armstrong et al., 2000).

Correspondingly, Theory of Planned Behavior (TPB) is a comprehensive, accurate and widely used theory to assist in explaining green purchasing intention (Steg & Vlek, 2009; Ajzen 1985; 1991). TPB is a very successfully applied model in predicting and explaining variance in volitional behavior (Watson et al., 2014; Kaiser, 2006; Ajzen, 1991) in addition to the examining of the causal link between values, beliefs, attitudes, intention and action, (Beedell and Rehmanm, 2000; Webb and Sheeran, 2006). TPB suggests that when exposed to a behavioral option, consumers will start to consider alternatives and evaluate the effects involved grounded by their beliefs related to the actions and its effects. Eventually, such beliefs will determine an individual's attitude regarding potential actions, ultimately affecting the intention to act. The impact of cultural values measured in this study utilizing the TPB is based on Luna and Gupta (2001) and McCort and Malhotra (1993) which suggest that culture influences individual through the affective and cognitive functioning resulting in behavior. This is in line with the statement of Ajzen (1991) and Lee and Green (1991), in which it is explained that the TPB model is based on cog-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

nitive and affective processing and the level of behavioral change. The utilization of TPB in predicting green consumer behavior, and robustness of the theory has been confirmed several studies (Wu, 2015; Yazdanpanah & Forouzani, 2015; Chekima et al., 2016; Kim & Chung, 2013).

Environmental Knowledge

Studies show that consumer behaviors and intention are affected by many factors, including environmental knowledge. Vining and Ebreo (1990) claimed that consumer knowledge about environment been acknowledged as an important motivator for environmental friendly behavior. Along with Chan (2001) Haron et al., (2005) refer to environmental knowledge as an individual ability to understand and evaluate the impact of ecosystem on the society as well as the amount of information they have regarding environmental issues. Werner and Alvensleben (2011) suggested that knowledge creates a positive influence on a consumers' viewing habits of buying and using eco-friendly products. According to Mostafa (2006) environmental knowledge consists of relationships leading to environmental features or effects, joint responsibilities required for sustainable development, what people know about the environment, and appreciation of 'whole systems'. By employing TPB, researchers found that the more knowledgeable the consumers are about the environment, the more they know about the effects of the human actions towards the environment, and the more they can be expected to purchase green products (Rahbar & Abdul Wahid, 2011; Nik Abdul Rashid, 2009; Mostafa, 2006; Laroche et al., 1996).

Bradley et al., (1999) found that environmental attitudes will improve in parallel with increased environmental knowledge. Amyx et al., (1994) also concluded that consumers with sufficient knowledge on environmental issues are more willing to pay a higher price to purchase environmental friendly products. In the same line, Loroche et al., (2001) confirmed that environmental knowledge is significantly correlated with attitudes and environmental behavior. In Malaysia, in their study of the environmental volunteers in Penang, Rahbar and Abdul Wahid (2011) found that individuals with more environmental knowledge tend to positively influence their green purchase intention and behavior. In fact, a lack of knowledge or information has been identified as an important barrier to environmental behavior (Kennedy et al., 2009). As environmental knowledge appears to be a necessary motivator for environmental behavior, a close examination on the impact of environmental knowledge on green purchase intention is worthwhile. Thus, it is hypothesized:

Hypothesis 1: Green purchase intention is positively influenced by environmental knowledge.

Man-Nature Orientation

Over the past few decades, different cultural value orientations were discussed by some social theorists (Schwartz, 1994; Hofstede, 1980, 2001; Rokeach, 1979; Kluckhohn & Strodbeck, 1961; Kluckhohn, 1956). Values are considered as principles that guide the formation of attitudes to act (Rokeach, 1973). This is because by understanding cultural values, this could help us explain many elements of individual behavior and the social atmosphere across and even within cultures (Schwartz and Sagiv, 1995; Schwartz, 1994). In the study, the researchers examine man-nature orientation dimension which was developed in the 1940s and 1950s by Florence Kluckhohn and Fred Strodtbeck (Kluckhohn and Strodtbeck, 1961) and is found in the Value Orientation Theory. Man-nature orientation (MNO) is defined as the friendly conducts of humans toward nature, because of the love of nature and the vigor of protecting nature

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

behavior (Churchill, 1979). In addition, Chan (2001) referred to man-nature orientation "as the relationship between human beings and the natural environment". According to Samovar et al., (1981) MNO is concerned with the relationship rooted between man and nature. Man-nature orientation considers how human dominates, lives harmoniously with nature or is subjugated to nature. Chan (2001) argues that the orientation of human nature operates at the level of which can stimulate affective norms, where all consumer behavior rests. Previous studies have found that the norms sometimes change and lead to a certain ambivalence in the attitudes; however, the impact is greater in guiding the practice of everyday life through intentions and behavior (Chekima et al., 2016; Chung et al., 2012; O'Neal, 2007; Ajzen, 1991).

Since to date, the relationship and influence in respect of man-nature orientation regarding green product purchase intention has been inadequately researched despite the mentioned theories that proposed cultural values as an influence on individual intention and behavior. Man-nature orientation has been examined in clothing fashions and impulsive buying, confirming its positive role in facilitating buying behavior (Rajagopal, 2011; Kacen & Lee, 2002). Likewise, man-nature orientation associated positively with consumer pro-environmental attitude on environmentally friendly buying behavior (Sabrina, 2007). This is desirable in terms of psychology, in which usually attitudes influence the reasoning function and emotional function that ultimately leads to affecting consumer behavior and buying intention (Hoyer & MacInnis, 2004). Hoyer and MacInnis (2004) recommend cultural orientation values to be included in future research when examining the factors influencing purchase intention. Based on the reviewed literature, this study aims to contribute to the very few studies to measure man-nature orientation values towards green purchase intention. Following on from this discussion, the second hypothesis is postulated:

Hypothesis 2: Green purchase intention is positively influenced by man-nature orientation.

Long-Term Orientation

Based on the review of literature, this study is among the earliest ones of its kind that attempt to incorporate and investigate the influence of long-term orientation values on purchase intention of green products. Long-term orientation is among the dimensions of cultural orientation that deals with time - past, present and future. Long-term orientation "stands for the fostering of virtues oriented towards future rewards, in particular perseverance and thrift" (Hofstede, 2001). This is an additional dimension to Hofstedes' initial four national cultural dimensions, uncovered by Bond (1987) and later proposed by Hofstede (1991) as the long- versus short-term orientation as it has been proven to be an important, independent dimension, particularly in Asian cultures. According to Bearden et al., (2006), long-term orientation is a prominent facet of national cultural values and of its influences on consumer's decision-making process; however research on its impact is lacking.

Despite the fact that Hofstede proposed that his cultural dimensions should not be measured at neither organizational nor individual level (Minkov & Hofstede, 2011), this study adopted the Cultural Values Scale (CVSCALE) proposed by Yoo et al., (2011) to capture Hofstede's long-term orientation at the individual level. It was developed as an extension of Hofstede (1991) cultural scale values. Bearden et al., (2006) further explained that long-term orientation will influence the individuals' level of ethical values. Thus, it would be expected that those who plan for future success would be less likely to engage in unethical behavior such as conventional purchasing behavior which holds harmful long term consequences affecting the environment. Hence, long-term oriented consumer is more likely to plan ahead before making purchases and are less tempted by immediate desires and purchasing temptations. This is

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

supported by Gul (2013) who found that long-term orientation was the best predictor for environmental attitude formation in Turkey. Consequently, it is expected that long-term oriented consumer will have a positive green purchase intention and thus the next hypothesis is hypothesized as:

Hypothesis 3: Green purchase intention is positively influenced by long-term orientation.

Environmental Advertising

According to Goodrum and Dalrymple, (1990) advertising is considered a business strategy intended to attract consumers to a new or existing product by generating positive emotional attachment. Baldwin (1993) is quoted stating that "environmental advertisements are designed to help form a consumer's values and translate these values into the purchase of green products". Haykto and Matulich (2008) mentioned several consumers' responses in manifesting the effectiveness of green advertisements in terms of willing to pay premium price; such as trusting the safety of the advertised product and believing it to be less harmful as demonstrated. By applying the Theory of Planned Behaviour (TPB), Litvine and Wüstenhagen (2011) established that increasing environmental messages allow consumers to recognize the advantage to purchase green power and it would significantly enhance green power market.

In his research, Xue, (2014) indicated that the green visuals in an advertisement lead to more advertising response and a more favorable perception of the brand's environmental effort. Besides, Kao et al., (2013) and Zhu, (2013) conducted empirical studies in Taiwan and China respectively, while the latter suggested that environmental advertising impact significantly influence consumer purchase intention of green products, the former found that appeals in environmental advertising lead to form a positive attitude towards advertising. In addition, Bator and Cialdini (2000) suggested that message involvement is a critical factor in broad behaviors and proper indication of messages is one of the main strategies to enhance environmental behavior through information share. In short, it is established based on the theory of planned behavior that people's behavioral intention (green purchase intention) are a function of their positive attitudes toward a specific behavior or subject (environmental advertising). Thus, it is hypothesized that:

Hypothesis 4: Green purchasing intention is positively influenced by environmental advertising.

Demographics

Previous studies indicate that socio-demographic are associated with green product consumption behavior. Berkowitz and Lutterman (1968) were pioneers in studying the green consumer profile and even reported demographics as one of the most influential factors to predict pro-environmental behavior. Gender, age, occupation, education level, income level and family size are among the demographics that have been found to have a significant relationship with environmental behavior (Sang and Bekhet, 2015; Kaufman et al., 2012; Yau, 2012). Additionally, Yin et al. (2010) noted that many studies have investigated the effect of demographics regarding purchasing intention; however, some studies reported contradictory results. Therefore, it is necessary to verify the moderating role of the income, education level and also gender between the independent factors investigated in this study and green purchase intention. This study employs a bi-dimensional approach to income (high income and low income), gender (i.e., male and female) and education (higher education and low education), to identify if there are differences in

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

the strength of their moderating impact. Compared with previous studies, they examine the direct effects of income, education and gender as uni-dimensional and found a significant influence on the intention to purchase, which is inaccurate and rather misleading. Thereby, it is difficult to identify if there is a difference between the strength's effect of income levels, education levels and gender on consumers' motivational factors and green purchase intention. With this, it will help contribute to a better understanding of the role of demography in enhancing green purchase intention motivational drivers. In addition, it can help to guide managers of green products to segment their target market appropriately (i.e., high income or low income, male or female and highly educated individual or low educated individual or considering both categories of each investigated demography); thus focusing on this segment when developing products and strategies for communicating more effectively in promoting green products.

Income

Based on the model of purchasing decision process Engel, Blackwell and Miniard, (1995) suggested that purchasing intention is strongly influenced by consumers' income. Hockett et al., (2004) reported that individuals with higher incomes are more likely to be pro-environmentally. Meantime, Roitner-Schobesberger et al., (2008) study concluded that in Thailand high earners are more likely to have purchased organic food. Moreover, Csutora and Mozner (2014), Abdul Wahid et al., (2011), Mahmoud et al. (2011), Fotopoulos (2002), Laroche and Bergeron (2001) have considered income as a significant factor influencing consumers toward green product purchasing intention. Mahmoud et al. (2011) argues that green purchase behavior depends on the economic conditions of the consumer. This can be explained in which people will be most interested and intend to spend money on green products when they have a sufficient level of income and welfare are maintained, allowing excess of money. This leads to the next hypotheses:

Hypothesis 5: Income will moderate the influence of environmental knowledge on green purchase intention.
Hypothesis 6: Income will moderate the influence of man-nature orientation on green purchase intention.
Hypothesis 7: Income will moderate the influence of long-term orientation on green purchasing intention.
Hypothesis 8: Income will moderate the influence of environmental advertising on green purchase intention.

Education

The majority of studies that examined and tested the level of formal education/literacy, found a positive relationship between education and the green consumer behavior (Schwartz and Miller, 1991; Zimmer et al., 1994). Zsoka and colleagues (2013), in Hungary, found that most of their respondents who were university students acquired more knowledge about the environment in the university possess a satisfactory level of environmental knowledge and are highly aware of the need for change in consumer behavior compared with high school students. In Pakistan, consumers who are highly educated show a positive attitude towards green products, and are more willing to buy the products. This is confirmed by the fact that well educated people often are better informed, and thus, have a strong desire to protect the environment (Torgler & Garcia-Valinas, 2007). Another study, in California, revealed that college-educated respondents prefer electric/hybrid vehicles (Brownstone et al., 2000). This is also feasible because they

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

are sensitive to the cause and are aware of the effect and tend to act in accordance. On the other hand, Straughan and Roberts (1999) suggested that education level does not have a significant relationship with the individual's pro-environmental behavior. In this study, education is divided into two categories: highly educated in reference to tertiary education qualifications and low educated covers high school and below. Thus, we predict the following hypotheses:

Hypothesis 9: Education will moderate the influence of environmental knowledge on green purchase intention.
Hypothesis 10: Education will moderate the influence of man-nature orientation on green purchase intention.
Hypothesis 11: Education will moderate the influence of long-term orientation on green purchase intention.
Hypothesis 12: Education will moderate the influence of environmental advertising on green purchase intention.

Gender

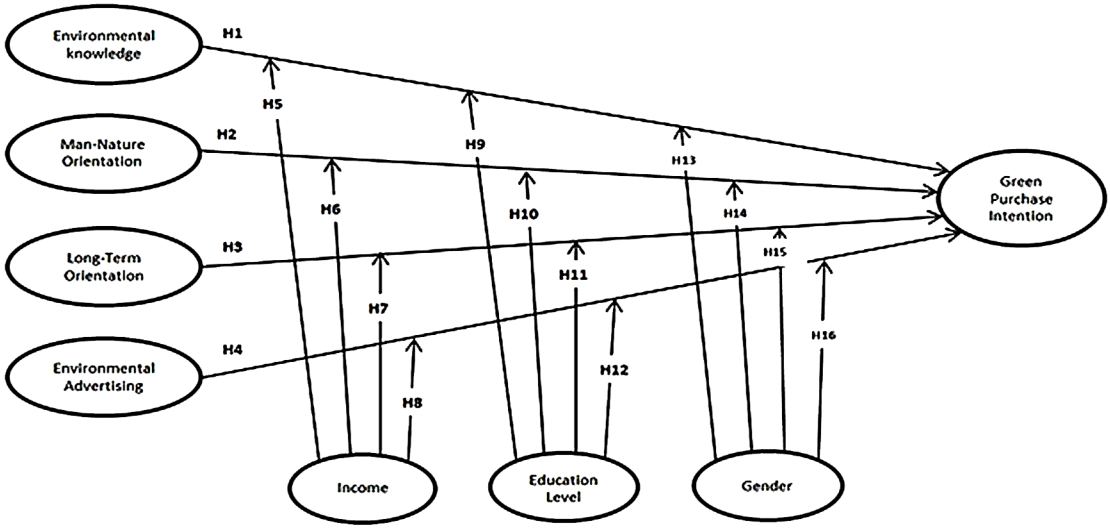
The empirical results of the role and effect of gender on environmental behavior are indeed contradictory. Several studies found that compared to males, females are more likely to participate in pro-environmental behavior as well as having higher intention to purchase green products, especially organic food (Rezai et al., 2011; Zelezny et al., 2000; Davidson and Freudenburg, 1996). Zelezny et al., (2000) conducted a survey in 14 countries, focusing on gender differences in pro-environmental attitudes, their findings show a significant difference between the genders in behavior patterns and environmental attitudes, the results showed that women are more consistently pro-environment than men are. Although many researchers suggested that women are more likely to act in a way that is more environmentally friendly than men, final results are not conclusive. Furthermore, Davidson and Freudenburg (1996) claim that gender differences in environmentalism are not to be generalized. This is very much supported by Diamantopoulos et al., (2003) who concluded that numerous researchers found that men have more knowledge about environmental issues than women and that the latter act accordingly. Contrary to the previous claims, Tan and Lau (2010) found no significant difference between male and female 'attitude' of green products for undergraduate students in main private universities in Malaysia. Guided by the past literature and findings, this study will explore the impact of gender interaction between the significant motivational factors toward green purchasing and identify of which gender is significant and contributes to pro-environmental. Accordingly, it is hypothesized that:

Hypothesis 13: Gender will moderate the influence of environmental knowledge on green purchase intention.
Hypothesis 14: Gender will moderate the influence of man-nature orientation on green purchase intention.
Hypothesis 15: Gender will moderate the influence of long-term orientation on green purchase intention.
Hypothesis 16: Gender will moderate the influence of environmental advertising on green purchase intention.

Our research model included pro-environmental motivational factors and its impact on green purchasing intention. The hypotheses are formulated based on aforementioned research studies to define the research framework shown in Figure 1. The research framework was developed using structural equation modeling.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 1. Research framework



METHODOLOGY

Sample and Data Collection

This study conducted a self-administered questionnaire surveys to collect the research data. Since green products are a relatively new product category in Malaysia, they are primarily available at large supermarkets and malls in the major and more populous states such as Kuala Lumpur, Selangor and Sabah. This study thus targeted both male and female customers at the age between 18 and 65 who have purchasing power and active in shopping (Salzman, 2012), at major supermarkets and malls in the cities of the three states mentioned above as the research sample. The sample was selected by convenience, as there was no available access to sampling frames, databases or records to select individuals randomly. Additionally, to ensure participants were qualified to answer the survey questions and meaningful data collected, a screening question that asked participants if they aware of or and had previously purchased green products was asked. In total, 600 questionnaires were distributed and 405 valid questionnaires were obtained, making the response rate of 67.5 per cent, which is above the 60 percent response rate recommended by Babbie (1990).

Measurement Instruments

Previous studies have been reviewed to ensure a comprehensive list of measures and consequently have been included. The initial instrument consists of 34 items that were pre-tested on a sample of 30 subjects. The pretest was developed and administered in a series of meetings and interviews with post-graduate students and senior academics to review and evaluate that constructs are comprehensible. Based on their feedback, two items were dropped and some minor wording changes were made to the final version.

The questionnaire comprised of two sections. Section A gathers demographic information of respondents and determine green consumer profile of respondents based on Suplico's (2009) categorization.,

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

while section B comprises of 32 items examining the factors affecting consumers' green purchase intention. Measurement of items was assessed using a five-point Likert scale ranging from 1 strongly disagree or highly unlikely to 5 strongly agree or highly likely. Items adapted from the following sources: green purchase intention (Mostafa, 2006; Chan, 2001), environmental knowledge (Haron et al., 2005; Tanner and Kast, 2003), man-nature orientation (Chan, 2001), long-term orientation (Yoo et al., 2011), and environmental advertising (Rahbar and Abdul Wahid, 2011).

FINDINGS

Respondents' Green Consumer Profile

In matter of practice 'green living', figures in Table 1 shows the majority of respondents (48.0 percent) claimed to be Sprouts in which they are fairly aware of environmental issues, believe in environmental causes in theory and buy green products from time to time. They should be encouraged with appeals to get involved in environmental activities (Ottman, 1998).

Respondents Profile

The demographic profile of respondents includes, gender, age, educational level, employment and yearly income level is presented in Table 2.

Just over half the sample (51%) was female with a majority having tertiary education. Most respondents are between 20 and 29 and 30 and 39 years old, with two most common annual income categories between RM36001 and RM60000 (26.7%) and RM60001 to RM96000 (22.2%) and the mean is RM74726.60. According to Economic Planning Unit of Malaysia, households with annual incomes between RM36001 and RM96000 are belong to middle income group.

This study used structural equation modeling (SEM) to examine the proposed model. SmartPLS 2.0 software was used to evaluate the relationships among the constructs of the research model by conduct-

Table 1. Respondents' green consumer profile

What Best Describes You as a Consumer?	Frequency	Percent
True Blue Green: I buy only green products. I spend time and effort in environmental activities such as recycling. I believe that an individual can do much to promote the environment.	46	11.4
Greenback Green: I am able to buy green products but I don't have the time and energy for environment activities. I do not want to change my lifestyle to promote the environment.	107	26.4
Sprout: I can buy green products from time to time but I am not involved in any environmental activities.	194	48.0
Grouser: I do not buy green products. I believe that business and government should be fixing environment problem.	28	7.0
Basic Browns: I am the least involved in environmentalism ad I believe that there is not much that an individual can do in solving environmental problems but the government and business should promote the environment.	29	7.2
Total	405	100

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 2. Demographic profiles of respondents

Demographics		Frequency (N=405)	Percentage (%)
Gender	Male	197	48.6
	Female	208	51.4
Age (Years)	18-19	5	1.2
	20-29	148	36.6
	30-39	128	31.6
	40-49	92	22.7
	51-65	32	7.9
Highest academic qualification	Secondary school or lower	26	6.4
	Pre-University or equivalent	83	20.5
	Bachelor Degree	244	60.2
	Master Degree	35	8.7
	PhD	17	4.2
Employment Yearly Income	Government	151	37.3
	Private	186	46.0
	Self-employed	42	10.3
	Unemployed	26	6.4
	RM18000 and below	15	3.7
	RM18001 - RM36000	84	21.7
	RM36001 - RM60000	108	26.7
	RM60001 - RM96000	90	22.2
	RM96001 - RM120000	52	12.8
	RM120001-RM180000	18	4.4
	RM180001 and more	17	4.2
	Missing	21	5.2

ing partial least squares (PLS) analysis. As widely accepted rule of thumb, structural equation modeling (SEM) should be conducted on samples of no less than 200 (Kline, 2005). Partial Least Squares (PLS) assesses the psychometric properties of the measurement model, and estimates the parameters of the structural model. PLS analysis was preferred as the methodological choice as it allows us to simultaneously evaluate both the measurement and structural model (Chin, 1998), maximize the variance explained of the dependent variables and allows the simultaneous analysis of a large number of constructs, allowing extensive examination of interactions between latent predictor variable and moderator (Hair et al., 2012). As suggested by Anderson and Gerbing (1988), the data analysis began with confirmatory factor analysis (CFA) to determine whether all indicator variables appropriately reflect their underlying constructs, and whether the measurement model has acceptable fit to the data.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Assessment of the Measurement Model

As suggested by Hair et al. (2010), reflective measurement model assessment in the PLS analysis includes composite reliability (CR) to evaluate internal consistency among items for each construct, item loading, and average extracted variance (AVE) to assess convergent validity.

As shown in Table 3, the item loadings are greater than 0.70 (Agan et al., 2013), varies from 0.733 to 0.919. The results of composite reliability (CR) for constructs were confirmed satisfactory with values above cut-off value 0.70 (Hair et al., 2010). The average variance extracted (AVE) which reflects the overall amount of variance in the indicators accounted for by the latent construct, were between 0.673 and 0.899, given the benchmark is 0.50 (Chen, 2014; Hair et al., 2012). Therefore, convergent validity was established.

Discriminant Validity of Constructs

Discriminant validity is the extent to which items measure distinct concepts and is indicated by the low correlations between the measure of interest and the measures of other constructs (Cheung & Lee, 2010). Discriminant validity can be examined by comparing the ratio between the square root of AVE and correlations (Fornell & Larcker, 1981). As shown in Table 4, the diagonal elements of the matrix, which represents the square root of the AVEs, are higher than the corresponding interconstruct correlations indicating adequate discriminant validity (Agan et al., 2013). The correlation between latent constructs' composite and all other constructs are also less than 0.7, indicating that constructs differ sufficiently from one another (Urbach & Ahlemann, 2010).

The Structural Model and Path Analysis

After the constructs were confirmed to be reliable and valid, we proceeded with the path analysis to test hypotheses. Figure 2 and Table 5 show the structural model parameter estimates. The overal model explained a significant variance of ($R^2 = 0.53.4$) 53.4% in green purchasing intention via latent variables and the moderating variable; considered significant and meaningful for the purposes of interpretation (Hair et al., 2012). In social science research, R^2 of 0.75 is substantial, 0.50 is moderate, and 0.25 is weak (Wong, 2013).

A close look shows that man-nature orientation is positively significant ($\beta = 0.359$, $p < 0.01$) to green purchase intention and so do long-term orientation ($\beta = 0.\ 298$, $p < 0.01$) and environmental advertising ($\beta = 0.252$, $p < 0.01$), whereas environmental knowledge is not a significant predictor of green purchase intention. Thus, H2, H3 and H4 are supported, whereas H1 is not. In this study, it was found that the cultural value of man-nature orientation is the strongest predictor of green purchase intention follows by cultural value of long-term orientation and environmental advertising.

For the moderating (interacting) variables, statistically significant beta path coefficients were indicated in both Figure 2 and Table 5. Bootstrapping procedure was used to test the moderating effect. The results show that income level is insignificant; thus, H5 through H8 are not supported. Results indicate that education is significantly influenced the effects between long-term orientation and green purchase intention ($\beta = 0.212$, $p < 0.01$) and environmental advertising on intention to purchase green products ($\beta = 0.256$, $p < 0.01$), however did not moderate man-nature orientation.Therefore H11 and H12 are sup-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 3. Assessment of the measurement model

Construct	Item	Convergent Validity		
		Loadings	AVE[a]	Composite Reliability[b]
Environmental Knowledge	EK1	0.915	0.899	0.900
	EK10	0.842		
	EK2	0.896		
	EK3	0.884		
	EK4	0.893		
	EK5	0.869		
	EK6	0.797		
	EK7	0.824		
	EK8	0.904		
	EK9	0.919		
Environmental Advertising	A1	0.889	0.862	0.898
	A2	0.906		
	A3	0.796		
	A4	0.838		
	A5	0.801		
	A6	0.866		
	A7	0.862		
Green Purchase Intention	GPIG1	0.869	0.792	0.950
	GPIG2	0.896		
	GPIG3	0.852		
	GPIG4	0.848		
	GPIG5	0.876		
Man-Nature Orientation	MNO1	0.800	0.694	0.882
	MNO2	0.884		
	MNO3	0.767		
	MNO4	0.775		
Long-Term Orientation	LTO1	0.798	0.673	0.902
	LTO2	0.840		
	LTO3	0.785		
	LTO4	0.759		
	LTO5	0.766		
	LTO6	0.733		

[a]Average variance extracted (AVE) = (summation of the square of the factor loadings)/{(summation of the square of the factor loadings) + (summation of the error variances)}

[b]Composite reliability (CR) = (square of the summation of the factor loadings)/{(square of the summation of the factor loadings) + (square of the summation of the error variances)}

Note: EK; Environmental Knowledge, MNO; Man-Nature Orientation, LTO; Long Term Orientation, EA; Environmental Advertising.

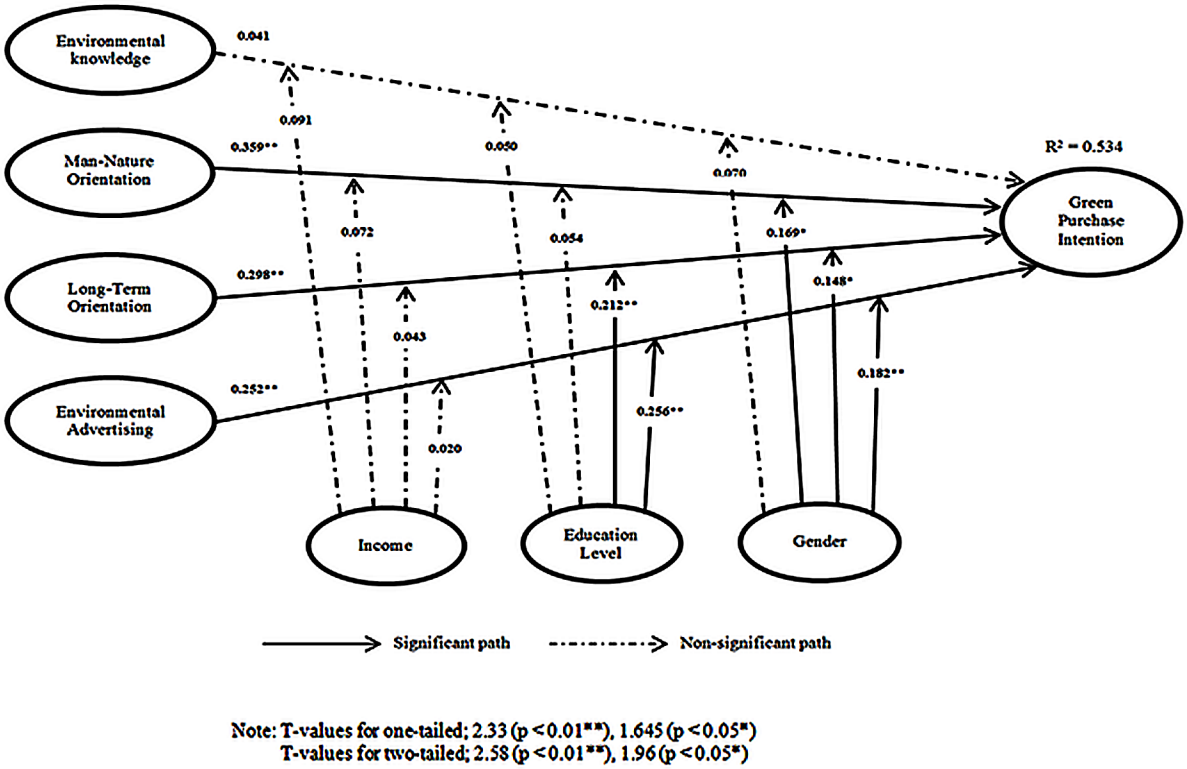
EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 4. Discriminant validity (intercorrelations) of constructs

Latent Variables	1	2	3	4	5
1. Environmental Advertising	**0.93**				
2. Green Purchase Intention	0.21	**0.89**			
3. Environmental Knowledge	0.32	0.17	**0.95**		
4. Man-nature Orientation	0.22	0.24	0.26	**0.82**	
5. Long-term Orientation	0.24	0.26	0.38	0.45	**0.83**

Note: Diagonals (in bold) represent square roots of average variance extracted (AVE) while the other entries represent the squared correlations.

Figure 2. Structural model results



ported but H9 and H10 are not. Gender exhibited three interaction effects; a positive moderating effect between man-nature orientation and green purchase intention ($\beta = 0.169$, $p < 0.05$), between long-term orientation and green purchase intention ($\beta = 0.148$, $p < 0.05$) and between environmental advertising towards green purchase intention ($\beta = 0.182$, $p < 0.01$). Thus H13, H14 and H15 are supported.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 5. Summary of the structural model

Hypotheses	Hypotheses Paths	Path Coefficients	T-Values	Results
H1	EK > Green Purchase Intention	0.041	1.488	Not supported
H2	MNO > Green Purchase Intention	0.359	4.714**	Supported
H3	LTO > Green Purchase Intention	0.298	3.791**	Supported
H4	EA > Green Purchase Intention	0.252	3.213**	Supported
H5	EK x Income > Green Purchase Intention	0.091	1.239	Not supported
H6	MNO x Income > Green Purchase Intention	0.072	0.702	Not supported
H7	LTO x Income > Green Purchase Intention	0.043	0.381	Not supported
H8	EA x Income > Green Purchase Intention	0.020	0.198	Not supported
H9	EK x Education level > Green Purchase Intention	0.050	1.441	Not supported
H10	MNO x Education level > Green Purchase Intention	0.054	1.110	Not supported
H11	LTO x Education level > Green Purchase Intention	0.212	2.583**	Supported
H12	EA x Education level > Green Purchase Intention	0.256	3.295**	Supported
H13	EK x Gender > Green Purchase Intention	0.070	1.184	Not supported
H14	MNO x Gender > Green Purchase Intention	0.169	2.245*	Supported
H15	LTO x Gender > Green Purchase Intention	0.148	2.224*	Supported
H16	EA x Gender > Green Purchase Intention	0.182	2.568**	Supported

Note: EK; Environmental Knowledge, MNO; Man-Nature Orientation, LTO; Long Term Orientation, EA; Environmental Advertising.
**p< 0.01, *p< 0.05

DISCUSSIONS

Sustainable consumption has attracted the attention of both academic researchers as well as the practitioners. Identifying and understanding how various factors affect the intention of green purchasing is a critical topic of green consumer behavior discipline. Accordingly, the study in hand was to explain consumers' green purchase intention motivational drivers. Of the examined 16 hypotheses, eight hypotheses demonstrated a significant relationship towards green purchase intention.

The results of the study show that environmental knowledge did not have a significant influence on green purchase intention. Therefore, the finding brings to question the assertion that in the theory of planned behavior, the more knowledgeable the consumers are about a subject, the more they know about the effects of the human actions towards it, the more they may be expected to adapt the right action. The possible explanation for the result of the study is supported by Tanner and Kast (2003) and Schahn and Holzer (1990) who concluded that action-related knowledge is positively related to green food purchases and environmental action, whereas the factual knowledge was not a significant predictor of the latter. The questions in this study were adopted from surveys administered based on factual knowledge. Moreover, Smith-Sebasto and Fortner (1994) quoted claiming that "when the relationship between environmental knowledge and behaviors/intention appears to be stronger, it is knowledge about environmental behaviors rather than factual knowledge about the environment that is related to ecological behavior.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

As for cultural influence, the statistical result supported the hypothesis confirming that man-nature orientation was found to be positively related to green purchase intention. This is consistent with previous studies (Rehman & Dost, 2013; Chan, 2001). The finding of the study indicates that man-nature orientation is a constant part of individuals' life, which shapes people's eco-friendly behavior ultimately leading to positive green products purchase intention. In other words, man-nature orientation values, as a way of expressing their wish to protect the environment, allow and increases consumers' interest in and desire for green products. Man-nature orientation is recognized as an important factor influencing consumer's intention and behavior. Schiffman and Kanuk (2010), Kotler (2003) and Schiffman and Kanuk (1994) stated that culture has a strong influence on consumers' behaviors that occur so "natural" and "automatic" and is a crucially fundamental determinant of a person's desires and behavior. It can be reasoned that man-nature orientation values will evoke consumers' desire and intention to buy green products as a mean to preserve the environment and maintain living harmoniously with nature as demonstrated by respondents in this study. This may be due to the fact that Asians in general perceive themselves as living in harmony with nature (de Mooij, 2004), causing them to adhere to the values of man-nature orientation that have consequently influenced their purchase intention of green product.

The cultural dimension of long-term orientation was also hypothesized to be positively related to green purchase intention. This study found that the hypothesis was supported and is in support of previous studies (Gul, 2013; Beardon et al., 2006) the findings conclude that long-term orientation is a prominent cultural facet and influencer on consumers' purchase decision making as well as a good predictor for the formation of environmental attitude. The respondents in this study exhibited a positive relation between long-term orientation and green purchase intention since green consumption is believed to save money and conserve the environment in the long run guaranteeing a better living. The results support the works of Sarigollu (2009) which theorize that long-term oriented people are more likely to develop values and attitudes pertaining to the protection of the natural environment.

Among the supported hypotheses is the hypothesis that environmental advertising significantly influence green purchase intention. This is in line with findings from from the studies by Xue (2014), Zhu (2013), Litvine and Wüstenhagen (2011) and Kao et al., (2013). The finding is reasoned by the fact that as environmental advertising would enhance consumers' knowledge and attitude towards green products while recognizing the advantages of the purchasing of such products. This could very much be due to the suggestion that the messages in environmental advertising are perceived to be credible, making them more socially responsible to the environment and keys in distinguishing green products from ordinary products and in avoiding confusion in identifying green products in the market and acknowledging its availability in the country. It is in line as proposed by Ruiz and Sicilia (2004), who suggested that through environmental advertisement there will be greater advertising effectiveness, which will arouse positive behavioral intention within the consumers.

The findings of the study suggest that gender and education level moderate the relationship between man-nature orientation, long-term orientation and environmental advertising. However, income had no moderating effect on the relationships between the independent variables and green purchase intention. This concludes that education level as well as gender can explain green purchase intention and show that its interaction with cultural values and environmental advertising represent more effective antecedent variable of green purchase intention. In terms of education level, the study finding indicates that individuals with higher education level (university and college degrees) show stronger relations between environmental advertising and green purchasing intention and long-term orientation and green purchasing intention compared to individuals with lower educational level (high school and lower).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The result suggests the potential impact of tertiary education/knowledge on the recognition and trust of environmental advertising and nature of being long-term oriented that may lead to the strengthening of the impact of the both on the green purchase intention. This finding supports the earlier study by Rezai et al., (2011) which testified highly educated individuals have a positive attitude on green products and a stronger intention to buy them. As for gender, the relationship between man-nature orientation and purchasing intention, long-term orientation and purchasing intention as well as environmental advertising and purchasing intention is stronger among females compared to that among males. This confirms the previous findings suggesting that women are more likely to be pro-environmentalists (Rezai et al., 2011; Lee, 2010; Laroche et al., 2001; Zelezny et al., 2000). Being the gatekeepers who are more likely to be pro-environmentalists with higher green purchasing intention, it is essential to recognize the influence of female gender on the relationship between pro-environmental motivational factors and the purchasing intention of green products.

IMPLICATIONS

From theoretical perspectives, this study is the first to develop a model that explain influencing factors and drivers of consumers' green purchasing behavior by integrating and examined various major aspects; namely individuals' possessed knowledge on environment, man-nature orientation and long-term orientation, marketing/organizational effort (environmental advertising) and the moderating effects of income, education level and gender in a single framework. The findings of this study bring new insights and interesting findings where it has identified and confirmed that cultural values, man-nature orientation and long-term orientation, play significant role in influencing green consumer purchase intention while the premium price factor is found to have no effect on green purchase intention. Thus, this study provides a building ground and paves the way for future researchers to explore in depth other cultural values along with other predictors that could promote pro-environmental activities and buying intention in Malaysia and other countries.

In terms of research, clearly, the study provides further evidence of the usefulness and validation of using CVSCALE developed by Yoo and colleagues to measure the influence of culture at the individual level. Due to the globalization of markets with products crossing national and geographical borders; making cultural context important in understanding the consumer behavior (Patterson et al., 2006). However, the existing literatures of cross-cultural business are rather inconsistent and chaotic due to the cultural valuation methods in using conflicting scale and the absence of a universally accepted scale. It is understood that by measuring the cultural values and not equate it with the national culture, researchers can avoid the ecological fallacy, which occurs when the ecological or country-level relationships are construed as if they apply to individuals (see Hofstede 1980). Thus, adoption of CVSCALE is recommended and can benefit multi-cultural business practitioners and cross-cultural researchers.

Based on the results of the partial least square (PLS) technique in testing the hypotheses in the study, man-nature orientation values exerted the most significant influence on green purchase intention, followed by long-term orientation and environmental advertising. Cultural values of both man-nature orientation and long-term orientation provide a stronger effect and therefore more useful profile of green behavior and product consumption. In term of managerial implications for green marketers, the results offer consumer segments (based on cultural values and personal/demographic traits) and execution of environmental advertising for green products in green marketing. Understanding how different

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

consumer orientations and value responses vary enables green marketers develop customized strategies aligned with specific consumer segments, ultimately increasing the effectiveness and efficiency of green marketing and sales activities.

Based on the finding of the study concluding that the influence of culture is dynamic, it is recommended for marketers to direct individuals toward green products through advertising based on cultural reasoning inducing their intention to purchase green products.This can be carried out by applying or instilling certain elements of the man-nature orientation and long-term orientation in advertising, such approach may include the demonstration of how green product can maintain and protect the environment, save money that benefits in the long run and reminders of the responsibility to act accordingly through environmentally friendly behaviour. Marketers can engage and reflect certain cultural values effectively through environmental advertising while providing environmental advertising a competitive advantage over normal advertising by affecting consumers' cognitive emotional functioning and exert strong intention to obtain green products. Additionally, through systematic educational program and proper societal and social marketing approach, marketers along with governments can utilize these cultural values to increase individual's' environmental awareness and stimulate intention to buy green products.

Although green advertising is widely recognized and accepted in this study, benefits, validity and credibility, associating with it rather controversial (Pfanner, 2008) due to the use of false green claims, ambiguous information, lurid and exaggerate language (Polonsky et al, 1997). The researchers suggest that managers need to constantly monitor the credibility of green claims in green advertising accordingly because it plays an important role in influencing consumers' green purchase intention. Therefore, a specific and well-planned strategy is required to execute a green advertising campaign, which consists of concise and clear information about the products' features as well as trustworthy environmental claim and benefits of using green products. This will eliminate consumers' doubt of the products advertised and establish a green corporate image for the firm, such image will stimulate stronger intention leading to an increase in sales of green products.

As the results suggest that women with higher education expressed higher purchase intention of green products than in men and individuals with lower education level it is recommended that green product managers should pay special attention to this segment of consumers by customizing green products that meet their personality preferences (e.g. design, size, and color options) to arouse stronger purchase intention which will encourage them to buy more green products and be active in green brand loyalty.

As confirmed in this study, interestingly environmental knowledge has been found to have insignificant relationship towards green purchase intention. Coddington (1990) quoted that "the seeds that are sown under the right approach to environmental marketing are the seeds of environmental education". Hence it is strongly suggested for the government to introduce an environmental subject in the formal curriculum in schools and higher institutions to enhance citizens' specific knowledge concerning the environment to foster green buying behavior.

LIMITATIONS AND FUTURE DIRECTIONS

Just like any other research, the study has certain limitations highlight the need for further research. Firstly, although the result of this study has further proven the usefulness of the CVSCALE in measuring Hofstede's cultural dimension, the cultural assessment method for individual-level is rather chaotic and needs future researchers to keep validating these measures on pro-environmental behavior using a larger

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

sample, demographically diverse samples and respondents from other countries, as well as employing other dimensions based on CVSCALE (etc. Collectivism, individualism, feminism and masculinity). A convenient start will be to replicate existing studies to see whether similar findings may be made when culture is measured at the individual level. Such similarities or differences between individual-level and national-level of Hofstede's' cultural dimensions will provide insights into psychological, sociological and business managerial differences of the same construct.

Secondly and clearly, more variables could be examined as an extension to this study. Other variables reflecting factors such as product attributes, social factors, psychological factors, premium price, and organizational and government roles and initiatives could be included.

Thirdly and finally, it would be interesting to extend this research by examining specific green products or industry. It can be implemented with a special focus on electrical and electronic appliance, automobiles, environmentally friendly cleaning products, food and agriculture.

Despite the mentioned limitations, the study evidently makes several contributions to the field of consumer buying behavior and green marketing.

REFERENCES

Abdul-Wahid, N., Rahbar, E., & Tan, S. S. (2011). Factors influencing green purchase behavior of Penang environmental volunteers. *International Business Management.*, *5*(1), 38–49. doi:10.3923/ibm.2011.38.49

Agan, Y., Acar, M. F., & Borodin, A. (2013). Drivers of environmental processes and their impact on performance: A study of Turkish SMEs. *Journal of Cleaner Production*, *51*, 23–33. doi:10.1016/j.jclepro.2012.12.043

Ajzen, I. (1985). *From intentions to actions: a theory of planned behavior, in action control: from cognition to behavior*. New York: Springer Verlag.

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179–211. doi:10.1016/0749-5978(91)90020-T

Ajzen, I., & Driver, B. L. (1992). Application of the theory of planned behavior to leisure choice. *Journal of Leisure Research*, *24*, 207–224.

Amyx, D. A., DeJong, P. F., Lin, Chakraborty, G., & Wiener, J.L. (1994). Influencers of purchase intentions for ecologically safe products: an exploratory study. In *AMA Winter Educators' Conference Proceedings*. American Marketing Association.

Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice: A review of recommended two-step approach. *Psychological Bulletin*, *103*(3), 411–423. doi:10.1037/0033-2909.103.3.411

Armstrong, J. S., Morwitz, V. G., & Kumar, V. (2000). Sales forecasts for existing consumer products and services: Do purchase intention contribute to accuracy? *International Journal of Forecasting*, *16*(3), 383–397. doi:10.1016/S0169-2070(00)00058-3

Babbie, E. (1990). *Survey research methods* (2nd ed.). Belmont, CA: Wadsworth Publishing.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Bator, R., & Cialdini, R. (2000). New ways to promote pro-environmental behavior: The application of persuasion theory to the development of effective pro-environmental public service announcements. *Journal of Science*, *56*, 527–541.

Bearden, W. O., Money, R. B., & Nevins, J. L. (2006). A Measure of Long-Term Orientation: Development and Validation. *Journal of the Academy of Marketing Science*, *34*(3), 456–467. doi:10.1177/0092070306286706

Beedell, J., & Rehman, T. (2000). Using social-psychology models to understand farmers' conservation behaviour: The relationship of verbal and overt verbal responses to attitude objects. *Journal of Rural Studies*, *16*(1), 117–127. doi:10.1016/S0743-0167(99)00043-1

Berkowitz, L., & Lutterman, K. G. (1968). The Traditional Social Responsibility Personality. *Public Opinion Quarterly*, *32*(2), 169–185. doi:10.1086/267597

Bond, M. H. (1987). Chinese Values and the Search for Culture-Free Dimensions of Culture. *Journal of Cross-Cultural Psychology*, *18*(2), 143–164. doi:10.1177/0022002187018002002

Bradley, J. C., Waliczek, T., & Zajicek, J. (1999). Relationship between environmental knowledge and environmental attitude of high school students. *The Journal of Environmental Education*, *30*(3), 17–21. doi:10.1080/00958969909601873

Brownstone, D., Bunch, D. S., & Train, K. E. (2000). Joint mixed logit models of stated and revealed preferences for alternative-fuel vehicles. *Transportation Research Part B: Methodological*, *34*(5), 315–338. doi:10.1016/S0191-2615(99)00031-4

Chan, R., & Lau, L. (2001). Explaining green purchasing behavior: A cross-cultural study on American and Chinese consumers. *Journal of International Marketing.*, *14*(2/3), 9–40.

Chekima, B., Syed Khalid Wafa, S. A. W., Igau, O. A., & Chekima, S. (2015). Determinant Factors of Consumers' Green Purchase Intention: The Moderating Role of Environmental Advertising. *Asian Social Science*, *11*(10), 318–329. doi:10.5539/ass.v11n10p318

Chekima, B., Syed Khalid Wafa, S. A. W., Igau, O. A., Chekima, S., & Sondoh Jr, S. L. (2016). Examining Green Consumerism Motivational Drivers: Does Premium Price and Demographics Matter to Green Purchasing? *Journal of Cleaner Production*, *112*, 3426–3440. doi:10.1016/j.jclepro.2015.09.102

Chung, J. E., Stoel, L., Xu, Y., & Ren, J. (2012). Predicting Chinese consumers' purchase intention for imported soy-based dietary supplements. *British Food Journal*, *114*(1), 143–161. doi:10.1108/00070701211197419

Csutora, M., & Mozner, Z. V. (2014). Consumer income and its relation to sustainable food consumption-obstacle or opportunity? *International Journal of Sustainable Development and World Ecology*, *21*(6), 512–518. doi:10.1080/13504509.2014.965238

Davidson, D. J., & Freudenburg, W. R. (1996). Gender and Environmental Risk Concerns: A Review and Analysis of Available Research. *Environment and Behavior*, *28*(3), 302–329. doi:10.1177/0013916596283003

De Mooij, M. (2004). *Consumer Behaviour and Culture: Consequences for Global Marketing*. Sage.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Engel, J. F., Blackwell, R. D., & Miniard, P. W. (1995). *Consumer Behavior* (8th ed.). Forth Worth, TX: The Dryden Press Harcourt Brace College Publishers.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *JMR, Journal of Marketing Research*, *18*(1), 39–50. doi:10.2307/3151312

Gleim, M. R., Smith, J., Andrews, D., & Cronin, J. J. Jr. (2013). Against the green: A multi-method examination of the barriers to green consumption. *Journal of Retailing*, *89*(1), 44–61. doi:10.1016/j.jretai.2012.10.001

Godelnik, R. (2012, December 28). *2012: Four Trends in Sustainable Consumption*. Retrieved from http://www.triplepundit.com/2012/12/sustainable-consumption-trends/

Goodrum, C., & Dalrymple, H. (1990). *Advertising in America, The First 200 Years*. New York: Henry N.Abrams.

Gul, M. C. (2013). Long-term Orientation, Perceived Consumer Effectiveness, and Environmentally Conscious Consumer Behavior: The Case of Turkey. *International Journal of Marketing Studies.*, *5*(5), 23–31. doi:10.5539/ijms.v5n5p24

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate Data Analysis*. Upper Saddle River, NJ: Prentice-Hall.

Hair, J. F., Sarstedt, M., Ringle, C. M., & Mena, J. A. (2012). An assessment of the use of partial least squares structural equation modeling in marketing research. *Journal of the Academy of Marketing Science*, *40*(3), 414–433. doi:10.100711747-011-0261-6

Haron, S. A., Paim, L., & Yahaya, N. (2005). Towards sustainable consumption: An examination of environmental knowledge among Malaysians. *International Journal of Consumer Studies*, *29*(5), 426–436. doi:10.1111/j.1470-6431.2005.00460.x

Haykto, D. L., & Matulich, E. (2008). Green advertising and environmentally responsible consumer behaviours: Linkages examined. *Journal of Management and Marketing Research*, *1*, 2–11.

Hofstede, G. (1980). *Culture's Consequences: International differences in work related values*. Beverly Hill, CA: Sage.

Hofstede, G. (2001). *Culture's consequences: Comparing values, behaviors, institutions, and organizations across nations* (2nd ed.). Thousand Oaks, CA: Sage Publications, Inc.

Hoornweg, D., Bhada-Tata, P., & Joshi-Ghani, A. (2013). *What a Waste: A Global Review of Solid Waste Management.* Urban Development Series – Knowledge Papers. Available at: http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTURBANDEVELOPMENT/0,contentMDK:23172887~pagePK:210058~piPK:210062~theSitePK:337178,00.html

Hoyer, W., & MacInnis, D. (2004). *Consumer behavior* (3rd ed.). Boston, MA: Houghton Mifflin Company.

Kacen, J. J., & Lee, J. A. (2002). The Influence of Culture on Consumer Impulsive Buying Behavior. *Journal of Consumer Psychology*, *12*(2), 163–176. doi:10.1207/S15327663JCP1202_08

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Kaiser, F. G. (2006). A moral extension of the theory of planned behavior: Norms and anticipated feelings of regret in conservationism. *Personality and Individual Differences*, *41*(1), 71–81. doi:10.1016/j.paid.2005.11.028

Kao, T. F., Tu, J. C., Tu, Y. C., & Chan, H. Y. (2011). Influences of Product Involvement, Environmental Message and Green Advertising Appeals on Consumers' Attitudes Towards Advertising. *Journal of Business Research*, *5*, 1–18.

Kennedy, E. H., Beckley, T. M., McFarlane, B. L., & Nadeau, S. (2009). Why we don't walk the talk: Understanding the environmental values/behaviour gap in Canada. *Human Ecology Review*, *16*(2), 151–160.

Kluckhohn. (1956). *Toward a Comparison of Value Emphasis in Different Cultures, in the State of Social Sciences*. Chicago: The University of Chicago Press.

Kluckhohn, F. R., & Strodtbeck, F. L. (1961). *Variations in value orientations*. Evanston, IL: Row, Peterson.

Laroche, M., Bergeron, J., & Barbaro-Forleo, G. (2001). Targeting consumer who are willing to pay more for environmentally friendly products. *Journal of Consumer Marketing*, *18*(6), 503–520. doi:10.1108/EUM0000000006155

Litvine, D., & Wüstenhagen, R. (2011). Helping "light green" consumers walk the talk: Results of a behavioural intervention survey in the Swiss electricity market. *Ecological Economics*, *70*(3), 462–474. doi:10.1016/j.ecolecon.2010.10.005

Luna, D., & Gupta, S. F. (2001). An integrative framework for cross318 cultural consumer behavior. *International Marketing Review*, *18*(1), 45–69. doi:10.1108/02651330110381998

Mahmoud, M., Saeidinia, M., Reza, G., Roozbeh, H., Omid, F., & Jamshidi, D. (2011). Brand Equity Determinants in Educational Industry: A study of large universities of Malaysia. *IJCRB*, *3*(7), 769–781.

McCort, D., & Malhotra, N. K. (1993). Culture and consumer behavior: Toward an understanding of cross- cultural consumer behavior in international marketing. *Journal of International Consumer Marketing*, *6*(2), 91–127. doi:10.1300/J046v06n02_07

Minkov, M., & Hofstede, G. (2011). The evolution of Hofstede's doctrine. *Cross Cultural Management: An International Journal.*, *18*(1), 10–20. doi:10.1108/13527601111104269

Mostafa, M. M. (2006). Antecedents of Egyptian consumers' green purchase intention: A hierarchical multivariate regression model. *Journal of International Consumer Marketing*, *19*, 97–126. doi:10.1300/J046v19n02_06

Nik Abdul Rashid, N. R. (2009). Awareness of eco-label in Malaysia green marketing initiative. *International Journal of Business and Management*, *4*, 132–141.

O'Keefe, D. J. (2002). *Persuasion: Theory and research* (2nd ed.). Thousand Oaks, CA: Sage.

O'Neal, P. W. (2007). *Motivation of Health Behavior*. New York: Nova Science Publishers Inc.

Ottman, J. (1998). *Green Marketing: Opportunity for Innovation* (2nd ed.). Lincolnwood, IL: NTC/Contemporary Books.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Patterson, P. G., Cowley, E., & Prasongsukarn, K. (2006). Service failure recovery: The moderating impact of individual-level cultural value orientation on perceptions of justice. *International Journal of Research in Marketing*, *23*(3), 263–277. doi:10.1016/j.ijresmar.2006.02.004

Peter, J. P., & Olson, J. C. (2008). *Consumer behaviour and marketing strategy* (8th ed.). New York, NY: McGraw-Hill Education.

Pfanner, E. (2008, July 18). Cooling off on dubious eco-friendly claims. *The New York Times*, p. 3.

Prasongsukarn, K. (2009). Validating the Cultural Value scale (CVSCALE) a Case Study of Thailand. *ABAC Journal*, *29*(2), 1–13.

Rahbar, E., & Abdul Wahid, N. (2011). Investigation of green marketing tools' effect on consumers' purchase behavior. *Business Strategy Series.*, *12*(2), 73–83. doi:10.1108/17515631111114877

Rajagopal, D. (2011). Consumer culture and purchase intentions toward fashion apparel in Mexico. *Journal of Database Marketing and Customer Strategy Management.*, *18*(4), 286–307. doi:10.1057/dbm.2011.33

Ramayah, T., Jason, L. W. C., & Mohamad, O. (2010). Green Product Purchase Intention: Some Insights from a Developing Country. *Resources, Conservation and Recycling*, *54*(12), 1419–1427. doi:10.1016/j.resconrec.2010.06.007

Rezai, G., Mohamed, Z., & Shamsudin, M. N. 2011. Malaysian consumer's perception towards purchasing organically produces vegetable. *Proceedings of the 2nd International Conference on Business and Economics Research*.

Roitner-Schobesberger, B., Darnhofer, I., Somsook, S., & Vogl, C. R. (2008). Consumer perceptions of organic foods in Bangkok, Thailand. *Food Policy*, *33*(2), 112–121. doi:10.1016/j.foodpol.2007.09.004

Rokeach, M. (1973). *The Nature of Human Values*. New York: Free Press.

Ruiz, S., & Sicilia, M. (2004). The impact of cognitive and/or affective processing styles on consumer response to advertising appeals. *Journal of Business Research*, *57*(6), 657–664. doi:10.1016/S0148-2963(02)00309-0

Sabrina, O. S. (2007). *Predicting environmentally purchase behaviour: a test of the value-attitude-behaviour hierarchy*. The 2nd Indonesian Business Management Conference, Jakarta.

Sang, Y. N., & Bekhet, H. A. (2015). Modelling electric vehicle usage intention: An empirical study in Malaysia. *Journal of Cleaner Production*, *92*, 75–83. doi:10.1016/j.jclepro.2014.12.045

Sarigollu, E. (2009). A Cross-Country Exploration of Environmental Attitudes. *Environment and Behavior*, *41*(3), 365–386. doi:10.1177/0013916507313920

Schahn, J., & Holzer, E. (1990). Studies of individual environmental concern: The role of knowledge, gender, and background variables. *Environment and Behavior*, *22*(6), 767–786. doi:10.1177/0013916590226003

Schiffman, L., & Kanuk, L. L. (2010). Consumer Behavior (10th ed.). Pearson Education, Inc.

Schiffman, L. G., & Kanuk, L. L. (1994). *Consumer Behaviour* (5th ed.). London: Prentice-Hall.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Schlosser, A. E., White, T. B., & Lloyd, S. M. (2006). Converting web site visitors into buyers: How web site investment increases consumer trusting beliefs and online purchase intention. *Journal of Marketing*, *70*(2), 48–133. doi:10.1509/jmkg.70.2.133

Schwartz, J., & Miller, T. (1991). The earth's best friends. *American Demographics*, *13*, 26–35.

Schwartz, S. H. (1994). Are there universal aspects in the structure and contents of human values? *The Journal of Social Issues*, *50*(4), 19–45. doi:10.1111/j.1540-4560.1994.tb01196.x

Selles, H. (2013). The relative impact of countries on global natural resource consumption and ecological degradation. *International Journal of Sustainable Development and World Ecology*, *20*(2), 97–108. doi:10.1080/13504509.2013.780190

Steg, L., & Vlek, C. (2009). Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of Environmental Psychology*, *29*(3), 309–317. doi:10.1016/j.jenvp.2008.10.004

Straughan, R. D., & Roberts, J. A. (1999). Environmental segmentation alternatives: A look at green consumer behavior in the new millennium. *Journal of Consumer Marketing*, *16*(6), 558–575. doi:10.1108/07363769910297506

Strizhakova, Y., & Coulter, R. (2013). The "green" side of materialism in emerging BRIC and developed markets: The moderating role of global cultural identity. *International Journal of Research in Marketing*, *30*(1), 69–82. doi:10.1016/j.ijresmar.2012.08.003

Suplico, L. T. (2009). Impact of green marketing on the students' purchase decision. *Journal of International Business Research.*, *8*(2), 71–79.

Tan, B. C., & Lau, T. C. (2010). The Influencing Factors of Green Purchase Behaviour*: An Exploratory Study. International Conference on Marketing (ICMAR2010).*

Tanner, C., & Kast, S. W. (2003). Promoting sustainable consumption: Determinants of green purchase by Swiss consumers. *Psychology and Marketing*, *20*(10), 883–902. doi:10.1002/mar.10101

Torgler, B., & Garcia-Valinas, M. A. (2007). The determinants of individual attitudes towards preventing environmental damage. *Ecological Economics*, *63*(2-3), 536–552. doi:10.1016/j.ecolecon.2006.12.013

Urbach, N., & Ahlemann, F. (2010). Structural Equation Modeling in Information Systems Research Using Partial Least Squares. *Journal of Information Technology Theory and Application*, *11*, 2, 5–40.

Vining, J., & Ebreo, A. (1992). Predicting recycling behaviour from global and specific environmental attitudes and changes in recycling opportunities. *Journal of Applied Social Psychology*, *22*(20), 1580–1607. doi:10.1111/j.1559-1816.1992.tb01758.x

Webb, T. L., & Sheeran, P. (2006). Does changing behavioral intentions engender behavior change? A meta-analysis of the experimental evidence. *Psychological Bulletin*, *132*(2), 249–268. doi:10.1037/0033-2909.132.2.249 PMID:16536643

Werner, J., & Alvensleben, R. V. (2011).Consumer Attitudes towards Organic Food in Germany (F.R.). *Symposium on Horticultural Economics, 8*, 155.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Wong, K. K. K. (2013). Partial least squares structural equation modeling (PLS-SEM) techniques using SmartPLS. *Marketing Bulletin.*, *24*, 1–23.

Wu, J. H., Wu, C. W., Lee, C. T., & Lee, H. J. (2015). Green purchase intentions: An exploratory study of the Taiwanese electric motorcycle market. *Journal of Business Research*, *68*(4), 829–833. doi:10.1016/j.jbusres.2014.11.036

Xue, F. (2014). It Looks Green: Effects of Green Visuals in Advertising on Chinese Consumers' Brand Perception. *Journal of International Consumer Marketing*, *26*(1), 75–86. doi:10.1080/08961530.2014.848094

Yaveroglu, I. S., & Donthu, J. (2002). Cultural influences on the diffusion of products. *Journal of International Consumer Marketing*, *14*(4), 49–36. doi:10.1300/J046v14n04_04

Yazdanpanah, M., & Forouzani, M. (2015). Application of the Theory of Planned Behaviour to predict Iranian students' intention to purchase organic food. *Journal of Cleaner Production*, *107*, 342–352. doi:10.1016/j.jclepro.2015.02.071

Yoo, B., Donthu, B., & Lenartowicz, T. (2011). Measuring Hofstede's Five Dimensions of Cultural Values at the Individual Level: Development and Validation of CVSCALE. *Journal of International Consumer Marketing*, *23*(3/4), 193–210.

Zelezny, L. C., & Schultz, P. W. (2000). Promoting environmentalist. *The Journal of Social Issues*, *56*(3).

Zhu, B. (2013). The Impact of Green Advertising on Consumer Purchase Intention of Green Products. *World Review of Business Research.*, *3*(3), 72–80.

Zimmer, M. R., Stafford, T. F., & Stafford, M. R. (1994). Green issues: Dimensions of environmental concern. *Journal of Business Research*, *30*(1), 63–74. doi:10.1016/0148-2963(94)90069-8

Zsoka, A., Szerenyi, Z. M., Szechy, A., & Kocsis, T. (2013). Greening due to environmental education? Environmental knowledge, attitudes, consumer behavior and everyday pro-environmental activities of Hungarian high school and university students. *Journal of Cleaner Production*, *48*, 126–138. doi:10.1016/j.jclepro.2012.11.030

KEY TERMS AND DEFINITIONS

Environmental Advertising: Environmental advertising is defined as a specific type of communication designed towards promoting social, economic and environmental benefits of products to form a responsible values and behavior of consumers.

Environmental Knowledge: Environmental knowledge is the amount of information individuals have concerning environmental issues and their ability to understand and evaluate its impact on society and the environment.

Green Purchasing Intention: Green purchase intention stands for a willingness and distinct kind of environmentally friendly behavior by individuals to give preference to green products compared to conventional products to express their concern to the environment.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Long-Term Orientation: Long-term orientation is a cultural orientation that deals with time - past, present and future to foster virtues oriented towards future rewards, in particular perseverance and thrift.

Man-Nature Orientation: Man-nature orientation is referred as the friendly behavior or relationship between human beings and the natural environment because of the love of nature and the passion to protect it.

Structural Equation Modeling: Structural equation modeling (SEM) as a second-generation technique, is a statistical technique for building and testing simultaneous modeling of relationships among multiple variables.

This research was previously published in the Handbook of Research on Consumerism and Buying Behavior in Developing Nations edited by Ayantunji Gbadamosi, pages 383-408, copyright year 2016 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 12
Constructing Green IT Alignment Framework: Car Manufacturer Case

Leelien Ken Huang
Feng Chia University, Taiwan

ABSTRACT

Using contingency theory (CT) of fit as a foundation for this research, we report the development of the notion of 'green IT alignment framework' and its determinants. This is followed by an analysis of the relationship between capability areas (i.e., contextual factors) and green IT alignment while the company pursues GREEN. Data were collected from a case study where a car manufacturer is our research setting—considered as suitable for this type of research. The author found that a total of 18 capability areas over three domains of technical, organizational, and environmental are a premise for green IT alignment. Such capability areas are considered as new and interdependent of traditional strategic alignment capabilities. The results of this research demonstrate an appropriate green IT alignment framework that is trust worthy to construct for understanding the factors of IT-business fit while pursing GREEN. Implications are discussed.

1. INTRODUCTION

With intensive public discussions and widespread coverage in the media, the impact of global warming on the environment has been the foremost issue to governments, non-government organizations, and consumers (Enkvist, Naucler, & Oppenheim, 2008; Friedman, 2007; Kuo & Dick 2009). Stronger national (or international) commitment to reduce greenhouse gas (GHG) emissions and achieve other environmental goals creates pressure for finding ways to achieve greater efficient use of energy and other resources while sustaining economic growth (Dedrick, 2010). This environmental issue has shifted from being solely the concern of scientists and/or environmentalists to being recognized by business executives now concerned with impact on shareholder value (Bonini, Hintz, & Mendonca, 2007). The notion of "GREEN" (i.e., environmental considerations [e.g., environment friendly products/services, etc.])

DOI: 10.4018/978-1-5225-7915-1.ch012

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

has therefore become important to sustainability (i.e., company success) in terms of business strategy (Elkington, 1998; Enkvist & Vanthournout, 2008; Price Water House Coopers & SAM, 2008) and social responsibility (Kuo & Dick, 2009).

To achieve sustainability, the notion of 'green information technology (IT)' has emerged and is considered as reducing the direct environmental impact of designing, manufacturing, using, and disposing of computer, servers, and associated sub-systems (Murugesan, 2008). For example, recycling electronic wastes can be a priority for many companies (Herat & Bahadir, 2007). Energy efficiency in hardware and data centres also receives great attention, given the potential to reduce carbon emissions and lower energy costs (Forrest, Kaplan, & Kindler, 2008). However, researchers argue that the scope of green IT mentioned above is too narrow (Dedrick, 2010). A broader scope includes the use of IT to improve sustainability across the economy (Watson, 2008). For example, improving efficiency in industries such as transportation, manufacturing, and energy sectors, where they or their products are the major sources of GHG emissions. A broad view of green IT to drive business innovation, productivity, and thus company growth in terms of environmental considerations, can also be a potential source of solutions to improve a company's overall performance (Ghose, Hasan, & Spedding, 2008).

In the literature, green IT toward sustainability has become a significant issue in the narrow sense, whereas less attention has been paid in the broad view (Dedrick, 2010). That is, conceptual and anecdotal evidence indicates that green IT is linked to energy and cost efficiency; it is mainly discussed in terms of equipment utilization (e.g., hardware, networking, applications, etc.) rather than organizational (strategic) impact of IT while pursuing GREEN. This is supported by a recent survey by Forrester (2009), which indicates that the top motivation for adopting green IT practices is still reducing costs. Because broad-viewed green IT involves business innovative practices that enhance the recognition of organizational situations (Ghose, Hasan, & Spedding, 2008; Swnson & Ramiller, 2004), and it is a company's adaptation to the external dynamics with the use of IT (Huang, 2009), a strategic nature is embedded. In particular, broad-viewed green IT considers IT organizational impact, which is a typical alignment issue where IT must support business and vice versa while the company pursues GREEN toward sustainability (Dedrick, 2010; Loeser, Erek, Limbach, & Zarnekow, 2013; Molla, 2009). This means 'green IT alignment'.

Our research focuses on broad-viewed green IT and conceptualizes 'green IT alignment' as equivalent to the traditional strategic alignment that has appeared as the top concern for IT practitioners and business executives (Luftman et al., 2005). The impact of strategic alignment between IT function, IT infrastructure, organizational infrastructure, and business planning processes on company performance has been widely studied (Sabherwal & Chan, 2001; Sabherwal, Hirschheim, & Goles, 2003; Tallon, Kraemer, & Gurbaxani, 2000). With the concept of GREEN, strategic alignment practices should consider how a company responds (or adapts) to the business market with the use of IT underlying increased public environmental concern (Molla, 2009).

Although green IT alignment can be referred to as traditional strategic alignment, it requires new organizational capabilities (Molla & Cooper, 2009). Therefore, a traditional step-by-step strategic alignment framework may not be a reliable guide for practitioners. Green IT alignment needs to start with a clear assessment of those capabilities (or factors) that can help identify the company's position, intended state, and IT progress in supporting the business in its pursuit for GREEN. This requires a framework that not only accounts for factors that allow (or inhibit) the diffusion (spread and usage) of IT that supports the business, but also explicitly considers the role played by different key stakeholders (e.g., IT, business, etc.). Unfortunately, the current green IT alignment framework is unclear (Molla & Cooper, 2009). As a result, there is a lack of understanding and guidance to help assess the extent to which how

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

IT supports the business while company pursues GREEN. An immediate field of research is necessary, and therefore conducted in order to examine how companies assess their green IT alignment.

Grounded on contingency of fit, this research uses the concept of 'strategic alignment' to examine whether fostering and/or development of a certain capability area is more effective toward green IT alignment. Use of the contingency theory (CT) is considered 'suitable' because its key concept of 'fit' indicates a feasible set of equally effective and internally consistent patterns of factors (Khazanchi, 2005), which fulfils our research objective of constructing a green IT alignment framework that demonstrates an optimal (or fit) model of organisational effectiveness that consider appropriate antecedents (or moderators). Thus, the contribution is the identification of a configuration that demonstrates key emphases specific to achieve green IT alignment.

In the sense of broad-viewed green IT, car manufacturing sector is suitable for this type of research to understand how IT supports the business while the company purses "GREEN" (e.g., electric vehicles--EVs). This research believes that both the government and car manufacturers are interested in knowing how green IT alignment can be achieved by considering the company's environmental performance, and therefore, improving overall competitiveness. To fulfil the research objective, we conceptualize green IT and contingency of fit first, then strategic alignment. Next, a notion of green IT alignment is presented. This is followed by a methodology. Findings and implications are also presented.

2. LITERATURE REVIEW

2.1. Green IT

Green IT has been conceptualised in several ways, with wider or narrow scope and a variety of terminologies and concepts. As noted, Murugesan (2008) defined 'green IT' as the study and practice of designing, manufacturing, using, and disposing computer, servers, and associated sub-systems efficiently and effectively with minimal or no impact to the environment. This definition emphasizes energy improvement and equipment utilization in terms of designing energy efficient chips, virtualization, reducing data centre energy consumption, using renewable energy to power data centres, and reducing electronic waste (Watson, 2008). In this sense, green IT is usually associated with technologies and techniques for improving the efficiency of data centres to reduce the environmental impact of IT operations (Nunn, 2007). Table 1 lists the traditional conceptualization of green IT.

Table 1. Exemplars of Green IT

Conceptualization of Green IT	Contributors
Reduction of energy consumption and subsequent CO2 emissions form ICT equipment	ACS (2007)
Equipment recycling, sever consolidation and virtualization, optimizing data centre energy efficiency, print optimisation, data centre airflow management, rightsizing IT equipment, green considerations in souring and RFPS, budget allocation for green IT projects, liquid cooling for IT equipment, DC powered IT equipment, airside/waterside economizer, carbon offsetting.	Info Tech (2007)
Managing IT assets and services in a more energy-efficient way to limit and reduce the company's overall carbon foot print	Nunn (2007)
Energy efficiency through solving challenges of cooling, power and space	Mitchell (2008)

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Nevertheless, IT use should allow organisational-wide green initiatives (Gartner, 2008). Green IT should encompass not only technological solutions, but also business practices and managerial actions that respond to the public environmental concern in terms of business sustainability (Mines & Davis, 2007). In other words, a broad scope of green IT should include the use of IT to enhance business sustainability. As noted, this includes improving efficiency in industries where they or their products create significant GHG emissions, and also considers business innovation that drives company growth. In particular, a broad scope of green IT should consider both the environmental and organizational impact created by the use of IT while pursuing GREEN.

The literature started to seriously consider the role IT can play in both creating and reducing global warming when IT was viewed as part of both the problem and solution (Fuchs, 2008). Thus far, much of the discussion and activity in green IT focus on the direct environmental impacts caused by making data centres and personal computing equipment more efficient. Such efforts can directly reduce IT costs, and therefore, there has been a strong incentive for companies to adopt them (Dedrick, 2010; Forrester, 2009). Cost reduction confirms the profit perspective of most businesses for greener IT practices (Dedrick, 2010). However, an unclear business value for green IT may discourage companies to adopt green IT practices (Molla, 2009). In other words, companies generally adopt green IT practices only when it makes economic sense. (Dedrick, 2010). In particular, nowadays, green IT is part of a fundamental change in business: it is a subset of the larger sustainable trend that reconciles sustainable business practices with profitable business operations (Mines & Davis, 2007).

2.2. Contingency of Fit

CT provides internal/external business and technology factors for identifying alternative courses of action in order to obtain an optimal model of organisational effectiveness (Khazanchi, 2005). CT contributes to the quality and productivity of IT and the company at large by providing feedback (i.e., business adjustments) to manage and improve IT to better meet business needs (Benlian & Hess, 2007). This process of seeking fit is often part of the strategic planning process that reflects a company's appropriate response to its business dynamics (Anderson & Paine, 1975).

Several contextual factors or situational characteristics (e.g., environmental, technical, or organisational factors) have been included in the analysis of a fit relationship (Benlian & Hess, 2007; Ducan, 1995; Earl, 1993; Jiang, 2003; Kearns, 2000; Kearns, 2005; Kearns & Lederer, 2004; Wang, 2001). With these contextual variables, IT contingency research on fit examines the problems, benefits, methodologies, and management issues of the IT strategic planning process that adapts IT to the dynamic business environment (i.e., strategic alignment) (Doherty, Marples & Suhaimi, 1999; Lederer & Sethi, 1996; Ragu-Nathan et al., 2004; Tang & Tang, 1996; Teo & Ang, 2001).

According to Van De Ven and Drazin (1985), a satisfied organisational outcome depends upon a 'fit' or match between two or more contextual factors. There are three ways for defining and testing the concept of fit: selection, interaction, and systems approach (Van de Ven & Drazin, 1984). Because of its relevance to this research, we focus on the systems approach. Underlying this approach, such a fit can be treated as a feasible set of equally effective and internally consistent patterns of contextual factors, structural alternatives, and organizational performance (Khazanchi, 2005; Van de Ven & Drazin, 1984). In a sense, the concept of fit has broad utility to various areas of theory development where organizational performance is a function of match, congruence, intersection, or union of two or more factors (Van de Ven & Drazin, 1984).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

2.3. Strategic Alignment

Over the past decades, many empirical and conceptual works have examined IT/business alignment (Chan & Reich, 2007a). Some studies adopt a strategic perspective in which alignment is the fit between IT and business strategies (e.g., Benbya & McKelvey, 2006; Chan & Huff, 1992; Huang, 2009), whereas others argue from the operational perspective that IT/business plans and structures (e.g., company/IT department) should be matched simultaneously (e.g., Ein-Dor & Segev, 1982; Fiedler, Grover & Teng, 1996; Fonstad & Subramani, 2009), and that business needs should fit information system priorities (Chan & Reich, 2007b).

We focus on the strategic perspective and define 'strategic alignment' as the degree to which IT and business missions, goals, and plans are matched internally and are externally valid, as well as the extent of the shared vision and commitment between business executives and IT managers on the congruence of the mission, goals, and plans (Chan & Huff, 1992; Henderson & Venkatraman, 1999; Luftman, 2000; Reich & Benbasat, 2000).

With this definition, strategic alignment can generally be viewed as the social and intellectual process of strategy formulation that seeks a fit among environmental, organisational, and technical factors (or situations as noted) and depends on those factors (Doty, Glick, & Huber, 1993; Kim, 2003; Reich & Benbasat, 2000). This process involves continuous adaptations that ensure successful alignment implementation results (Chen, Sun, Helms, & Jih, 2008). Simply speaking, when formulating IT strategy and actually implementing IT plans that support business (or vice versa), managers must consider (or adapt) relevant situations over time to ensure cohesive goals across market and technological domains (Pfeffer & Salancik, 2003).

The literature has argued that the inability to realise better organisational performance is due in part to strategic misalignment (e.g., Benco & McFarlan, 2003; Croteau & Bergeron, 2001; Fonstad & Subramani, 2009; Henderson & Venkatraman, 1999; Kearns & Lederer, 2003; Preston & Karahanna, 2009; Tallon, 2003). This indicates that an effective and efficient IT organisational impact requires strategic alignment. To respond effectively to a dynamic environment, appropriately exploiting IT (based on situations) has been viewed as an important strategic alignment resource (Chung, Rainer, & Lewis, 2003; Khazanchi, 2005; Kohli & Devaraj, 2004; Porter & Millar, 1985). However, the literature agrees that strategic perspective alignment is an on-going issue, and in the long term, a difficult task because of the need for a high-quality set of inter-related IT and business plans (Chen et al., 2008; Henderson & Venkatraman, 1999; Luftman et al., 2006; Reich & Benbasat, 2000).

2.4. Green IT Alignment

As noted, a narrow scope of green IT is the direct environmental impact from IT hardware during a product lifecycle, including production, use, and disposal of computer equipment, whereas broad-viewed green IT is longer term and more dynamic, as are the effects of IT on processes such as transportation and industrial production (e.g., products/services provided), influencing their environmental impacts. The environmental impact of broad-view green IT occurs when widespread use of IT leads to changes in lifestyle and economic structure, for example, widespread use of IT that supports manufacturing automobiles, which in turn leads to suburbanization, motels, fast food chains, and other changes in lifestyles and economic systems; however, the changes and environmental impact generated from these changes are not evident until decades later (Dedrick, 2010).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Because environmental considerations can be significant for the long-term environmental impact of IT-based products/services that change lifestyles, they form important dimensions in company sustainability (Pricewater House & SAM, 2008). Social responsibility becomes a concern in business strategy, and the triple profit measure of company success that includes economic, social, and ecological sustainability should be considered (Elkington, 1998). Therefore, green IT practices should take a longer term and more dynamic view to examine both IT organizational and environmental impacts. This often requires broader organization operations, for example, the IT department is not the only one directly involved in the company's efforts to pursue GREEN. Comparable efforts are also required by personnel and/or other business units when making decisions about telecommuting; operations and logistics managers that are concerned with transportation, production, and supply chain issue; and product development that is responsible for reducing the environmental footprint of products or services (Dedrick, 2010). This sense of strategic alliance between IT and all other relevant units within an organization for GREEN ensures both the business value of IT (i.e., IT organizational impact) and environmental performance, which is a green IT alignment issue.

However, even encountering pressure from legitimation, social responsibility, and rival competition, unclear business values (i.e., strategic misalignment) can be a disincentive to adopting green IT practices (Molla, 2009). Therefore, green IT alignment should be viewed as the company's adaptive process of the strategy formulation that is a function of the fit among environmental, organisational, and technical factors, and depend on those factors.

3. METHODOLOGY

Because of the idiosyncratic nature of those conditions or contextual factors that we explore in this paper, and there should be no generalized IT contingency model according to CT, a single case study is used. We employ the approach of Wintershield (1994) to identify the conditions for achieving green IT alignment through interviews with managers. This allows us to capture and understand the social and organizational context where the phenomenon 'technology adoption' (e.g., green IT practices) occurs (Bunduchi, 2005). Following Bunduchi's (2005) rationale, we search for happenings and not occurrences. That is, we attempt to understand the phenomenon of green IT alignment issues or difficulties in relation to the strategic alignment of IT and business perception without necessarily looking for the statistical significance of findings (Bunduchi, 2005).

3.1. The Case

Taiwan is an ideal location for examining the green IT alignment issue. Global warming has drawn the government's attention, and clean energy and the reduction of GHG emissions have been the primary focus of Taiwan green policy (Lee, 2009). In support of this, Executive Yuan launched the Dawning Green Energy Industry Program. In this program, one of the major green goals is to be a major Asian production base for EVs. This provides local car manufacturers with an incentive for developing EVs (Li, 2013).

For example, Luxgen EV, a new electric car prototype model recently released by local major automobile manufacturer Yulon Motor (noted as Y Motor), is the outcome of using IT to support auto technology

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

that considers both environmental impact (i.e., reduction of GHG emissions) and fuel efficiency. EVs have become an essential product to meet public environmental concerns.

We limit our case to Y Motor because it is suitable for this type of green IT alignment research given that it has relied heavily on IT to support engineering techniques and green business innovation in the development of EVs that are both fuel efficient and produce zero carbon dioxide (CO2) emissions. With the readiness of IT resources, auto manufacturing, and ET, Y Motor has been aggressively pursuing EV for years, partnering with Nissan Japan and Geely China.

GREEN towards sustainability has been the vision of Y Motor. Green products inevitably become the primary business strategy. To fulfil the research objective, it is worthwhile for us to examine how Y Motor uses IT strategically, generating business value while pursuing GREEN. We identify critical contextual factors, and accordingly, develop a general green IT alignment framework.

Participants for interview were selected if they had worked on the IT department that supports GREEN practices, and were typically located at headquarters, where there is a significant IT presence. Single source bias is well recognized. We also selected business executives familiar with the company's strategic position, and participants from other business units with GREEN experience in production, supply chain issue, and product development. These participants are believed to be knowledgeable about the entire company's strategic position with regard to green IT alignment. Six participants were selected (i.e., two from the IT side and four from the general business side), which is consistent with Sanders' (1982) argument that three to six individuals can provide sufficient information. Table 2 lists their profile and the characteristics of Y Motor.

Table 2. Characteristics of Case: Y Motor

General Information							
Company Size	1350	Annual Sales (US$)	>= 9.3 Bn	IT Dept. Size	>=40	IT Dept. History	>=20
Company History Primary Business:	>=59			# of Systems	>=30		
Assembling	87% (Nissan, Cadillac, Buick, Renault, Luxgen, Opel)						
Component	8%						
Others	5%						
Participant	Title		Function			Years in Company	
A	Senior VP		Business			18	
B	Manger		IT			11	
C	Assistant Mgr.		IT			7	
D	VP		Manufacturing			16	
E	Manager		Distribution			6	
F	Manager		Car Design Center/R&D (HAITEC)			12	

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

3.2. Case Research Concept

As noted, **g**reen IT alignment requires new organizational capabilities (e.g., new technical and business skills) (Molla & Cooper, 2009); the traditional strategic alignment mechanism may not be applicable to explain how companies assess the relationship between IT organizational impact while considering their environmental performance. This is supported by the information systems (IS) community, which claims that in most cases of strategic alignment studies, conclusions cannot be generalized easily (Chan, 2007). Therefore, the use of CT with a nature of 'it depends' is encouraged for examining strategic alignment issues (Chan, 2007).

Given CT, we describe the notion of green IT alignment as consisting of the conditions under which Y Motor should consider itself a likely successful candidate for adopting broad-viewed green IT practices (i.e., satisfied IT organizational impacts and environmental performance). Thus, we construct an exploratory study to identify the contextual factors considered by Y Motor to evaluate how IT supports business (and vice versa) while pursuing GREEN (e.g., EV products) in terms of potential fit (i.e., adaptive) and its ability to influence benefits accrued to the company. In view of contingency of fit, we address two research questions in terms of the content (knowing) and the process (know-how), as indicated in Table 3. This is used for a subsequent interview guide for the data collection and analysis of constructing a green IT alignment framework.

3.3. Data Collection

As indicated in Table 4, the interviews were semi-structured based on the interview guide, which attempts to answer the preceding two major research questions (demographic questions not included). The interview questions were cited and justified according to extant literature in green IT practices and traditional strategic alignment (e.g., Dedrick, 2010; Huang, 2009; Huang, 2010; Kuo & Dick, 2009; Gupta, Karimi, & Sommers, 1997, Mollar & Cooper, 2009, etc.).

To ensure content validity and question reliability, we requested IS professors to review the preliminary English version of the interview questions, as well as the Chinese translation to ensure that the meaning was not altered, the terminologies and technical terms were translated accurately, and the participants understood the questions. The Chinese version of the questions was tested to examine whether there were major modifications to the questions. The pilot test result was satisfactory and provided valuable comments for the interview guide revisions.

Table 3. Research questions: the content and the process

What	Why
The Content: Under what conditions (contextual factors) should the company consider itself a likely candidate for IT planning and implementation that support business and vice versa while the company pursues GREEN? (RQ1)	This provides a better understanding of the structure and characteristics of appropriate green IT alignment framework.
The Process: What and how is the relationship of those factors on the company performance during the planning process in terms of green IT alignment? (RQ2)	This addresses the notion expressed earlier from the contingency of fit that suggests that there needs to be a match between organizational, environmental and technical factors on the company performance that pursues GREEN with the use of IT.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Data were collected over an eight-month period. Each participant was interviewed for at least 90 minutes. While interviewing the participants, we attempted to ensure that they express their opinion on the contextual factors they considered important, and answer our questions related to strategic alignment and green IT alignment concerns. Although the pilot test was satisfactory, the questions were still modified to incorporate the findings of the previous interviews after each interview in order to help strengthen and develop a green IT alignment framework.

Field notes were captured in order to record a detailed account of the participants' thoughts, feelings, experiences, and perceptions throughout the research process. Follow-up interviews were conducted to ensure that all necessary data were collected. With the prior consent of participants, tape recording was also used. We also examined internal documents (e.g., presentations, internal newsletters, etc.), public records and news articles, and press releases related to the GREEN practices used by Y Motor's IT department.

4. RESULTS AND DISCUSSION

After careful data aggregation and classification, we grouped the responses into several meaningful commonalities across the different types of questions we asked, as indicated in Table 4. These commonalities were compared constantly with new data/responses, and allowed us to realize that they were required to ensure better green IT alignment. These classified commonalities were developed later as the contextual factors that had impact on green IT alignment.

Accordingly, a contingency-based green IT alignment framework of Y Motor was constructed as shown in Figure 1. In the framework, emergent contextual factors were compared with the literature and treated as capability areas that Y Motor needs to reinforce and develop toward effective organizational and environmental performance—i.e., the strategic alignment of IT and business goals while pursuing GREEN. This is similar to the contextual factors that are antecedents to the capabilities that have impact on strategic alignment in the studies of Kearns and Lederer (2003, 2004). In particular, in our case study, CT supported the fact that emergent contextual factors should be appropriately considered and coordinated as an organization's new capabilities when planning and implementing IT to effectively support GREEN (Ryoo & Koo, 2013).

As shown in Figure 1, the capability areas identified in the three dimensions of technical, organizational, and environmental were viewed as higher order factors from the narrow sense to a broader sense of green IT that influences green IT alignment. Because the participants were both from the business and IT sides, we believe that these capability areas truly capture the phenomena of green IT alignment practices. That is, the single source bias was well controlled. In the following paragraphs, capability areas with their key corresponding responses are presented.

4.1. Technical Capability Areas

One of the IT participants commented that '*we need to save IT budget, power consumption, and enhance our entire efficiency of using IT*'. This argument is similar to that in the most recent narrow-sense green IT literature noted previously. This is also echoed by a business senior VP who commented that the cost efficiency of IT resource management is one of Y Motor's strategic concerns in planning IT, as well as

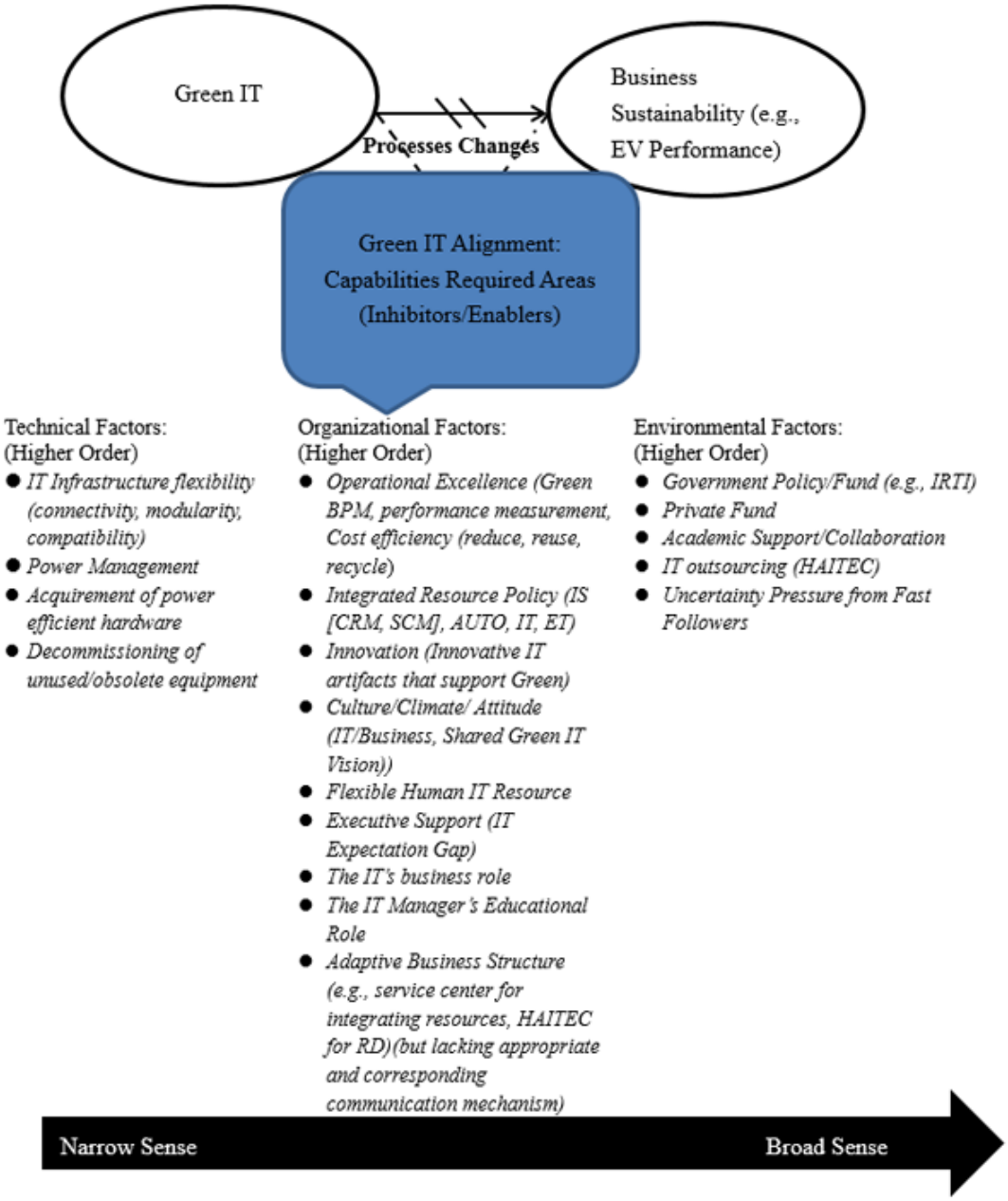
EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 4. Interview guide

Type of Question	Interviewee	Interview Question	RQ to Answer
General Questions	Business Executive (A)	What motivated you company to go GREEN? Has the GREEN proved successful so far? Why or why not?	RQ1, RQ2
Organizational Factors	Business Executive (A) IT Manager (B,C) Functional Manager (D, E, F)	How did you recognize that IT is critical to this GREEN success? How did you endorse IT investments that have not satisfied traditional justification criteria and procedures to support go GREEN? Did you commit to information systems function to pursue GREEN? And why or why not? How did you support the progressive use of IT in your company for GREEN? How did you make choices about IT infrastructure, IT processes and IT people, and even IT outsourcing while the company pursues GREEN? While company pursuing GREEN, how did you decide on centralization, decentralization, or hybrid structures of your IT department? What outcomes were you expecting from green IT practices? How did you set up IT supporting teams for company's GREEN? How did your IT people communicate and interact with non-computer oriented people in terms of their needs for GREEN? And why? How did your IT people recognize organizational key issues and problems of a given GREEN area (e.g., product development)? And why? How did you IT people determine positive and negative impacts of a specific IT system on specified parts of GREEN)? And why? How did your IT people work effectively in cross-functional teams addressing business problems while the company pursues GREEN? And why?	RQ1
Technical Factors	IT manager (B, C)	How did your IT department provide electronic links and connections while the company pursues GREEN? And why? How did your IT department provide access to a large variety of data types, including text, voice, and graphics while the company pursues GREEN? And why? How did your IT department use object-oriented and pre-packaged modular tools to create software applications while the company pursues GREEN? And why? Can computer software modules be easily added to, modified, or removed from existing IT infrastructure with minimal impact? Please explain.	RQ1
Technical Factors	IT manager (B, C)	How did your IT people design and implement databases with a generalized database management system; and develop structured or modular programs while the company pursues GREEN? How did your IT people recognize the appropriate management science model for situations commonly encountered while the company pursues GREEN? How did your IT people formulate and solve complex simulation models while the company pursues GREEN?	RQ1
Environmental Factors	Business Executive (A) IT Manager (B, C)	How did you feel competitive pressure while company pursuing GREEN with the use of IT? How did you feel legitimation pressure to go GREEN with the use of IT? How did you feel social responsibility pressure to go GREEN with the use of IT? What are environmental concerns in planning and implementing IT to support GREEN? And why? Any other concerns? For example, governmental support, attitude, policy, infrastructure, etc., please explain?	RQ1
Green IT Alignment Questions	Business Executive (A) IT Manager (B, C)	What was the role of IT in the GREEN practices? In addition to cost reduction, how do you decide that you have a successful green IT alignment? How IT was previously aligned with business and what changes were necessary to ensure it was re-aligned in the GREEN context? Who made the decisions and why? How did your IT strategy reflect and support mission and goals, and vice versa while the company pursues GREEN? How did your IT strategy recognize external business forces while the company pursues GREEN? How did your IT strategy reflect business resource constraints while the company pursues GREEN? How did your GREEN practices utilize strategic capability of IT? How did your business executives expect IT reasonably while the company pursues GREEN?	RQ2

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 1. Emerged green IT alignment framework of Y motor



the baseline of their business goals while pursuing GREEN. Apparently, for Y Motor the fundamentals of performing GREEN with the use of IT is clearly economic-oriented through the development of technical capability areas that can help reduce cost and increase the efficiency of IT use. To do this, the three capability areas are labelled as 'Power Management', 'Acquiring Power Efficient Hardware', and 'Decommissioning Unused/obsolete Equipment', and they allow Y Motor to reduce cost and GHG emissions, as well as retire servers and/or defer the purchase of new servers, thus decreasing electricity

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

consumption and heat waste. Such three capability areas are more associated with the narrow sense of green IT while Y Motor pursues GREEN in its daily business operation.

However, as noted, GREEN towards sustainability is Y Motor's vision. The above narrow-sense three technical capability areas are not sufficient for explaining the new capability required for Y Motor's green product development to be the primary business strategy. As commented by the IT participants,

…our boss seems to expect more from what we can use the systems for, not only to help internal operations, but also to interact updated data and information with those people outside our department or even company…this can help everyone capture timely messages and share the same vision…without deviating from our policy while pursuing GREEN…therefore the IT platform, functions, and communication must flexibly reflect the current and future green business needs… considering the public and government environmental concerns…

To ensure that IT has a comprehensively positive impact on the entire organization while pursuing GREEN, another technical capability area for 'Flexibility in IT infrastructure' is labelled. The term 'flexibility' is borrowed from the literature because our participants' comments are similar to those in Ducan's study (1995). Accordingly, we classify this flexibility into the three types of connectivity, modularity, and compatibility that Y Motor should emphasize in order to gain better green IT alignment.

Based on the previous comments, we argue that, in order to reduce transaction costs and increase efficiency while pursuing GREEN in either the EV production process or general administration routines, Y Motor must improve the connectivity flexibility in electronic links and connections, which ensures that end users are electronically well linked with other end users across departments. This provides smooth communication while exchanging green data and information, and therefore ensures accuracy and updated situations during the process of GREEN implementation (e.g., shared green IT vision among IT and business units).

Y Motor also needs to improve modular flexibility. As commented by business participants,

…our IT systems are just not appropriate to handle current business issues and problems while developing our EV… so our IT decision is often to acquire new IT resources which may not be necessarily needed and often takes too much time and effort to update the systems. This indeed incurred our costs.

In this sense, to reduce costs, Y Motor requires a level of modularity in systems and applications to be improved in order to ensure reusable software modules in new systems development; the use of a great extent of object-oriented and pre-packaged modular tools to create software applications; and software modules that can be easily added to, modified, or removed from existing IT infrastructure with minimal impact while pursuing GREEN.

Because EVs have been one of the core products of Y Motor, various types and sources of data and information have been highly involved in the traditional process of design and even production. This addresses an issue for how Y Motor can integrate these different data and information, and obtain synergy in terms of production efficiency and cross selling. Hence, Y Motor requires an increase of compatible flexibility by providing a great extent of multiple interfaces or web access (EDI) for external suppliers and customers to share all types of information, and also a great extent of access to a large variety of data types, including text, voice, and graphics.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

A total of four technical capability areas were identified. Future research should focus on exploring measurements for these technical capabilities. Moreover, although a variety of technical capability areas were found, given CT, future research should focus on how the moderating (contingent) effect of these technical capability areas may indicate that a certain level of technical capabilities distinguishes the IT plan (i.e., the level of IT management sophistication), which in turn affects green IT alignment, similar to the study of Gupta, Karimi, and Somers (1997).

4.2. Organizational Capability Areas

As commented by a business senior VP, "…recognized that the EV project is critical to our success… embraces a strong broad-based vision for the role of IT and sometimes endorses IT investments, even those that have not satisfied our traditional justification criteria and procedures." This is similar to past findings where the executives' shared IT vision and IT confidence leads to a better strategic alignment (e.g., Preston & Karahanna, 2009; Loeser et al., 2013).

Therefore, the capability area of 'Executive Support' for IT while pursuing GREEN is found, indicating that understanding how importantly business senior VPs perceive IT resources, and thus support IT, is critical and fundamental to achieving a green IT alignment. We also found that effective communication is key to ensuring strong executive support. Although this is a common finding in the literature (e.g., Johnson & Lederer, 2007), we continuously argue that this is true for Y Motor. That is, effective communication facilitates the relationship between business senior VP, IT people, and other units, such as manufacturing, distribution, and car design centre, while pursuing GREEN (e.g., EVs). As a result, they allocate energy to making the relationship more responsive so that IT does not necessarily generate a sustained business value unless top management's perception is much broader sensed while pursuing GREEN.

As commented by a manufacturing participant, "we know that our VP did support EV, and IT people did initiate new IT projects to meet our assembly line [components, body, painting] needs…but we need to streamline our process because current business process and operational procedures seems too complex, out-dated [traditional] to handle …just cannot effectively use IT systems to retrieve data [information] quickly and handle changing and updated EV engineering and design requirements on time…." Participants from the car design/RD centre also complained that they "…always got feedback [very late] from the manufacturing side about whether EV design meets engineering and technical standards…need to correct it if there is something wrong…don't want to slow down the process…need newer and clearer performance criteria…." These comments are similar to past literature (e.g., Chew & Gottschalk, 2009; Herzog, Lefevre, & Pierson, 2012; Rouyet & Spauwen, 2011, Salam, 2011, etc.)

Therefore, the three organizational capability areas of 'Operational Excellence', 'Integrated Resource Policy', and 'Innovative IT Climate' are found as the new organizational capabilities that Y Motor should reinforce or develop in order to alleviate the aforementioned processes issue. The literature argues that an efficient process for developing green products/services is a critical innovative initiative. We believe that this process, including green business process management (BPM), performance measurements (e.g., balance scorecard model), and cost efficiency through reduce, reuse, and recycle of IT resources (as previously commented by IT participants), supports an operational excellence strategy.

This broader-sense operational excellence fulfils Y Motor's vision of GREEN towards sustainability, where it is an environmentally and socially responsible automobile manufacturer. Future research should

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

focus on how BPM and performance measurements can be well integrated and distinguish operational excellence strategies caused by a different perception of the speed-to-market green product development process, and on how this divergence would influence an organization's financial performance (Chew & Gottschalk, 2009).

However, to obtain better operational excellence, we found that an integrated resource policy of using IT-based customer relationship management (CRM), supply chain management (SCM), automation, IT, and even engineering technology, should be formulated to offer greater convenience and flexibility to Y Motor's business units, such as manufacturing, car design centre, distribution, and/or even suppliers and customers, in managing different aspects of their needs for EV products. This is similar to the study of Chew and Gottschalk (2009), which indicated that integrative use of resources can generate intimacy toward sustainable environment pursuing GREEN. Hence, intimacy among internal IT and business units, and external suppliers and customers, is believed to increase the shared vision and thus ensure a green IT alignment that delivers value.

As commented further by the business senior VP, "IT people may not share this enthusiasm [GREEN towards sustainability] when it comes to allocating cash to implement them…but as the IT manager, his job is not only to keep the business running, but also to be innovate; to show the C-suite, the board, and the marketplace ways of running a business, developing IT-based products, and providing insight they didn't know were possible…". This implies that higher executive support depends on how well an IT manager can convince top management. This allows top management to believe that IT people are capable of solving difficult business problems or challenges, and thus increases confidence in endorsing new and unproven IT techniques while pursuing GREEN.

Therefore, we found that building innovative climate, culture, and/or attitude, where innovative IT artefacts effectively support GREEN, is an important organizational capability where IT people can share (the green IT) vision with business and vice versa. This is similar to Olavsrud's study (2015), where setting the IT organization up to an innovative climate of learning, discovery, and iteration is exactly what a company arranges to do. Given CT, future research should focus on how innovative IT climate moderates the organizational impact of green IT alignment.

We also found that the business role of IT is a necessary organizational capability. As noted by the business senior VP, "they [IT people] need to work with key business stakeholders [car design centre, manufacturing] to evangelize for change [EV]…need to ensure on-going communication at regular intervals to all audiences to report progress, provide updates, promote relevant key project milestone wins and recognize project contributors". In Y Motor, changes caused by pursuing GREEN are difficult for most people (business and IT) to accept. To avoid disconnects between the vision and IT implementation, the IT manager needs a clear shared vision (including business financials) and business roadmap to communicate while pursuing GREEN. Given CT, future research should focus on how that shared vision can be developed while pursuing GREEN and what those antecedents are (e.g., Preston & Karahanna, 2009).

Another key organizational capability that we found is that IT human resources should be flexible in order to manage the diverse business contacts of GREEN. Given Y Motor's vision, the new skill from IT people that is different from the traditional should be more business-oriented. As commented by the IT manager, "to ensure IT's contribution not only in energy savings and cost efficiency [cost centre], but also in helping to synthesize all units to realize GREEN goals [EV]…business skills are crucial for both IT managers and staff while coordinating the multi-faceted and sophisticated IT activities…they [IT people] should work as partners to EV engineers to gain knowledge and experiences about procedures". This would increase executives' confidence (and support), and indicates that along with technical skills,

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

IT people are expected to have business skills in order to improve their flexibility in response to a dynamic environment (Huang, 2015). In the literature, Lee's study (2005) shows that IT people need both technical and behavioural skills. Bailey and Mitchell (2006) also identified soft, business (or strategic) concepts, and technical skills that are important for flexible IT people. Given CT, future research should focus on what and how business skills can be complementary and co-evolve with technical skills, which achieves alignment (e.g., Chan, Sabherwal, & Thatcher, 2006; Huang, 2010).

To foster flexible IT human resources, we found that the IT manager plays an educational role. As commented by the IT manager, "being an educator trains how IT people provide flexible solutions for service problems…it is also important to educate executives on green technology issues, knowledge, IT capabilities, and problems". The literature indicates that the organization's education of flexible human resources should include on the job training, experience sharing, relationships, and shared employee insights (Grant, 1996). This education can be conducted by providing organizational elements such as empowerment and autonomous system design teams, enriched and shared jobs, and incentives for collaborative learning and shared work practices in order to build an environment wherein skilled IT people can leverage technical and business skills, and bear the assets of an entire social network. Based on CT, these flexible human IT resources are difficult to fit with internal strategic needs and should be matched with the external environment. With this education, IT people may work flexibly under various business situations and leverage their performance with stronger executive support. This education could also reduce the IT expectation gap and create better strategic alignment (Huang, 2015; Preston & Karahanna, 2009).

We also found that an adaptive business structure is a critical organizational capability area. As commented by the business senior VP, "we need new units to speed up business processes by integrating information and data so as to fulfil our GREEN goals…". This finding supports CT in that an adaptive relationship between the organizational structure and external public environment while pursuing GREEN is the key to strategic alignment. To do this, Y Motor set up HAITEC (i.e., car design/RD centre) as a platform that facilitates and integrates all EV-related business ideas and required information/data. This reduces the possibility of misunderstandings and smoothens the information flow, thus resulting in efficient and precise outcomes for EV development.

However, in spite of HAITEC, as previously noted by the car design/RD centre, obtaining late feedback from manufacturing indicates the lack of an appropriate and corresponding communication mechanism through the use of IT for information and data integration. Future research should focus on how IT-based communication mechanisms differ with the various adaptive business structures (e.g., prospector, defender, and/or analyser [Miles and Snow, 1978]). In other words, future work should investigate whether an appropriate type of IT-based communication mechanism (e.g., an IT steering committee) could effectively help integration in a certain business structure (e.g., conservative defender). We believe that with an appropriate communication mechanism, GREEN project planning and implementation in a specific strategic environment can be effective (i.e., alignment).

A total of nine organizational capability areas were identified. Future research should focus on exploring measurements for such organizational capabilities. With both the technical and organizational capability areas identified, future research could also use analysis of dominance to investigate the relative importance within and between them. This can prioritize the area that is more relatively important to improve green IT alignment. Based on CT, future research will also focus on interaction (i.e., complementary) effect of technical and organizational capabilities on green IT alignment.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

4.3. Environmental Capability Areas

The business senior VP commented that "government's green policy encourages EV development…this utilization of green technology would be a beneficial one against global warming, but also an interest to the market… exactly our GREEN vision". This indicates that government policy that relates to EV is a critical external environment factor. The government must put forth efforts to develop the fundamental infrastructure for EVs (e.g., battery charging), which would increase market acceptance of EVs. With the support of IT, Y Motor should establish a capability that is highly linked with the government or government's research institute (e.g., Industrial Technology Research Institute) to ensure satisfactory communication with regard to EV development and market needs.

Private funding is also important. As commented by the senior business VP, "we have to control our financial debt to avoid financial leverage risk and gain better capital structure… so as to increase our shareholder's value by commercializing EV…we need more cash injection to support RD [new EV ideas]". This implies that Y Motor must acquire sufficient funding support for EVs from private investors. However, the senior business VP claimed that "we must rely on flexible IT systems to keep investors updated on EVs and avoid unexpected disappointments that results in withdrawals"; this echoes the technical capability of flexible IT infrastructure that we found previously. This finding is also similar to Bakker's study (2010). Based on CT, future research should focus on how IT people should work as business partners, and 'talk' the language of investors to ensure private investment is properly managed.

The senior business VP also commented that "IT systems help our team to work…collaboratively with the university on the continuous improvement of engineering technology, battery charging, and infrastructure for EV use". This implies that academic support and collaboration is key to a broader sense green IT (i.e., developing EVs for both public environmental concerns and the economic value of sustainability). We argue that this new capability of collaboration with universities in EV growth and innovation needs more flexible and timely IT systems and infrastructure. This IT-based collaboration could effectively change how Y Motor applies IT to business needs, and how they collaborate both internally and externally. Future research should focus on how this IT-based collaboration might impact green IT alignment. Future research should also focus on the collaborative mechanisms (i.e., what the focus is and what needs to be improved) that capture profits by enhancing intellectual property rights, and avoid slight tacit knowledge involved in the EV product while pursuing GREEN.

Outsourcing is another key external environmental capability. As commented by the senior business VP, by "…leveraging benefits ranging from low cost, improved quality to product, and service innovation…we delegate our EV design and business processes to HAITEC". HAITEC is a third-party company set up by Y Motor. This implies that outsourcing can release internal resources that can be effectively utilized for other purposes while Y Motor pursues GREEN. For example, Y Motor can dedicate more effort to improving (leveraging) engineering technology and IT resources for better alignment with business needs (i.e., EV design) that are effectively provided by a third party while pursuing GREEN. Future research should focus on how certain outsourcing strategies are more effective than others, in particular IT and business strategies (i.e., conservative or aggressive), as well as how effective green IT alignment positively affects outsourcing benefits.

A fast follower is another critical external factor encountered by Y Motor. The senior business VP commented that "uncertain pressure from fast followers indeed gives us a high challenge to speed up our EV innovation…we must differentiate our EV products and integrate our supply chain resources like RD, manufacturing, sales and marketing, and service…". This indicates that EVs are fast becoming a

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

competition between the traditional automotive value chain and a focus on recharging infrastructures. As commented by the senior business VP, "some original equipment manufacturers and newcomers from both western economies and China are our major competitors". This implies that in order to increase competiveness and secure a position, IT must be sufficiently agile and play a critical role in helping the business strategy respond to external pressure by scanning the environment effectively (e.g., global issues of CO2 emissions, fuel economy, fuel price volatility, energy security gaining increased government and consumer attention, etc.), and thus monitor the EV first market signal in time to develop new EV products (e.g., battery pack). Similar to outsourcing, future research should focus on how certain EV product development strategies are more effective than others, in particular IT and business strategies, in improving green IT alignment.

In terms of the environmental dimension, five capability areas were found to impact green IT alignment. Similar to technical and organizational capability areas, future research should focus on exploring measurements for environmental capabilities for the purpose of operationalization. Based on CT, future research will focus on the prediction and interaction effects of the environmental capability area on green IT alignment.

5. CONCLUSION AND POLICY IMPLICATIONS

The results presented in this research are based on qualitative comments from the interviews. We identified 18 capability areas over the three aspects of technical, organizational, and environmental through which the green IT alignment of a car manufacturer can be enabled or inhibited while pursuing GREEN. Our findings demonstrate the CT key concept that they play the influential contextual role of antecedents (or moderators) of green IT alignment.

In comparison with the literature about alignment antecedents such as corporate vision and culture (e.g., Attaran, 2004; Avison, Eardley, & Powell, 1998; Brown & Magill, 1994), shared knowledge (e.g., Reich & Benbasat, 2000), prior experience with IT (e.g., Teo & Ang, 1999), leadership (e.g., Baker, 2004), planning process (Teo & Ang, 19999), and communication styles (e.g., Campbell, 2005; Reich & Benbasat, 2000; Sledgianowski & Luftman, 2005), our results are considered new and different from traditional capabilities of strategic alignment, particularly in the environmental aspect.

For example, car manufacturers should put forth more effort in fostering the capability of building reliable and agile IT systems to scan information relating to governments' GREEN policies/subsidies, and public environmental concerns, other than simply market/product information. To do this, they should have flexibility in electronic links and connections, and provide multiple interfaces or web access (EDI) for external government and the public, as well as suppliers and customers, to share all types of information and vice versa. Doing so should help defend the strategic position, and/or secure the first signal (e.g., timing, content, etc.) of regulation changes, car engineering and technological deployment, green-based new product collaboration with universities (e.g., EV research and development, incubation, etc.), and even the protection mechanism of innovative green ideas, such as patents. This can ensure that car manufacturers obtain updated and correct information, and thus reduce external uncertainty in order to maintain a competitive position while pursuing broad-sensed GREEN toward green IT alignment.

However, this type of environmental capability could develop differently because of different business strategies adopted by car manufacturers, given that executives could perceive environmental uncertainty differently (Miles & Snow, 1978). It also should be noted that all antecedents of strategic alignments in

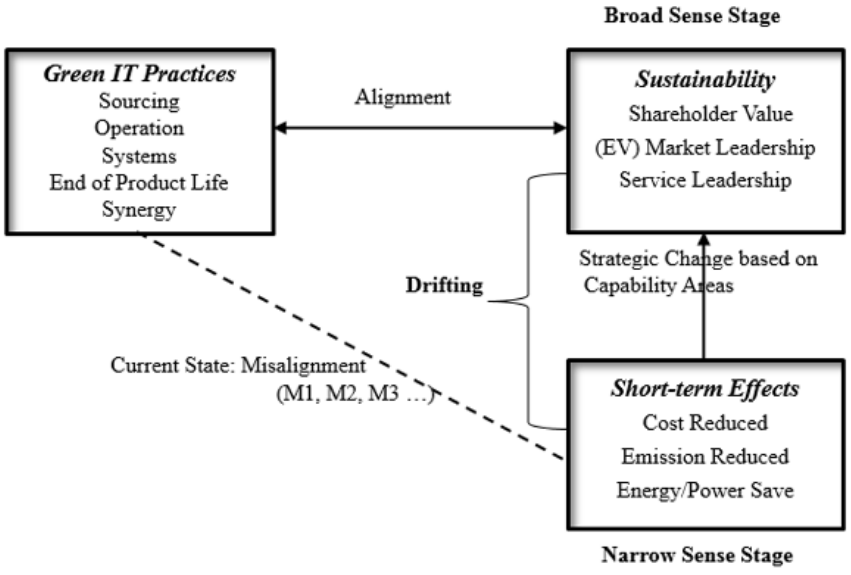
EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

the literature could be interdependent with the factors found in the green IT alignment framework. For example, a close working relationship between business and IT, corporate culture, and shared knowledge can be an influential background of our organizational capability areas (e.g., Attaran, 2004; Luftman & Brier, 1999). Another example is where building stakeholder commitment and environmental IT scanning can be a foreground (i.e., visible behaviour that influences the alignment) of our environmental capability areas (e.g., Chan & Reich, 2007). Moreover, executive commitment to the strategic use of IT, confidence in the IT department, and knowledge in IT can be a foreground of our technical capability areas (e.g., Teo & Ann, 1999).

The practical implication of our findings is shown in Figure 2, which indicates a Path to Green IT Alignment (P2GA) Paradigm. Understanding the current status of the green IT alignment is very important to proper green IT practices, such as sourcing, operation, systems application, end of product life, synergy with business, etc. Based on the P2GA paradigm, we suggest that the systematic analysis of the present green IT alignment status (e.g., level of misalignment [M1, M2, M3, etc.]) in a company can be the first step in establishing a further direction for alignment in terms of both short-term effects (e.g., cost reduced, emission reduced, energy/power save, etc.) and sustainability (e.g., shareholder value, market leadership, service leadership, etc.). Accordingly, because of the misalignment between short-term effects and sustainability, strategic changes (i.e., action plans) based on capability areas can be identified. However, there must be a drifting time toward the ideal status of green IT alignment. It might take years to complete and/or improve the required capability area, depending on how much executives support the broad sense of green IT while pursuing GREEN, and whether there is a shared IT vision among all stakeholders within the company.

We conclude that the narrow sense of green IT does not guarantee business sustainability, unless comparable efforts are dedicated to the integration of all broad-sensed IT and business resources to generate business value, that is, a green IT alignment that considers both organizational and environmental impacts. However, this is a long-term and difficult task to do.

Figure 2. Path to Green IT Alignment Paradigm



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Our emergent green IT alignment framework provides a guideline for car manufacturers where green IT alignment can only be achieved when those certain identified capability areas are properly fostered and developed together. That is, with CT, we proposed that there is no single solution for alignment problems; rather, it is the capability areas found in the three aspects of technical, organizational, and environmental that allow car manufacturers to leverage engineering technology and IT to gain business value while pursuing GREEN. We further proposed that the measurement models of our identified capability areas are required because the previous literature argues that neglecting to specify exact conceptual or measurement models of fit could lead to inconsistent results in the alignment study (e.g., Chang & Reich, 2007).

The limitations should be noted. Although other industries might refer to our green IT alignment framework, our findings can only be useful to the car industry while pursuing GREEN. This is because the literature argues that alignment can be institutionalized in certain industries, no longer making it a differentiating factor (e.g., Palmer & Markus, 2000). Future research may focus on specific industries to ensure better granularity in findings and deeper understanding in how green IT alignment allows business value creation. Another limitation is that, because the capabilities areas found are higher order factors, we could not explain the specifications for how to improve capability areas (i.e., we lack a first order factor of those capabilities areas that can be operationalized). In other words, with our framework, future research should study how to improve green IT alignment. This echoes our previous proposal that measurement models are needed.

We suggest that stakeholder theory can be used to identify the influences and interests of each stakeholder to construct a well-defined green IT alignment framework, or even a step-by-step mechanism. However, it must be noted that the interests of each stakeholder might change over time while pursuing green IT. Executives must be careful to consider this when examining the status of green IT alignment. We further suggest that the theory of dynamic capabilities can also be used to examine the framework and/or mechanism required to build the company's new capability for developing, deploying, and shaping the IT resources that support green business because the environment is dynamic. In a sense, we may clearly understand how the company can shorten the time required to develop capability areas and streamline the green IT alignment process.

ACKNOWLEDGMENT

This study was supported by the National Science Council of Taiwan (grant number NSC 100-2410-H-035-009).

REFERENCES

ACS. (2007). Australian Computer Society Policy Statement on Green ICT. WWW.acs.org.au

Attaran, M. (2004). Exploring the Relationship between Information Technology and Business Process Reengineering. *Information & Management*, *41*(5), 581–596. doi:10.1016/S0378-7206(03)00098-3

Avison, D. E., Eardley, W. A., & Powell, P. (1998). Suggestions for Capturing Corporate Vision in Strategic Information Systems. *Omega*, *26*(4), 443–459. doi:10.1016/S0305-0483(97)00076-5

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Bailey, J., & Mitchell, R. B. (2006). Industry Perceptions of Competences Needed for Computer Programmers: Technical, Business, and Soft Skills. *Journal of Computer Information Systems*, *47*(2), 28–33.

Baker, E. H. (2004). Leading Alignment. *CIO Insight*, *1*(45), 19–20.

Bakker, S. (2010). The Car Industry and Blow-out of the Hydrogen Hype. *Energy Policy*, *38*(11), 6540–6544. doi:10.1016/j.enpol.2010.07.019

Banerjee, S. B. (2002). Corporate Environmentalism: The Construct and Its measurement. *Journal of Business Research*, *55*(3), 177–191. doi:10.1016/S0148-2963(00)00135-1

Bonini, S., Hintz, G., & Mendonca, L. (2007). Assessing the Impact of Society Issues: A McKinsey Global Survey. *The McKinsey Quarterly*.

Brown, C. V., & Magill, S. L. (1994). Alignment of the IS Functions with the Enterprise: Toward a Model of Antecedents. *Management Information Systems Quarterly*, *18*(4), 371–403. doi:10.2307/249521

Campbell, B. (2005). Alignment: Resolving Ambiguity within Bounded Choices. Proceedings of PACIS 2005, Bangkok (pp. 1-14).

Chan, Y. E., & Reich, B. H. (2007). IT Alignment: What Have we learned. *Journal of Information Technology*, *22*(4), 297–315. doi:10.1057/palgrave.jit.2000109

Chan, Y. E., Sabherwal, R., & Thatcher, J. B. (2006). Antecedents and Outcomes of Strategic IS alignment: AN Empirical Investigation. *IEEE Transactions on Engineering Management*, *53*(1), 27–47. doi:10.1109/TEM.2005.861804

Chew, E. K., & Gottschalk, P. (2009). *Information Technology Strategy and Management: Best Practices* (p. 436). New York: Information Science References. doi:10.4018/978-1-59904-802-4

Dedrick, J. (2010). Green IS: Concepts and Issues for Information Systems Research. *Communications of the Association for Information Systems*, *27*, 174–184.

Duncan, N. B. (1995). Capturing the Flexibility of Information Technology Infrastructure: A Study of Resource Characteristics and Their Measure. *Journal of Management Information Systems*, *12*(2), 37–57. doi:10.1080/07421222.1995.11518080

Elkington, J. (1998). *Cannibals with Folks: The ripple Bottom Line of 21st Century Business*. Stony Creek, CT, USA: New Society Publishers.

Enkvist, P. A., Naucler, T., & Oppenheim, J. M. (2008). Business Strategies for Climate Change. *The McKinsey Quarterly*, *2*, 24–33.

Enkvist, P. A., & Vanthournout, H. (2008). How Companies Think About Climate Change: A McKinsey Global Survey. *The McKinsey Quarterly*, *2*, 46–51.

Forrest, W., Kaplan, J. M., & Kindler, N. (2008). Data Centers: How to Cut Carbon Emissions and Costs. *The McKinsey Quarterly*, *14*. Retrieved from https://www.mckinseyquarterly.com/Data_centers_How_to_cut_carbon_emissions_and_costs_2255

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Forrester (2009). IT's Role in Reducing Corporate Environmental Impact: A Commissioned Study Conducted on Behalf of Cisco Systems Inc. Retrieved from http://www/cisco.com/en/US/prod/collateral/switches/ps5718/ps10195/CiscoTLP Final.pdf

Friedman, T. L. (2007). The Power of Green. *The New York Times Magazine*, August. Retrieved from www.nytimes.com/2007/04/15?magazine/15green.t.html>

Fuchs, C. (2008). The Implications of New Information and Communication Technologies for Sustainability. *Environment, Development and Sustainability*, *10*(3), 291–309. doi:10.100710668-006-9065-0

Ghose, A., Hasan, H., & Spedding, T. (2008). *Carbon-centric Computing: IT Solutions for Climate Change*. University of Wollongong Working Group on the Carbon-Centric Computing initiative. Retrieved from www.uow.edu.au/∽aditya/research/ccci/CCCI

Grant, R. M. (1996). Prospering in Dynamically: Competitive Environments: Organizational Capability as Knowledge Integration. *Organization Science*, *7*(4), 375–389. doi:10.1287/orsc.7.4.375

Gupta, Y., Karimi, J., & Somers, T. (1997). Alignment of a Firm's Competitive Strategy and Information Technology Management Sophistication: The Missing Link. *IEEE Transactions on Engineering Management*, *44*(4), 399–413. doi:10.1109/17.649870

Heart, S., & Bahadir, M. (2007). Sustainable Management of Electronic Waste (e-Waste). *CLEAN-Soil, Air. Water (Basel)*, *35*(4), 305.

Herzog, C., Lefevre, L., & Pierson, J. (2012). Green IT for Innovation and Innovation for Green IT: The Virtuous Circle. *IFIP International Federation for Information Processing. AICT*, *386*, 79–89.

Huang, L. K. (2015). Exploring Factors Affecting Top Management Support of IT Implementation: A Stakeholder Perspective in Hospital. *Journal of Information Technology Management*, *26*(1), 31–45.

Info-Tech. (2007, July). 11 Green Initiatives Your Peers are Cultivating. *Info-Tech Research Group*.

Johnson, A. M., & Lederer, A. L. (2007). The Impact of Communication between CEOs and CIOs on Their Shared Views of the Current and Future Role of IT. *Information Systems Management*, *24*(1), 85–90. doi:10.1080/10580530601038246

Kearns, G. S., & Lederer, A. L. (2003). A Resource-Based View of Strategic IT Alignment'. *Decision Sciences*, *34*(1), 1–29. doi:10.1111/1540-5915.02289

Kearns, G. S., & Lederer, A. L. (2004). The Impact of Industry Contextual Factors on IT focus and the Use of IT for Competitive Advantage. *Information & Management*, *41*(7), 899–919. doi:10.1016/j.im.2003.08.018

Kuo, B. N., & Dick, G. N. (2009). The Greening of Organizational IT: What Makes a Difference? *Australasian Journal of Information Systems*, *16*(2), 81–92.

Lee, C. K. (2005). Analysis of Skills Requirements for Systems Analysts in Fortune 500 Organizations. *Journal of Computer Information Systems*, *45*(4), 84–92.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Lee, P. C. (2009). Reductions of Greenhouse Gas Emissions from Nuclear Energy in Taiwan. *Taiwan Economic Forum*, 7(6), 54-70.

Li, S. (2013). The Development of Green Energy Industry in Taiwan and Future Prospects. In *Seminar Presentation, May*. Hsinchu, Taiwan: Industrial Technology Research Institute.

Loeser, F., Erek, K., Limbach, F., & Zarnekow, R. (2013). Shared Domain Knowledge in Strategic Green IS Alignment" AN Analysis from Knowledge-based View. *Proceedings of 46th Hawaii International Conference on Systems Science*, Wailei, Hawaii (pp. 3515-3524).

Luftman, J., & Brier, T. (1999). Achieving and Sustaining Business–IT Alignment. *California Management Review*, *42*(1), 109–122. doi:10.2307/41166021

Luftman, J., Kempaiah, R., & Nash, E. (2005). Key Issues for IT Executives 2005. *MIS Quarterly Executive*, *5*(2), 81–101.

Miles, R. E., & Snow, C. C. (1978). *Organizational Strategy*. McGrawhill, New York: Structure, and Process.

Mines, C., & Davis, E. (2007). Topic Overview: Green IT. *Forrester Research*. Retrieved from www.forrester.com/research/document/excerpt/0,7211,43494,00.html

Mitchell, R. L. (2008). Green by Default. *ComputerWorld*. Retrieved from www.computerworld/pdfs/LFG_green_IT_2008

Molla, A. (2009). An International Comparison of Green IT Diffusion. *International Journal of Business and Management*, *3*(2), 3–23.

Molla, A., & Cooper, V. (2009). Green IT Readiness: A Framework and Preliminary Proof of Concept. *Australasian Journal of Information Systems*, *16*(2), 5–23.

Murugesan, S. (2008). Harnessing Green IT: Principles and Practices. *IT Pro*, January/February, 24-33.

Nunn, S. (2007). Green IT: Beyond the data Centre How IT Can Contribute to the Environmental Agenda Across and Beyond the Business (White Paper). Accenture.

Olavsrud, T. (2015). Why a Data Driven Transformation Requires A Cultural Shift. *CIO*, April, 10-14.

Palmer, J. W., & Markus, M. L. (2000). The Performance Impacts of Quick Responses and Strategic Alignment in Specialty Retailing. *Information Systems Research*, *11*(3), 241–259. doi:10.1287/isre.11.3.241.12203

Preston, D., & Karahanna, E. (2009). How to Develop a Shared Vision: The Key to IS Strategic Alignment. *MIS Quarterly Executive*, *8*(1), 1–8.

Price Water House Coopers & SAM. (2008). The Sustainability Year Book 2008. Retrieved from www.sam-group.cm/downloads/YB/Yearbook_2008.pdf>

Reich, B. H., & Benbasat, I. (2000). Factors that Influence the Social Dimension of Alignment between Business and Information technology Objectives. *Management Information Systems Quarterly*, *24*(1), 81–113. doi:10.2307/3250980

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Rouyet, J. I., & Spauwen, W. J. (2011). Using COBIT to Achieve Green Business-IT Alignment. *Computerworld*, (January), 3–7.

Ryoo, S. Y., & Koo, C. (2013). Green Practices IS Alignment and Environmental Performance: The Mediating Effects of Coordination. *Information Systems Frontiers*, *15*(5), 799–814. doi:10.100710796-013-9422-0

Salam, M. A. (2011). Supply Chain Commitment and Business Process Integration: The Implication of Confucian Dynamism. *European Journal of Marketing*, *45*(3), 358–382. doi:10.1108/03090561111107230

Simulation Modelling and Strategic Change: Creating the Sustainable Enterprise, Patrick Dawson, Trevor Spedding, AJIS,(2009) 16 (2)

Sledgianowski, D., & Luftman, J. (2005). IT-Business Strategic Alignment Maturity: A Case Study. *Journal of Cases on Information Technology*, *7*(2), 102–120. doi:10.4018/jcit.2005040107

Teo, T. S. H., & Ang, J. S. K. (1999). Critical Success Factors in the Alignment of IS Plans with Business Plans. *International Journal of Information Management*, *19*(2), 173–185. doi:10.1016/S0268-4012(99)00007-9

Van De Ven, A. H., & Drazin, R. (1985). The Concept of Fit in Contingency Theory. *Research in Organizational Behavior*, *7*, 333–365.

Watson, R. T. (2008). Green IS: Building Sustainable Business Practices. *Information Systems*.

This research was previously published in the International Journal of Strategic Information Technology and Applications (IJSITA), 6(3); edited by Caroline Howard, Karen Schenk, and Kathleen M. Hargiss, pages 1-22, copyright year 2015 by IGI Publishing (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 13
Understanding Attitude Towards Green IT Among Professionals in IT Service SMEs in Bangladesh

P. L. Gan
Universiti Sains Malaysia, Malaysia

Imran Mahmud
Daffodil International University, Bangladesh

T. Ramayah
Universiti Sains Malaysia, Malaysia

Fatema Tuz Zuhora
Daffodil International University, Bangladesh

ABSTRACT

Bangladesh is a least developed country which ranks 131 out of 132 in the environment pollution index. Currently, small- and medium-sized enterprises (SMEs) provide 70–80 percent of job opportunities in Bangladesh. Information technology (IT) is one of the industries providing highest employment in the country. The IT professionals' expertise plays an important role in influencing the firms' decisions regarding sustainability. The objective of this chapter is to develop a theoretical model to measure attitude towards green IT usage among IT professionals in Bangladesh. The model will be grounded on self-determination theory.

INTRODUCTION

The study of attitude towards green IT practice has emerged to be a dominant and driving field in current information system research. Many researchers suggest that the green IT perspective can be a partial solution to environmental problems According to Ansari et al. (2010), from the business point of view,

DOI: 10.4018/978-1-5225-7915-1.ch013

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

"Green IT is part of a fundamental change in the economy and society. It is a subset of the larger green (sustainable) business trend, which reconciles sustainable business practices with profitable business operations." Molla et al. (2011) defined green IT attitude as sentiment, norms, and values with relation to eco sustainability and role of IT. Esfahani et al. (2015) tested green IT attitude by measuring the impact of argument quality, source credibility and green IT belief. By using value-belief-norm theory, Huijts et al. (2013) measured the predictive power of personal norms on pro-environment behaviour. Akman and Misra (2015) investigated on technology acceptance model to explain the attitude towards using green IT. In this research, we primarily focus on green IT attitude, which will influence end users to adopt green IT practice. On individual level, limited researchers worked on self-determination theory (SDT). The objective of this study is to derive and empirically test a theoretically grounded model of the factors leading to green IT attitude.

BACKGROUND

Burning of fossil fuel, e-waste, deforestation and land clearing for agricultural purposes, and overexploitation of definite resources are some causes behind the increase of greenhouse gases in the atmosphere. According to The *Economist* (2015) special report on climate change, the earth's atmospheric carbon dioxide concentration increased from 361 parts per million in 1995 to 399 parts per million in 2014, with drastic increase between years 2000 and 2015.

Carbon dioxide, methane, CFCs – also commonly known as greenhouse gases – trap heat and warm the earth's surface, thus being the main culprits behind rising temperatures. The earth's temperature now is 0.9 degrees warmer than it was in 1880, that is, before the Industrial Revolution. The rising concern over climate change, pollution and ozone depletion has led to various treaties and agreements among the world leaders. With the Kyoto Protocol, participating countries agreed upon reducing greenhouse gas emissions by year 2020. In addition to the Kyoto Protocol, COP21, held in Paris recently, had participating nations achieve agreement that the global temperature increase should be kept below 2 degrees or 1.5 degrees Celsius above the industrial era (UNFCC, 2015). However, researchers argued reducing carbon emission or mitigating temperature is not achievable over a short period of time (Molla et al, 2009).

On the other hand, innovations in the last century have led to cheaper, better, and faster production. Modern technology has also changed business transactions from traditional business to e-business, and the economy to an e-economy. Information technology has taken an important role, both in business and daily human life. It has made the world closer and smaller, through eliminating global boundaries and creating economic opportunities. Sadly, such opportunities came with their own flaws, like increasing demand of energy, servers, and data centres. Older equipment or e-waste ended in landfills faster than we could imagine – all in order to make way for newer and higher-efficiency equipment (Srivastava & Srivastava, 2012). Although IT is one of the culprits behind environmental issues, Ruth (2009) argued that IT can also provide solutions to address the problem of the remaining 98 per cent of the carbon emission.

The mentioned effects are explained as first-order effects and second-order effects. First-order effects are the negative effects of IT, resulting from all phases of production from cradle to grave. Second-order effects refer to the positive effects of IT on the environment (Esfahani et al, 2014; Faucheux & Nicolaï, 2011). Hence, making greener and environmental friendly IT products is termed green IT, whereas using IT to tackle environmental issues is termed IT for green.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The IT Industry in Bangladesh

Bangladesh is a least developed country (LDC), located in South Asia, with a population of 160 million (Trading Economics, 2015) that has increased 211 per cent in 50 years. The country's vast population led it to becoming a country with large labour markets. Although Bangladesh Bureau of Statistics could not provide accurate data on the number of SMEs, Asian Development Bank reported that SMEs in Bangladesh create 70-80 per cent of all job opportunities in the country. It is estimated that SMEs in Bangladesh account for 90 per cent of employment in the industrial sector (Asian Development Bank, 2013). SMEs also contribute 25 per cent to national gross domestic product (GDP) and 75 per cent to the household income (Rahman et al, 2014).

The IT industry in Bangladesh is now expanding. It has a history of a few decades and is one of the mainstream contributors to the country's income. According to 2012 data from Bangladesh Association of Software and Information Services (BASIS), the information and communications technology (ICT) industry is growing at 20 to 30 per cent annually. The ICT market size is estimated at 350 million US dollars and it has increased 17 per cent compared to that in 2008. Software and IT Enabled Service (ITES) market amount to about 250 million US dollars, which is 70 per cent of the overall IT market in Bangladesh (JICA, 2015). Based on BASIS and other data, there are 800 to 1,000 software and IT service companies, and more than 30,000 IT professionals now working in Bangladesh. Every year, there are almost 6000 IT graduates joining the IT industry. BASIS aims to create 1 million IT professionals by year 2018 (Allmedialink, 2015; BASIS, 2012). According to the report (The New Age, 2015), very few software and IT firms hired a workforce of 300 people. Most IT firms in the country operate with a workforce of 30 people or less, which lead us to conclude that most of the software and IT service providers are SMEs (The New Age, 2015).

IT creates job opportunities alongside changing the business operations. For example, IBM pursues product innovation to improve their hardware energy efficiency, and cradle-to-cradle product life cycle to minimise environmental impact. Fuji Xerox has taken sustainability into their core business. According to their 2013 sustainability report, Fuji Xerox planned to reduce 30 per cent of their carbon emission by 2020, apart from practicing cradle-to-cradle product life cycle. Firms have taken various measures to incorporate sustainability in the business values, whereas IT professionals play an important role in ensuring that the objectives are met. Molla et al (2014) in their study believes that IT professionals play a big role in environmental sustainability. IT professionals stand on the front line in influencing the organisations to practise green initiatives and transformations. They are the ones able to provide technical expertise and solutions.

Green IT in Bangladesh

According to Bangladesh Air Pollution Management Project in 2015, Bangladesh was ranked 131 among 132 countries in the current environmental pollution index. Based on World Health Organization reports, Bangladesh was ranked fourth among 91 countries for the worst urban air quality (*The Daily Star*, 2015). Despite being one of the countries with highest pollution, Bangladesh takes environmental issues seriously. Several policies have been implemented over the years to curb environmental problems. Bangladesh's Ministry of Environment and Forest (MoEF) is formed in 1989 and there are two department fell under the ministry, Bangladesh Forest Department (BFD) and Department of Environment (DoE). MOEF oversees the planning, promotion, co-ordination and the implementation of environment

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

and forestry programmes. BFD is in charge of the reservation of the forestry while DoE is the technical wing and responsible for the implementation of the Environment Conservation Act, 1995 (MOEF, 2016). The breakdown of government policies in Bangladesh are explained in Table 1.

Despite the importance, green IT is rather new, and least focused in Bangladesh. Ansari, et al(2010) reported that the idea of environmental conservation in Bangladesh focused more on preservation of forests and extinct wildlife, though there is increased interest in green IT issues.

Recently, the government agency, banks and industries are taking initiatives for green practice within the organisation. Sobhani et al. (2012) reported only 25 per cent of banks in Bangladesh provided disclosure for environmental sustainability. Sobhani's research identified various green practices like green promotion and marketing, green office, and green finance. But in case of green information technology usage, organisations are still falling behind.

Again, small-scale businesses and local financial intermediaries can play a crucial role by joining hands with the public sector to combat climate change. But accessing financial resources remains a challenge for most SMEs, particularly in least developed countries like Bangladesh. For that purpose, the United Nations proposes that the multi-billion dollar Green Climate Fund (GCF) engage the private sector, particularly SMEs, to combat climate change risks.

THEORETICAL BACKGROUND AND RESEARCH MODEL

The concept of green IT emerged in 2007, in CIO magazines. According to Gartner (2007), green IT manifested when firms wanted to sustain the triple bottom line. Yang et al (2013) argued that being green is regarded as a moral issue in the digital age and were supported by Murugesan. Murugesan (2008) defined green IT as environmentally sound IT. Green IT is the study and practice of designing, manufacturing, using and disposing of computers, servers and related subsystems efficiently and effectively with minimal or no impact to the environment (Murugesan, 2008). Four strategies were identified - green use, green disposal, green design, and green manufacturing. Green use aims to reduce energy usage of IT devices and promote energy efficiency; green disposal aims to minimise e-waste generated by extending the usability of computer equipment; green design aims to provide greener product via product innovation; and lastly, green manufacturing strives to manufacture computer equipment with minimal and or no impact to the environment. Therefore, green IT aims to improve the environmental sustainability via product stewardship, pollution prevention and sustainable development.

Nevertheless, researchers argue about the economic viability of green IT since it is believed that adopting green IT results in longer time to break even (Ambec & Lanoie, 2008). Over the years, the conceptualisation of green IT has been different in different studies – green IT, Green IS, IT for green, green by IT and so on. Bose and Luo (2011) explained that green IT implies three main research areas: namely, energy efficiency, end of life management of IT, and IT as enabler of green governance. The terms green IT and green IS have been used interchangeably in certain studies, while other researchers clearly define and separate green IT and green IS based on the idea that IT is both a cause of environmental problems and a means to solve them. In this study, we will assume both green IT and green IS share the same objective of tackling environmental sustainability.

Many researchers tried to measure green IT by incorporating various theories like belief-action-outcome, organisational motivation theory, process virtualisation theory, theory of planned behaviour,

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 1. Policies in Bangladesh

Year	Policy Name	Task
1970	Water Pollution Control Ordinance	Adopt measures of prevention, control, and abatement of existing or potential pollution of any waters.
1977	Environmental Pollution Control Ordinance	Extends the control on prevention and abatement of pollution to air, water or soil.
1992	National Environmental Policy (NEP)	• Maintain ecological balance and overall development via protection and improvement of the environment. • Identify and regulate environmentally degrading activities. • Environmentally sound development. • Associate with all international environmental initiatives.
1995	National Environmental Management Plan (NEMAP)	• Programmes and intervention aim at implementing NEP. • Manage scarce resources and reduce environmental degradation. • Improve natural and man-made environment. • Conserve habitats and biodiversity. • Promote sustainable development. • Improve quality indicators of human life.
1995 and 1997	Environmental Conservation Act and Rules	• Conservation, improvement of quality standards and control by mitigating pollution. • Coordinate with other agencies relevant to the objectives of the act. • Adopt safety measures and determine abatement measures that may cause environmental degradation. • Advise on environmental use, storage, transportation, import and export of hazardous material or components. • Conduct research and assist other agencies in conservation and improvement of the environment. • Investigate locations, equipment, manufacture to ensure control and mitigation of pollution. • Publish and disseminate information regarding environmental pollution. • Advise government on pollution-causing manufacturing processes and materials. • Ensure potable water quality.
1999	National Water Policy	• Protection of water quality, sanitation and potable water. • Protection of fish and fisheries. • Participation of local communities in all water sector development.
2000	The Environmental Court Act	Support the Environment Conservation Act (1995) and Environmental Conservation Rules (1997).

technological-organisational-environmental framework, technology acceptance model, resource-based view, innovation diffusion theory, stakeholder theory, institutional theory, absorptive capacity theory, stakeholder theory, technology acceptance model, inter-organisational knowledge transfer view, organisational information processing theory, theory of reasoned action, resource dependency theory, and transaction cost theory (Khor et al, 2015; Lei & Ngai, 2013). Lei and Ngai (2013) also clarify that most theories have only been used once. Moreover, the applied theories examine green IT differently, focusing on organisational, individual, environmental and technology perspectives (Esfahani et al, 2014).

However, very few researchers were interested to explore motivational factors of green IT usage attitude. Therefore, we plan to investigate the impact of motivational factors and institutional factors together, to measure the attitude. As a result, this research discovers one specific research question:

Is there any impact of external motivation factors like integrated, identified, introjected and external regulations on attitude towards green IT?

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Based on the above research questions, our research objectives are:

RO1: To examine the effect of integrated regulations on attitude towards green IT.
RO2: To examine the effect of identified regulations on attitude towards green IT.
RO3: To examine the introjected regulations' impact on attitude towards green IT.
RO4: To examine the impact of external regulations on attitude towards green IT.

Self-Determination Theory

Self-Determination Theory (SDT) is an approach to human motivation and personality that uses traditional empirical methods, while employing organismic metatheory that highlights the importance of humans' evolved inner resources for personality development and behavioural regulations (Ryan & Deci, 2000). Three psychological needs of autonomy, competence, and relatedness need to be continuously satisfied through life in order for an individual to experience an ongoing sense of integrity and well-being. These three needs change through a person's life and are influenced by the culture she or he resides in.

SDT categorises motivation into several types – amotivation, intrinsic motivation, and extrinsic motivation. Amotivation refers to the results of not valuing an activity, not being competent to do it, or expecting it to harvest a desired outcome. Intrinsic motivation refers to doing an activity for the inherent satisfaction of the act itself. Extrinsic motivation refers to any activity performed in order to obtain separable types of outcomes. Intrinsic motivations are autonomous motivations, while extrinsic motivations are controlled motivations. According to Gagne and Deci (2005), autonomous motivation happens when people find that the activity they are involved in is interesting, and therefore, they involve in the activity on their own volition. Controlled motivation means performing a certain activity due to pressure, or a sense of feeling compelled to engage in the actions.

Extrinsic motivation is further explained by four sub categories – external regulations, introjected regulations, identified regulations, and integrated regulations. External regulations occur when an individual performs an action in order to avoid being punished or to gain a reward. Introjected regulations imply accepting a certain regulation, but not fully accepting it as one's own. External regulations and introjected regulations are identified as controlled motivations. Identified regulations reflect a conscious valuing of a behavioural goal. Integrated regulations occur when identified regulations are fully assimilated into the self. In the case of green IT, we would like to investigate if extrinsic motivations influence the IT professionals' intention to adoption green IT.

The importance of understanding adoption of green IT by individuals is critical. Practitioners and researchers may gain a better understanding of why people use green IT and predict how motivational factors influence users' attitudes.

Integrated Regulations (IR)

Integrated regulation means identifying so much with the value of doing an activity, that it becomes a habitual part of the self. People who are positively self-motivated have more interest, excitement, and confidence, which in turn enhance their performance, persistence, creativity (Deci and Ryan, 1991). IR has some relation with intrinsic motivation in the form of self-regulation. Intrinsic motivation is characterised by interest in the activity itself, whereas integrated regulation is characterised by the activity being personally important for a valued outcome. In our case, if any IT user believes that by practicing

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

green IT he or she is contributing to conserve nature, then attitude towards green IT will improve. Higher level of IR will lead to higher level of positive attitude towards that activity. As a result, based on the research findings of Koo and Chung (2014), the researcher proposes the following hypothesis.

H1: Integrated regulation (IR) has positive effect on attitude towards using green IT.

Identified Regulations (IDR)

Identified regulation means that a person performs an activity solely because she or he identifies the value or meaning of that behaviour, and accepts the reason why it has to be done. Pelletier et al. (1998) posit that highly self-determined motivational subtypes are expected to lead to positive psychological and behavioural consequences. IDR allows the person to feel a sense of choice or volition about behaving. This is a kind of extrinsic motivation which allows users to act for the goal of improving nature because of its usefulness, rather than finding it interesting. This behaviour is relatively self-determined because the user acts in a certain way willingly for personal reasons, rather than due to external pressure.

In case of green IT, if the IT professionals recognise the values of green IT, that person will have a positive attitude towards green IT use. Koo and Chung (2014) observed identified regulations have positive impact on attitude towards green IT. Thus this researcher hypothesises:

H2: Identified regulation (IDR) has positive effect on attitude towards using green IT.

Introjected Regulations (ITR)

Taking in, but not accepting a regulation as one's own, is the basis of introjected regulations. Introjected regulations refer to behaviour motivated by feelings of self-worth, such as guilt and ego involvement. The IS field by its very nature is reliant on information and communication technologies. IT professionals have no option but to be highly dependent on technology, regardless of the impact on environment. An instance of being regulated by introjects would be a professional who feels like a bad person because she or he does not practise green IT. According to Watson et al (2010), people have a natural tendency to practise green. If IT professionals don't feel guilt while using technologies that effect environment, then attitude towards using green IT would be lower . Based on the findings of Koo and Chung (2014), we propose:

H3: Introjected regulation (ITR) has positive effect on attitude towards using green IT.

External Regulations (ER)

External regulations represent the least self-determined form of extrinsic motivation. External regulations refer to behaving in a certain way, solely to obtain a reward or to avoid a punishment. External regulation is referred to as controlled motivation because the motivation to perform comes from outside the self, or, is less determined by the self than autonomous motivations. If an organisation has no policy, reward or punishment for the employees, there is less possibility that the organisation will receive the desired behaviour from employees. In case of green IT, external regulations often identified the motivation of getting benefit from green IT usage. It implies that if external regulations are high then attitude towards

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

green IT would be positive. Similar evidence was found in green IT research by Koo and Chung (2014). Thus, we propose the following hypothesis:

H4: External regulation (ER) has positive impact on attitude towards using green IT.

Attitude Towards Green IT Adoption (ATT)

Attitude refers to a person's assessment of certain behaviour as favourable or unfavourable. Attitudes are learned dispositions and often result from experience. Molla et al (2011) explained green IT attitude as employees' sentiment, values and norms towards climate change, eco-sustainability, and IT roles. Molla et al. (2011) added that there are two attitudes towards climate change. The first is the belief that human activities are the culprits behind alarming climate change, while the second is skeptical about the change. In addition, Esfahani et al (2015) argued that the former group has positive influence on green IT adoption due to their pro-environment behaviour, while the latter has negative influence on green IT adoption. Hence we conclude that attitude has influence on green IT adoption. In another study by Gholami et al (2013), attitude is affective characteristic of senior managers, as the senior managers play an important role in decision-making in the firms. Attitude measures the extent to which they are aware of, and interested in, green IT.

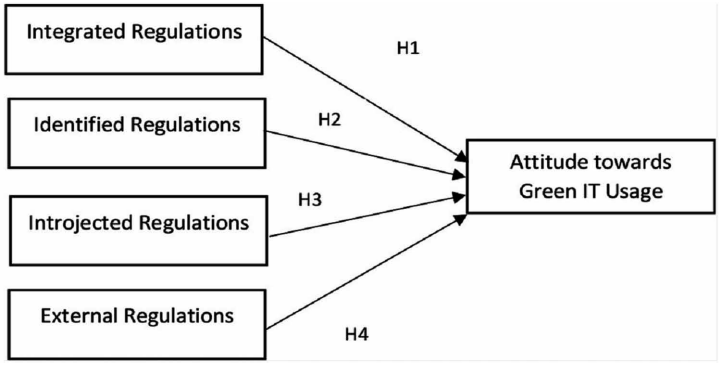
The research model is shown in Figure 1.

METHODOLOGY

Study Design

In order to empirically test our hypotheses, data were collected via field survey. Purposive sampling method was used in this study. Participants of this study are individuals working in the IT field, across several SMEs, including software development companies, hardware sales and services, internet service providers, and network solution providers. Self-administered survey questionnaires were distributed to the respondents from eight different companies. Out of 250 individuals contacted, data from 108 were collected, generating response rate of 43.2 per cent. Based on the G*power calculation method, sample

Figure 1. Research model



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

collected should have been 124. However, we only managed to collect data from 108 respondents, which is close to the targeted response.

Table 2 provides the demographic information of the respondents. 65.7 per cent of respondents are between 26 and 30 years of age and 76.8 per cent are male. The survey participants represent various IT positions within their industries. 79.6 per cent of our respondents work with information technology from 5 to 8 hours.

Measures

Items of the questionnaire were adapted from valid instruments. The IT managers, who evaluated the questionnaire items, suggested necessary changes to make the questionnaire simpler and easier to understand. The survey questionnaire consists of three parts. The first part focuses on demographic information. The second part explains the basic information of green IT as many respondents might not understand about green IT usage, despite their use of green IT. The third part focuses on measurement items of the research model. All the items are adapted from the research of Koo and Chung (2014). Measurement items are given in Table 3.

Table 2. Demographic information

	Frequency	**Percentage**
Gender		
Male	83	76.8
Female	25	23.2
Age		
21-25	15	13.8
26-30	71	65.7
31-35	18	16.6
More than 35	4	3.7
Use of Technology		
1-5 hrs	7	6.48
5 to 10 hrs	86	79.6
More than 10 hrs	15	13.8
Industry		
Software development company	2	33.3
Network solutions	1	16.6
Hardware sale and service	2	33.3
Internet service provider	1	16.6

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 3. Items of the measurement questionnaire

Measurement Questionnaire
Integrated Regulations
Being green is part of my life
Being green has become a fundamental part of who I am
Being green has been a part of the way I have chosen to live my life
By using green technology, I take care of myself and, at the same time, I take care of my environment
Identified Regulations
Using green IT is a sensible thing to do
Using green IT is a way I have chosen to contribute to protecting the environment
Using green IT is a reasonable thing to do
Using green IT is a good idea to do
Introjected Regulation
I would regret it if I am not doing something for the environment and future generations
I would feel guilty if I did not do something for the environment and future generations
I would feel ashamed of myself if I was doing nothing to help the environment
External Regulations
This green technology device is of benefit to me
The advantages of this green technology device outweigh the disadvantages
Overall, using this green technology device is advantageous
Attitude
Using green technology is a good idea
Using green technology is a wise idea
I have a favour to the idea of using green technology
Using green technology would be pleasant

ANALYSIS AND RESULT

Analysis Technique

We adopted structural equation modelling, using partial least squares (PLS) to analyse the data. PLS has been widely used in theory testing. Of all other structural equation modelling techniques, PLS is best suited for testing a model with small sample size. (Koo and Chung, 2014; Cha, 2012; Haenlein and Kaplan, 2004). We have a small sample size, and therefore, PLS is a suitable analysis tool for the purposes of this study. We decided to use SmartPLS 3.0 to test the research model.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Measurement Model

Convergent validity is the degree to which the items that are used as indicators to a variable must cover high proportion of variance (Hair et al. 2011). According to Hair et al. (2011), factor loadings and average variance extracted (AVE) of more than 0.5 and composite reliability (CR) of 0.7 or above is deemed to be acceptable. Table 4 depicts that all loadings and AVE are above 0.5 and the composite reliability values are more than 0.7. Only IDR1 and IDR3 were removed due to poor loadings. Therefore, we can concluded that convergent validity has been established.

Next, we assessed the discriminant validity which reflects the distinction from one construct to other constructs (Hair et al. 2011). Fornell and Larcker (1981) suggested that to report the discriminant validity, the square root of the AVE should be compared with the correlation of the other constructs. Discriminant validity of the model is reported in Table 5, which shows discriminant validity is fully established in the data.

Table 4. Loadings, AVE, and composite reliability

	Loading	AVE	CR
ATT1	0.897		
ATT2	0.870	0.767	0.929
ATT3	0.872		
ATT4	0.864		
ER1	0.901		
ER2	0.828	0.751	0.900
ER3	0.868		
IDR2	0.913	0.852	0.920
IDR4	0.933		
ITR1	0.843		
ITR2	0.886	0.774	0.911
ITR3	0.910		
IR1	0.892		
IR2	0.890	0.780	0.914
IR3	0.868		

Table 5. Discriminant validity

	ATT	ER	IDR	IR	ITR
ATT	0.876				
ER	0.810	0.866			
IDR	0.847	0.809	0.923		
IR	0.789	0.710	0.764	0.883	
ITR	0.626	0.623	0.571	0.634	0.880

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Multicollinearity is tested by calculating the variance inflation factor (VIF). Our VIF calculation is shown in Table 6.

According to Hair et al. (2011), VIF value of 5 and higher indicate a potential collinearity problem. Our study indicated VIF values of less than 5. Therefore we assume that there is no multicollinearity in our data set.

Structural Model

After analysing the AVE, reliability and validity of the data, we further analysed the structural model by using the evaluation coefficient of determination, and the significance level of each path coefficient. Focusing on the significance level of the path coefficients, our result indicated the following: Integrated regulation (IR) was found to be significantly related to attitude (ATT) towards using green IT ($\beta = 0.247$, $p < 0.01$). Similarly, identified regulation (IDR) was also found to have impact on attitude towards green IT use ($\beta = 0.457$, $p < 0.01$). External regulation (ER) also has significant positive relation with attitude ($\beta = 0.238$, $p < 0.01$). However, introjected regulation (ITR) has positive, but not significant, relation with attitude ($\beta = 0.051$, $p < 0.01$). Thus, hypotheses H1, H2 and H4 are significant; and H3 is not supported. Path coefficients, t-values and results of hypotheses are reported in Table 7.

Blindfolding procedure was performed to measure the predictive relevance (Q^2) of the model fit. Q^2 represents a measure of how well observed values are reconstructed by the model and its parameter estimates. (Chin, 1998). Models with Q^2 greater than zero imply that the model has predictive relevance. In this case, $Q^2 = 0.558$ which indicates the model has predictive relevance. Table 8 represents the strength of effect of each construct to endogenous variable.

Table 6. Variance inflation factor of the constructs

	VIF
ER	3.317
IDR	3.663
IR	2.846
ITR	1.861

Table 7. Hypothesis testing result

Hypothesis	Relationship	Path Coefficient	t value	Result
H1	IR -> ATT	0.247	2.640	Supported
H2	IDR -> ATT	0.457	3.871	Supported
H3	ITR -> ATT	0.051	0.506	Not Supported
H4	ER -> ATT	0.238	3.225	Supported

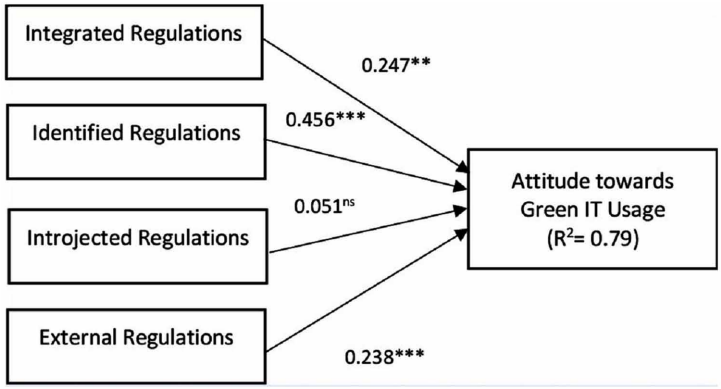
EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 8. Strength of effect

	Relation with	f^2	Strength
IR	ATT	0.105	Weak
IDR		0.218	Medium
ITR		0.015	No effect
ER		0.100	Weak

Cohen, 1988.
$f^2 > 0.35$, strong effect; $f^2 > 0.15$, medium effect; $f^2 > 0.02$, weak effect.

Figure 2. Final model
*$p < 0.01$***, $p > 0.05^{ns}$*



Importance Performance Map Analysis

The impact-performance analysis provides the variables which need to be improved in the areas of management and marketing. This kind of model measurement technique, based on index value, is for better interpretation of the model (Kirstensen et al. 2000). To improve the performance level of any specific variable, stakeholders should look at the variables with high performance and low performance. According to Slack (1994), the impact of variables on other variables can be derived from the total effects; and the calculation of these values can be derived by reformatting the scores from range 0 to 100 (Anderson and Fornell, 2000).

From Figure 3, identified regulation is highly relevant for increasing total effect on IT professionals' attitude towards green IT use. For example, in ceteris-paribus assessment of output, if the index value of the latent variable (identified regulation) increases one unit, the index value of the endogenous latent variable (attitude) should increase 0.404 points (See Table 9). The same applies as ITR has lower total effect, but IR and ER have comparatively higher performance level than other constructs, except IDR.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 3. Importance-performance map analysis

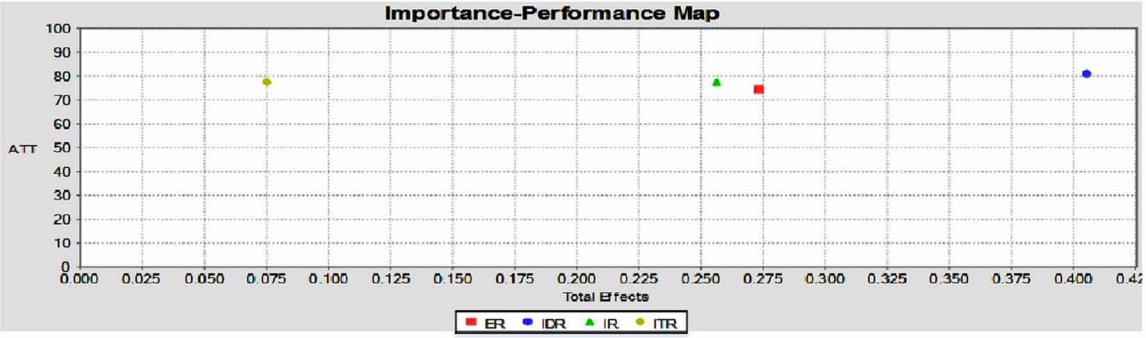


Table 9. Index value and total effects

Constructs	Index Value	Total Effect
IR	77.429	0.247
IDR	80.961	0.404
ITR	77.404	0.076
ER	74.313	0.260

DISCUSSION

The purpose of our study was to test the self-determination theory (SDT) among the IT professionals of SMEs in Bangladesh. The study also examined the relationships of integrated regulations, identified regulations, introjected regulations, and external regulations, with attitude towards green IT use.

The result of our study is similar to the previous green IT research of Koo and Chung (2014), where all the relationships were significant positive relations, except relation with introjected regulations. According to Ryan and Deci (2000), introjected regulations focus on the attitude of people when they perform certain acts to avoid guilt. In the context of Bangladesh, green IT is a new concept and the IT professionals are unaware of its importance. Although there are green IT practices in some cases, IT professionals are still not sure of its environmental impact. As a result, this relationship is not consistent in our study and result was not significant. The importance of using green IT, and its impact on environment, is crucial in the context of Bangladesh (Ansari et al. 2010). Since the variable identified regulations has the highest impact on attitude towards green IT usage, it implies that there is a need for further research to identify the antecedents that have highest variance and effect on identified regulations.

Overall, internal, external, identified, and introjected regulations explain 79 per cent variance on attitude towards using green IT. Results from the study also indicate that identified regulation has highest effect on attitude of IT professionals towards green IT usage.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

IMPLICATIONS

This study marks two principal contributions to research and practice. The first contribution is that the paper sets out to revisit psychological behaviour from self-determination point of view. This deserves research attention. Most of the behavioural theories applied to predict behaviour rely on external influences to predict behaviour. For example, theory of planned behaviour (Azjen, 2002) depends on three types of belief to shape one's intention and actual behaviour. SDT, on the other hand, focuses on how one regulates herself or himself to behave through internalised regulations, that is, regulations that have become a part of one's life and shape one's attitude. The application of SDT in research signifies that one's motivational behaviour does not necessarily rely on surrounding influence, but rather on how one is perceived to behave in certain circumstances. Given as such, the application of SDT in this chapter provides new insights on aspects that influence human behaviour.

The second contribution is related to managers. If organisations can conduct several awareness programmes to improve users' attitude towards green IT, they could potentially maximise the likelihood of positive attitude towards green IT. An example would be a green IT photography contest among users on Facebook, or other social media platforms. These events will work as external regulations (ER) to improve attitude. In highlighting the highest impact of identified regulations (IDR) on attitude towards green IT, managers can arrange awareness programmes like green lifestyle. Green lifestyle may include practicing recycling both at work and home. Awareness programmes can motivate employees to take necessary steps willingly to practise green IT.

LIMITATIONS AND FUTURE DIRECTIONS

Despite the useful findings of this study, there are several limitations that need to be acknowledged. Firstly, due to time and resource constraints, the sample size of the study is only limited to 108 respondents. Secondly, the findings cannot be generalised in Bangladesh as the scope of this study only focused on SMEs, and more importantly, only on IT companies. Finally, this research focused only on measuring attitude, which does not represent the measurement of intention to use green IT. The researcher plans to test the theory of planned behaviour in this model in the future, by including two new variables — subjective norms and perceived behaviour control.

CONCLUSION

In this research, it was observed that self-determination theory fits to measure attitude towards green IT. More importantly, identified regulation is a very strong predictor to find out attitude towards using green IT, in the context of IT professionals in Bangladesh. The government, non-governmental organisations, and IT companies can focus to further develop identified regulations to improve attitude of IT professionals. This research, therefore, has meaningful implications for both theory and practice. It contributes to the literature on green IT projects, as well as to self-determination theory in the field of information systems.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

REFERENCES

Ajzen, I. (2002). Residual effects of past on later behavior: Habituation and reasoned action perspectives. *Personality and Social Psychology Review*, *6*(2), 107–122. doi:10.1207/S15327957PSPR0602_02

Akman, I., & Mishra, A. (2015). Sector diversity in Green Information Technology practices: Technology Acceptance Model perspective. *Computers in Human Behavior*, *49*(0), 477–486. doi:10.1016/j.chb.2015.03.009

AllMediaLink. (2015). *BASIS will create 23000 IT skilled man power*. Retrieved on February 2, 2016, from https://allmedialink.com/basis-will-create-23000-it-skilled-manpower/

Ambec, S., & Lanoie, P. (2008). Does It Pay to Be Green? A Systematic Overview. *The Academy of Management Perspectives*, *22*(4), 45–62. doi:10.5465/AMP.2008.35590353

Anderson, E. W., & Fornell, C. (2000). Foundations of the American customer satisfaction index. *Total Quality Management*, *11*(7), 869–882. doi:10.1080/09544120050135425

Ansari, N. L., Ashraf, M. M., Malik, B. T., & Grunfeld, H. (2010). *Green IT awareness and practices: Results from a field study on mobile phone related e-waste in Bangladesh*. Paper presented at the Technology and Society (ISTAS), 2010 IEEE International Symposium on. 10.1109/ISTAS.2010.5514618

Asian Development Bank. (2013). *Asia's economic transformation: Where to, how, and how fast?* Retrived April 1, 2016, from http://www.adb.org/sites/default/files/publication/30358/ki2013.pdf

Basis. (2012). *Bangladesh software and IT service industry*. Retrieved on March 12, 2016, from http://www.basis.org.bd/resource/About_Industry.pdf

Bose, R., & Luo, X. (2011). Integrative framework for assessing firms potential to undertake Green IT initiatives via virtualization – A theoretical perspective. *The Journal of Strategic Information Systems*, *20*(1), 38–54. doi:10.1016/j.jsis.2011.01.003

Cha, H. S. (2012). Factors influencing the adoption of location-based smartphone applications: An application of the privacy calculus model. *Asia Pacific Journal of Information Systems*, *22*(4), 7–29.

Chin, W. W. (1998). The partial least squares approach to structural equation modeling. *Modern Methods for Business Research, 295*(2), 295-336.

Cohen, J. (1988). *Standard power analysis for the behavioral sciences*. Hillsdale, NJ: Erlbaum.

Deci, E. L., & Ryan, R. M. (1991). A motivational approach to self: Integration in personality. In R. Dienstbier (Ed.), *Nebraska Symposium on Motivation:* Vol. 38, *Perspectives on motivation* (pp. 237-288). Lincoln, NE: University of Nebraska Press.

Economist. (2015). Hot and Bothered. *The Economist*.

Esfahani, M. D., Azizah Abdul, R., & Nor Hidayati, Z. (2015). *Influence process for practicing green information technology: Elaboration likelihood model.* Paper presented at the Pacific Asia Conference on Information Systems.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Esfahani, M. D., Rahman, A. A., & Zakaria, N. H. (2014). The status quo and the prospect of green IT and green IS: A systematic literature review. *Journal of Soft Computing and Decision Support Systems*, *1*(1).

Faucheux, S., & Nicolaï, I. (2011). IT for green and green IT: A proposed typology of eco-innovation. *Ecological Economics*, *70*(11), 2020–2027. doi:10.1016/j.ecolecon.2011.05.019

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *JMR, Journal of Marketing Research*, *18*(1), 39–50. doi:10.2307/3151312

Gagne, M., & Deci, E. L. (2005). Self determination theory and work motivation. *Journal of Organizational Behavior*, *26*(4), 331–362. doi:10.1002/job.322

Gartner. (2007). *Gartner estimates ICT industry accounts for 2 per cent of global CO2 Emissions.* Retrieved on February 2016, from http://www.gartner.com/newsroom/id/503867

Gholami, R., Sulaiman, A. B., Ramayah, T., & Molla, A. (2013). Senior managers perception on green information systems (IS) adoption and environmental performance: Results from a field survey. *Information & Management*, *50*(7), 431–438. doi:10.1016/j.im.2013.01.004

Haenlein, M., & Kaplan, A. M. (2004). A beginners guide to partial least squares analysis. *Understanding Statistics*, *3*(4), 283–297. doi:10.120715328031us0304_4

Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a silver bullet. *Journal of Marketing Theory and Practice*, *19*(2), 139–152. doi:10.2753/MTP1069-6679190202

Hock, C., Ringle, C. M., & Sarstedt, M. (2010). Management of multi-purpose stadiums: Importance and performance measurement of service interfaces. *International Journal of Services Technology and Management*, *14*(2-3), 188–207. http://newagebd.net/ doi:10.1504/IJSTM.2010.034327

Huijts, N. M. A., De Groot, J. I. M., Molin, E. J. E., & Van Wee, B. (2013). Intention to act towards a local hydrogen refueling facility: Moral considerations versus self-interest. *Transportation Research Part A, Policy and Practice*, *48*, 63–74. doi:10.1016/j.tra.2012.10.006

JICA. (2015). *Finding Diamond for IT industry: Information technology engineers examination in Bangladesh.* Retrieved March 23, 2016, from https://www.jica.go.jp/bangladesh/english/office/about/story_04.html

Khor, K.-S., Ramayah, T., Ahmad, N. H., Halim, H. A., & Lo, M.-C. (2015). Bridging the Gap of Green IT/IS and Sustainable Consumption. *Global Business Review*, *16*(4), 571–593. doi:10.1177/0972150915581101

Koo, C., & Chung, N. (2014). Examining the eco-technological knowledge of Smart Green IT adoption behavior: A self-determination perspective. *Technological Forecasting and Social Change*, *88*, 140–155. doi:10.1016/j.techfore.2014.06.025

Kristensen, K., Martensen, A., & Gronholdt, L. (2000). Customer satisfaction measurement at post Denmark: Results of application of the European customer satisfaction index methodology. *Total Quality Management*, *11*(7), 1007–1015. doi:10.1080/09544120050135533

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Lei, C. F., & Ngai, E. W. T. (2013). *Green IT adoption: An academic review of literature.* Paper presented at the Pacific Asia Conference on Information System (PACIS).

Mines, C., & Davis, E. (2007). *Topic overview: Green IT*. Forrester Research.

Molla, A., Abareshi, A., & Cooper, V. (2014). Green IT beliefs and pro-environmental IT practices among IT professionals. *Information Technology & People*, *27*(2), 129–154. doi:10.1108/ITP-10-2012-0109

Molla., A., Cooper., V., & Pittayachawan., S. (2011). The green IT readiness(g-readiness) of organizations: An exploratory analysis of a construct and instrument. *Communication of Association of Information Systems, 29*.

Molla, A., Cooper, V. A., & Pittayachawan, S. (2009). IT and eco-sustainability: Developing and validating a green IT readiness model. *ICIS 2009 Proceedings, 141*.

Murugesan, S. (2008). Harnessing green IT: Principles and practices. *IT Professional*, *10*(1), 24–33. doi:10.1109/MITP.2008.10

Pelletier, L. G., Tuson, K. M., Green-Demers, I., Noels, K., & Beaton, A. M. (1998). Why are you doing things for the environment? The motivation toward the environment scale (mtes) 1. *Journal of Applied Social Psychology*, *28*(5), 437–468. doi:10.1111/j.1559-1816.1998.tb01714.x

Rahman, S. A., Amran, A., Ahmad, N. H., & Taghizadeh, S. K. (2014). GrameenPhone: Creating a Win-Win at the Base of the Pyramid in Bangladesh. *Global Business and Organizational Excellence*, *33*(5), 41–53. doi:10.1002/joe.21562

Ruth, S. (2009). Green IT More Than a Three Percent Solution? *IEEE Internet Computing*, *13*(4), 74–78. doi:10.1109/MIC.2009.82

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *The American Psychologist*, *55*(1), 68–78. doi:10.1037/0003-066X.55.1.68 PMID:11392867

Slack, N. (1994). The importance-performance matrix as a determinant of improvement priority. *International Journal of Operations & Production Management*, *14*(5), 59–75. doi:10.1108/01443579410056803

Sobhani, F. A., Amran, A., & Zainuddin, Y. (2012). Sustainability disclosure in annual reports and websites: A study of the banking industry in Bangladesh. *Journal of Cleaner Production*, *23*(1), 75–85. doi:10.1016/j.jclepro.2011.09.023

Srivastava, S., & Srivastava, R. (2012). Adoption of green information technology (GIT) in India-A current scenario. *Journal of Information and Operations Management*, *3*(1), 61–63.

The Daily Star. (2015). *Deteriorating air quality in Bangladesh*. Retrieved on March 12, 2016, from http://www.thedailystar.net/editorial/deteriorating-air-quality-bangladesh-197032

The New Age. (2015). *Not so digital after all.* Retrieved on March 2, 2016, from http://newagebd.net/38216/not-so-digital-after-all/#sthash.03ORQNWR.dpuf

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Trading Economics. (2015). *Bangladesh Population*. Retrieved April 4, 2016, from http://www.trading-economics.com/bangladesh/population

UNFCC. (2015). *195 Nations set path to keep temperature rise well below 2 degrees Celsius.* Retrieved October 9, 2016, from http://newsroom.unfccc.int/unfccc-newsroom/finale-cop21/

Watson, R. T., Boudreau, M.-C., & Chen, A. J. (2010). Information systems and environmentally sustainable development: Energy informatics and new directions for the is community. *Management Information Systems Quarterly*, *34*(1), 23–38.

Yang, X., Li, Y., & Tan, C.-H. (2013). *Drivers for green IT in organizations: Multiple case studies in China and Singapore.* Paper presented at the Pacific Asia Conference on Information Systems (PACIS).

KEY TERMS AND DEFINITIONS

External Regulations: Rules or behaviour being practiced in order to avoid punishment or to gain rewards.

Green IT: The practices of using computers and IT resources in environment-friendly manner.

Identified Regulations: Rules or behaviour that a person practices because of the value of such rules and behavior.

Integrated Regulations: Rules or behaviour being accepted as part of a person's life and routine.

Introjected Regulations: Rules or behaviour being practiced, but not being fully accepted.

Self Determination Theory: Theory that studies individual motivation and behaviour.

This research was previously published in the Handbook of Research on Small and Medium Enterprises in Developing Countries edited by Noor Hazlina Ahmad, T. Ramayah, Hasliza Abdul Halim, and Syed Abidur Rahman, pages 48-66, copyright year 2017 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 14
Implementation of Green Supply Chain Management in a Globalized Economy

Harish C. Chandan
Argosy University, USA

ABSTRACT

Green supply chain management (GSCM) practices help a firm to become eco-friendly, socially responsible, meet customer expectations, deal with industry peer-pressure and comply with government regulations (Luthra, 2014). GSCM refers to the management of all activities involved in sourcing, purchasing, manufacturing, transportation and distribution of products and services to customers in an eco-friendly way (Sharma, 2013). A conceptual framework of GSCM is presented that consists of eco-friendly organizational culture, collaborative relationships, innovative products and eco-friendly processes (Mutingi, 2013). A SWOT analysis for context specific implementation strategies for global GSCM is presented (Lee and Chen, 2010). The contribution of GSCM practices to a firm's performance is discussed (Laisirihongthong et al., 2013). The critical success factors required to achieve GSCM include top management commitment, government regulations, environment protection literacy and compliance among the supply chain partners, and ISO14001 certification (Jain and Sharma, 2014).

INTRODUCTION

The conventional "Supply Chain Management (SCM)" includes the firm's strategies to efficiently integrate suppliers, manufacturers, warehouses and stores so that merchandise is produced and distributed in the right quantity, to the right location, and at the right time, in order to minimize system wide costs while satisfying service-level requirements (Simchi-Levi et al., 1999). SCM's goal is to achieve downstream integration and upstream collaboration of firm's partners and customers in an effective and efficient manner. SCM includes manufacturing operations, purchasing, transportation, and distribution and is a key component of organizational competitiveness and effectiveness (Womack & Jones, 2005). The practices, concerns, competencies, and performance criteria of conventional supply chain are different from those for green supply chain management (GSCM).

DOI: 10.4018/978-1-5225-7915-1.ch014

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

GSCM adds the 'green' component to conventional supply chain management by sourcing, purchasing, designing, manufacturing, operations, transportation, and distribution of products to customers in an eco-friendly way. GSCM uses reverse logistics and waste management for scheduling, applying and monitoring the well-organized, economical drift of raw materials, in-process catalog, finished goods and associated information from the point of ingesting to the point of recollecting value or proper discarding (Srivastava, 2007; Green et al., 2013; Ghobakhloo et al., 2013).

The green supply chain is defined as the chain of touch points for a product or service from the manufacturer to the customer where each link in the chain integrates the concerns for environment along with economic and social concerns into all their processes. The term "green" refers to the environment and is one of the three pillars of the concept of sustainability – environmental, social, and economic. The links in the supply chain include the raw materials suppliers, components, finished product/service, and wholesale and retail distributors. GSCM applies to each of the links in the supply chain acting in an environment-friendly way and involves ensuring that all the partners in the supply chain share the same concern for the environment (Rahimifard & Clegg, 2007). The overall strength of the whole green supply chain is limited by the weakest link.

The stakeholders' demands and government regulations continue to push businesses to be more and more sustainable (Ashby et al., 2012). Motivated by the need for companies to move towards ecologically sustainable business practices including the practices of ISO14000 and ISO 26000, there is a growing need for integrating environmentally sound choices into supply chain management practices. A number of operational guidelines, standards, and legislative frameworks have been put in place to minimize environmental impact of manufacturing, distribution and retailing (Baines et al., 2012). Corporations, consumers and governments are becoming more aware of protecting the environment and adopting strategies for renewable resources (Sharma, 2013). Corporations are upgrading their supply chain management from a purely functional role to a strategic role to comply with current environmental legislations and maintain an enduring competitive advantage, through technological innovation and improved eco-efficiency (Mutingi, 2013).

The strategy of implementing GSCM can be risk-based and/or innovation based (Lee & Chen, 2010). A green supply chain strategy directly impacts the overall environmental, economic and operations performance. The economic benefits are derived from increased efficiency through reduced waste, competitive advantage through innovation, improved product quality, consistent corporate environmental goals and improved public image (Sharma, 2013). In today's globalized economy, corporations are increasingly demonstrating a convergence of supply chains and sustainability (Mollenkopf et al., 2010). The firms' ability to implement green supply chains is becoming a powerful novel source of competitive advantage and good economic performance (Rao & Holt, 2005; Green et al., 2012).

This chapter focuses on the role of the various factors that contribute to a firm's green supply chain management. A conceptual framework of GSCM is presented that consists of eco-friendly organizational culture, collaborative relationships, innovative products and eco-friendly processes. Environmental Performance Index (EPI) and International Environmental and Social standards like ISO 14000 and 26000 are discussed. A SWOT analysis of GSCM is presented to enable a firm to select its context-specific GSCM strategy. The drivers of the implementation strategies for GSCM are described. Finally, the role of GSCM to firm's business performance is presented.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

GREEN SUPPLY CHAIN MANAGEMENT: CONCEPTUAL FRAMEWORK

GSCM practices include green design, green purchasing, reduction in energy consumption, reuse/recycling, packaging, environmental collaboration in the supply chain, cleaner production, internal service quality, just-in-time inventory, environmental auditing, and green innovation. The goals of GSCM are to minimize waste, minimize energy consumption and optimize resource usage. The elements of the green supply chain include green procurement, production, packaging, marketing, logistics and recycling (Emmet & Sood, 2010; Cervera & Flores, 2012). There are two types of GSCM practices – proactive and reactive. Proactive practices include eco-design, green purchasing and reverse logistics while reactive practices include compliance with the legislation and regulation. GSCM performance is influenced by the organizational culture, collaboration with supply chain partners, and the product and process design.

A conceptual framework of GSCM strategy consists of *eco-friendly organizational culture, collaborative relationships with supply chain partners,* innovative and eco-friendly *products and processes* (see Figure 1). GSCM focuses on the green design, green operations, green manufacturing, reverse logistics and waste management (Srivastava, 2007), and must be context specific due to local, national and international environmental regulations. The critical areas of GSCM focus include environmental performance standards, eco-efficiency, green technology innovations, and collaborative supply chain with reduced waste and recycling (Mutingi, 2013).

Organizations are beginning to prioritize the importance of the environmental and social aspects in addition to the economic aspect. The eco-friendly organizational culture and GSCM originates in the boardroom as top management commitment sets the tone and policies for the entire organization. However, when the top management of an organization decides to implement an environmental vision and goals, the employees may resist the change. The same methods that are used for changing the organizational culture can also be used for making the organization more eco-friendly. Communicating the information about the need to become eco-friendly and involving all employees in the process of becoming eco-friendly is essential. Ongoing evaluation of the progress and celebrating successes is crucial since environmental work is an ongoing process.

To implement GSCM effectively, firms must possess both internal environmental management and external collaboration with suppliers and customers in their supply chain to ensure eco-friendly strategy. Firms must collaborate with the first and second tier suppliers to comply with environmental regulations in creating products and services. Green purchasing involves conducting an environmental audit of the

Figure 1. Determinants of green supply chain management strategy



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

supplier and requiring an external international environmental system certification like ISO 14000 (Hsu & Hu, 2008). In global GSCM, the suppliers may not be aware of the environmental regulations in foreign countries so buyers must make their suppliers aware of such regulations (Lee, 2008).

Two main practices of GSCM include green design and green processes. A green product can be an innovative product that may have an unpredictable demand and may have a short life cycle. The innovative product focuses on green efficiency using innovative technology and should be innovative and designed with environment in mind. The manufacturing processes need to be eco-efficient or green-efficient (Paulraj et al., 2008). Green design involves environmentally conscious design (ECD) and life cycle assessment (LCA). Green operations include green manufacturing, reuse, recycle, reverse logistics, and network design.

In a green supply chain of a manufacturer and retailer of a consumer product, one has to determine the effect of the package size and shelf space on profit. Reducing the package size of its product reduces environmentally costly transportation cost, reduces product packaging cost, and cost savings (Swami & Shah, 2011, 2013). Green performance metrics need to be put in place for assessing the impact on business performance. Performance measurement for GSCM includes intra-organizational, inter-organizational and environmental issues that affect all the members in the green supply chain (Hervani et al., 2005). Implementation of GSCM is governed by institutional theory (IT), ecological modernization theory (EMT), and total environmental quality management (TQM) (Muslan, 2013; Li, 2011). Risk theory has been applied to GSCM (Khan & Burnes, 2007).

COLLABORATIVE RELATIONSHIPS BETWEEN GLOBAL GREEN SUPPLY CHAIN MEMBERS

With increased globalization, the supply chain often involves partners across continents. Globalization enables new markets for products and access to suppliers who can provide materials and inputs more efficiently than domestic sources. The globalization of supply chains involves off shoring production, inventories, suppliers and customers. It also represents differences in economies, infrastructures, cultures, and politics in the competitive environment (Manuj & Mentzer, 2008). The green, global and lean supply chain strategies need to be considered in an integrated life cycle management framework (Mollenkopf, Stolze, Tate, & Ueltschy, 2010).

The buyer-supplier quality management facilitates cooperative learning and improves inter-organizational learning processes leading to enhancement of supply chain satisfaction and performance. The interaction of the firm level and supply chain-level quality practices influence buyer-seller performance and lead to buyer-supplier satisfaction. The firm-level quality practices involve top management support, information systems, employee involvement, process improvement, product/service design and customer satisfaction. The supply chain level quality practices involve trust, governance, information integration, process integration, and cooperative learning (Mellat-Parast, 2012).

The relationships between all the links of the supply chain need to be collaborative and based on trust. The collaborative relationship involves enhanced mutual involvement and high degree of information sharing between the stakeholders. A collaborative supply chain is agile, flexible, and responds quickly to dynamic demand using innovation and dynamic technology evolution (Liker & Choi, 2004). Product life-cycle costs and overall supply chain costs are minimized through collaborative relationships (Zhu & Sarkis, 2007).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Corporations have to take environmental initiatives in inbound logistics, production or the internal supply chain, outbound logistics and, in some cases, reverse logistics which include materials suppliers, service contractors, vendors, distributors and end users working together to reduce or eliminate adverse environmental impact of their business activities (Rao & Holt, 2005).

Trust among the partners in all the links in the green supply chain ensures proper coordination and functioning of the entire supply chain. The geographically distributed supply chain stakeholders represent virtual organizations connected by the trust and information communication technologies (ICT). Trust is a significant factor in achieving supply chain integration. Cooperation of the stakeholders in the supply chain determines their exposure to business and market risk. As the number of links in the supply chain increases, the trust relationships can get more complex. Some partners rely on trust based on direct interactions (e.g., A-B). Other business interactions rely on derivative trust, which affect A through B's interaction with C.

Successful SCM offers all the stakeholder firms a competitive edge. Among medical equipment suppliers, communication, behavioral certainty, asset specificity, partner reputation and perceived benefits contributed to positive trust. The relationship tenure did not have a significant effect on trust (Chao et al., 2013). Trust is a key factor inter-organizational knowledge sharing. Participation and communication which enhance trust, positively influence knowledge –sharing. Opportunistic behaviors, which reduce trust, negatively influence knowledge sharing (Cheng, et al., 2008).

In a study of the supply chain for metallurgical enterprises, stakeholders depended on the direct trust and derivative trust for smooth functioning of the entire supply chain (Gajdzik & Grzybowska, 2012). Trust is a key factor inter-organizational knowledge sharing. Participation and communication which enhance trust, positively influence knowledge –sharing. Opportunistic behaviors, which reduce trust, negatively influence knowledge sharing (Cheng, et al., 2008).

To enhance inter-organizational coordination, manufacturing firms often insist with their partners in supply chain management such as suppliers and subcontractors to establish common processes. This requires sharing process and inter-organization knowledge. It enhances the competitive advantage of the supply chain as a whole (Luthra et al., 2013; Spekman et al., 2002). Knowledge management in supply chain relationships is crucial to firm performance. The three dimensions of strategic orientation (i.e., alliance, leadership and learning and two dimensions of inter-organizational knowledge management (i.e., knowledge creation and acquisition are related and are positively related to firm's performance) (Gupta, 2006). The coercive relationship between supply chain stakeholders has low information sharing, legal contracts -driven and is focused on supply for the predictable demand at the lowest possible cost (Pagell et al., 2007).

A sustainable green supply chain requires proactive relationship management including organizational learning and transfer of knowledge and capabilities from the large players in the supply chain (Mellat-Parast, 2012; Cheung & Rowlinson, 2011). GSCM ensures that each of the links in the supply chain (i.e., all the suppliers, subcontractors and retailers), act in an environment-friendly way (Muslan et al., 2013; Rahimifard & Clegg, 2007).

Supply chain coordination improves performance by aligning the objectives of the links in the chain. The focus is on inventory management and ordering decisions. Some of the channel coordination models include multi-echelon inventory theory, multiple decision makers, asymmetric information, mass customization, outsourcing, short product life cycles and delayed differentiation. To enhance inter-organizational coordination, manufacturing firms often insist with their partners in supply chain management such as suppliers and subcontractors to establish common processes. This requires sharing

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

process and inter-organization knowledge. It enhances the competitive advantage of the supply chain as a whole (Spekman et al., 2002).

GSCM is challenging because different countries involved in the supply chain may not have uniform "green" local regulations and standards and is an improvement over conventional supply chains. It includes green design, green operations, green manufacturing, reverse logistics, and waste management (Srivastava, 2007). Firms should prioritize the relative importance of the four dimensions of GSCM: supplier management, product recycling, organizational involvement and life-cycle management (Hu & Hsu, 2010).

INNOVATIVE ECO-FRIENDLY PRODUCTS AND PROCESSES

There are two main practices towards GSCM: Green design and green operations. Green design is in the direction of systematic environmental consideration in the product design and green operations are related to all aspects of supply chain management operations. Green design involves environmentally conscious design (ECD) and life cycle assessment (LCA). Environmentally conscious design is the process of understanding the ways and means to develop concern over of how design decisions affect a product's environmental compatibility. The life-cycle assessment/analysis (LCA) is to analyze, assess and evaluate the conservational, professional health and resource-related concerns of a product through all the stages of its life cycle. Green operations include manufacturing and remanufacturing, reverse logistics, and network design. Green manufacturing is about using appropriate material and technologies and thereby saving most of the resources which are on the verge of being exhausted.

Remanufacturing is to utilize the waste products in the process of manufacturing to re-use them for manufacturing new valuable products. Recycling is done to regain the material content of used and non-functioning goods. Reverse logistics is the process of scheduling, applying and monitoring the well-organized, economical drift of raw materials, in-process catalogue, finished goods and associated information from the point of ingesting to the point of source for the purpose of recollecting value or proper discarding. The collection is the first stage in the retrieval process is followed by sorting of used products (Ghobakhloo et al., 2013). In a green supply chain of a manufacturer and retailer of a consumer product, one has to determine the effect of the package size and shelf space on profit. Reducing the package size of its product reduces environmentally costly transportation cost, reduces product packaging cost, cost savings. It helps the manufacturer to achieve 'green manufacturer' status (Swami & Shah, 2011).

Innovative eco-friendly processes aim to reduce waste, emissions to the environment, energy usage and increase recycling at the end-of-life for the product. Innovative products and processes go hand-in-hand. The green process is centered on eco-efficiency or green efficiency. Four main areas of focus for environmental performance standards include eco-efficiency, green technology innovations, remanufacturing and recycling. The comprehensive boundaries and flow framework can be valuable for identifying barriers to implementing GSCM (Sarkis, 2012). Fisher's perspective of efficient versus responsive supply chains can be a stepping-stone to the development of two green supply chains-eco efficient and eco-responsive (Youn et al., 2012). The critical success factors required to achieve GSCM include top management commitment, government regulations, environment protection literacy and compliance among the supply chain partners, and ISO 14001 certification (Jain & Sharma, 2014).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

INTERNATIONAL STANDARDS FOR ENVIRONMENTAL MANAGEMENT AND SOCIAL RESPONSIBILITY

Environmental and social responsibility performance is increasingly being used as additional measures for the overall performance of firms. The ISO 14000 standard addresses various aspects of environmental management and ISO 26000 addresses social responsibility management. The ISO 14000 family provides practical tools for companies and organizations to identify and control their environmental impact and constantly improve their environmental performance. ISO 14001:2004 and ISO 14004:2004 focus on environmental management systems. The other standards in the family focus on specific environmental aspects such as life cycle analysis, communication, and auditing.

ISO 14001:2004 sets out the criteria for an environmental management system and can be certified. It does not state requirements for environmental performance, but maps out a framework that a company or organization can follow to set up an effective environmental management system. It can be used by any organization regardless of its activity or sector. The ISO 14001:2004 can provide assurance to company management and employees as well as external stakeholders that environmental impact is being measured and improved. The benefits of using ISO 14001:2004 can include reduced cost of waste management, savings in consumption of energy and materials, lower distribution costs and improved corporate image among regulators, customers and the public. Small and medium sized enterprises (SMEs) can also benefit from ISO 14001:2004. The publication, ISO 14001 Environmental Management Systems, provide an easy to use checklist for SMEs (ISO, 2014).

Corporate social responsibility is covered by ISO 26000. Social responsibility means acting in an ethical and transparent way that contributes to the health and welfare of society. ISO 26000:2010 provides guidance rather than requirements, so it cannot be certified to unlike some ISO 14001. Instead, ISO 26000:2010 helps clarify the meaning of social responsibility and helps businesses and organizations translate principles into effective actions and shares best practices relating to social responsibility, globally. It is aimed at all types of organizations regardless of their activity, size or location. The standard was launched in 2010 following five years of negotiations between many different stakeholders across the world. Representatives from government, non-government organizations (NGOs), industry, consumer groups and labor organizations around the world were involved in its development, thus meaning it represents an international consensus (ISO, 2014).

Other international occupational health and safety management standards include Occupational Health and Safety Assessment Series (OHSAS 18000), and the Restriction of Hazardous Substances (RoHS). The Waste Electrical and Electronic Equipment (WEEE) enforces compliance with the relevant laws relating to product recycling and prohibit the use of hazardous substances in products for sale in the market (Mutungi, 2013).

ENVIRONMENTAL PERFORMANCE INDEX (EPI), INTERNATIONAL AGREEMENTS, LEGISLATION AND NGOS

The 2014 EPI Framework includes nine issues and 20 indicators. The nine issues cover the areas of environmental health and Ecosystem vitality (EPI, 2014). The three issues in environmental health include health impacts, air quality, water, and sanitation. The ecosystem vitality issues include six issues- water resources, agriculture, forests, fisheries, biodiversity and habitat, and climate and energy. The Environ-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

mental Performance Index (EPI) is constructed through the calculation and aggregation of 20 indicators reflecting national-level environmental data. These indicators are combined into nine issue categories, each of which fits under one of the two primary objectives. Table 1 lists 2014 EPI values for various economies out of a total of 178 countries.

The international organizations formulate various acts and reach agreements that affect the countries and corporations (Andressen & Boasson, eds., 2012; Yu & Hui, 2008). International environmental agreements such as the United Nations Multilateral Environmental Agreement Negotiator's Handbook (2007), Negotiator's Handbook for Pacific Region (2013), ASEAN agreement on Trans boundary and Haze Pollution, Framework convention on climate change(UNFCCC,1992), the Kyoto Protocol, the Climate Change Treaty and the Montreal Protocol influence the local and national governments to create environmental legislation. This guides and forces the firms to practice GSCM (Chien & Shih, 2007).

CONTEXT SPECIFIC GSCM IMPLEMENTATION STRATEGIES

Implementation of GSCM should be context-specific to the industry sector, country, and firm. Global GSCM presents new challenges since the environmental regulation standards and their enforcement varies significantly from country to country. ISO 14001 certification of all the suppliers helps with managing global suppliers. The Twelve Steps to a Greener Supply Chain include redesign of the product, reconfiguration of manufacturing, shifting to green suppliers, shortening the distances, altering service-level settlements, shrinkage in packaging, plan for inverse supply chain activity, consolidation of shipments, planning for shorter routes, coordination with partners, taking a holistic lifecycle view, starting early and if required starting now (Sharma, 2013). A structural model of natural resource based green supply chain management can provide managers with validated measurement scales to evaluate their strengths and weaknesses in implementing GSCM (Shi et al., 2012).

The SWOT analysis of GSCM helps a firm to see beyond the legislative, social, and peer pressures to create an effective strategy. The strengths, weaknesses, opportunities, and threats for implementing GSCM are listed in Table 2. Using the SWOT analysis, a firm has to create a context-specific strategy by maximizing the strengths, minimizing the weaknesses, taking advantage of the opportunities and guarding against the potential threats. A more critical POWER SWOT may be more helpful as it includes **P**ersonal experience, rank **O**rder, assigning **W**eights, **E**mphasize detail and **R**ank order(Power SWOT, 2014). Using a Balanced Score card and Key Performance Indicators can make additional enhancements.

Table 1. Environmental performance index, EPI and rank of selected countries

Country	Environmental Performance Index, epi, %	Rank Out of 178 Countries
Switzerland	87.67	1
USA	67.52	33
Russia	53.45	73
Brazil	52.97	77
China	43	118
India	31.23	155
Somalia	15.47	178

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 2. SWOT Analysis for GSCM (adapted from Lee & Chen, 2010)

	Details
Strengths	Green design, materials, process, packaging and recycling, can reduce product-life-cycle costs by reducing waste clean up cost, lower production costs, minimize waste and lower price for consumers
	Enhance efficiency and profit through improvements in workplace settings for employees
	Upgrade corporate image and product reputation, increase market share, Earn the confidence of lenders
	Trust building in each link in the supply chain leading to efficient collaboration and reduced costs
Weaknesses	One or more links in the chain may practice superficial green practices
	Collaboration management challenges with all the links in the chain
	Require R&D expenditure for innovation to find green solutions
	Lack of mutual trust may cause opportunistic behavior for one or more links in the chain and undermine overall goals for the GSCM
Opportunities	Increasing consumer demand for green products/services
	Take advantage of government incentives for manufacturing green products
	Awareness of environmental standards in the host country by each chain link
Threats	In international markets, products may face import barriers and lose competitive edge by not practicing GSCM
	Additional inspection and certification costs to meet international market standards can raise price and lower market share
	Lack of international green certification system may encourage counterfeit green products

A firm in a given industry sector should identify relevant goals for implementing GSCM and specifying long-term plans to achieve these goals (Mudgal, Shankar, Talib, & Raj, 2010). Firms have to select a suitable strategy in accordance with stipulated regulations and customer requirements. For each industry sector in a given geographical context, one has to identify and rank the major strategies that help successful implementation of green supply chain management. Using fuzzy analytic hierarchy processes to prioritize the relative importance of supplier management, product recycling, organizational involvement and life cycle management, it was found that the organizations that place more emphasis on supplier management find it easy to implement GCSM successfully. (Hsu & Hu, 2008). Firms have to prioritize the relative importance of the four dimensions of GSCM – supplier management, product recycling, organizational involvement and life-cycle management (Hu & Hsu, 2010).

The strategy of implementing GSCM can be risk-based and/or innovation based. A risk-based strategy involves the inclusion of basic clauses towards purchasing contracts for suppliers to meet all pertinent environment regulatory requirements. To implement green supply chain, there must be a set instructions and processes that should be well notified to enterprises to follow environment-friendly based methods for all company's operations. Innovation strategy involves more inclusive product life-cycle management deliberations for consumers of their products during the designing stages. Innovation at every step of supply chain structure is necessary in order to differentiate a company's unique selling from its competitors.

The GSCM strategy can be lean-based, innovation centered, compliance-driven or closed loop strategies. Efficiency-based GSCM practice creates an environment of being generous towards the environment by minimal waste generation. This type of strategy involves in meeting operational efficiency objectives like quality standards. Companies should adhere to proper quality control measures in order to meet up to tackle environmental ill effects. Closed-loop strategy is significant in implementing green initiatives.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

This type of a strategy involves product designing through artifact take-back and reverse logistics implemented in the supply chain components for waste reduction (Lee & Chen, 2010). A taxonomic scheme for developing green strategies involves analyzing the green supply chain activities and identifying key dimensions that influence green supply chain management (Mutingi, 2013). The biggest challenge for firms in practicing GSCM is to select suitable strategies in accordance with the stipulated regulations in a given context and customer requirements (Hu & Hsu, 2010).

The organizational factors that influence GSCM are explained by the institutional theory, which includes coercion or external pressure, normative (compliance) and mimetic (imitation). Innovation and technological development to make GSCM effective is explained by the ecological modernization theory. Using Total Environmental Quality Management (TQM) in implementing GSCM helps one to focus on effectiveness and efficiency (Muslan, 2013). Risk theory has been applied to GSCM (Khan & Burnes, 2007).

Another study identified four categories of GSCM implementation strategies in terms of supply chain touch points: non-members, downward stream, organization, and upward stream as shown in Table 3. The first dimension of the non-members of a supply chain includes the international environmental agreements, government legislation and acts formulated by the non-government organizations. The second dimension of the downward stream supply chain management includes involvement of suppliers in green activities, training programs, technology transfer to suppliers and environmental auditing of suppliers.

It is still the firm's responsibility to the public even if an adverse event happens in any one of the links in the supply chain. Some examples are McDonald's recall of 12 million drinking glass gift sets and Mattel's Fisher Price recall of over 10 million lead-painted toys (Lee, Kim, & Choi, 2012).

The third dimension of the organizational perspective includes top management perspective, innovative green practices, employee perspective, economic interests, firm's competitiveness and industrial perspective. The top management perspective includes initiation and commitment, proper company policies,

Table 3. Four dimensions of GSCM Implementation (Adapted from Luthra, Garg, & Haleem, 2013)

	Dimensions	Details
1.	Non-Members of Supply Chain	**International environmental agreements** **Government legislation** **Non-government organizations (NGO's)**
2.	Downward Stream Supply Chain Members	**Involvement of suppliers in green activities, Training programs,** **Technology transfer to suppliers** **Technology transfer to suppliers** **Environmental auditing of suppliers**
3.	Organizational Perspective	**Top Management Perspective**: Initiation and commitment, Proper company policies, Technology advancement, Information technology enablement **Innovative Green Practices:** Environmental management systems, ISO 14000 implementation, Green procurement strategies, green product development and design, eco friendly products and process optimization, eco-friendly packaging and labeling, eco friendly transportation and distribution. **Employee Perspective:** Human resources, Information quality and sharing, Training programs. **Economic Interests** **Firm's Competitiveness** **Industrial Perspective:** Waste management, Reuse and recycle, lean manufacturing, Proper workplace management
4.	Upward Stream Perspective	**Awareness level of customers** **End-of-life management** **Association with local recycling organizations**

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

technology advancement and information technology enablement. The innovative green practices consist of adopting environmental management systems like ISO 14000, green procurement strategies, green product development and design practices, use of environmental friendly packaging and labeling of the products and use of environment friendly transportation and distribution. The environmental footprint is established at the product design stage when one decides the materials and processes to manufacture a product (Zhu & Sarkis, 2007).

The employee perspective includes human resources, information quality and sharing, and training programs. The economic interests include lower cost by reducing waste, recycling and lowering environmental compliance costs. The firm's competitiveness comes from first mover advantage of the green innovations. The industrial perspective includes waste management, reuse and recycle, lean manufacturing and proper workplace management. The fourth dimension of upward supply chain members includes awareness level of customers, end-of-life management, and association with local recycling organizations. These four dimensions play an important role in greening the supply chains and enable the firm to achieve enhanced operational performance (Luthra, Garg, & Haleem, 2013).

GREEN SUPPLY CHAIN MANAGEMENT PRACTICES AND BUSINESS PERFORMANCE

There are two types of GSCM practices: proactive and reactive. The proactive practices include eco-design, green purchasing, and reverse logistics. The reactive practices include legislation and regulation. GSCM practices include green design, green purchasing, reduction in energy consumption, reuse/recycling, packaging, environmental collaboration in the supply chain, cleaner production, internal service quality, just-in-time inventory, environmental auditing, and green innovation

Consumers are demanding eco-friendly products and services and corporations are reporting economic benefits from green practices (Bajdor & Grabara, 2011). Commonwealth Edison reported savings of US$50 million annually from managing material and equipment with a life-cycle management approach. Pepsi saved US$44 million by switching from corrugated to reusable plastic shipping containers. Mitigating environmental impact of production and services is a novel strategy to enhance organizational competitiveness. This includes improvements in their environmental performance to comply with environmental regulations and addressing the environmental concerns of their customers (Bacallan, 2000). GSCM implementation improves business performance when operational efficiency and relational efficiency are improved (Lee et al., 2012; Green et al., 2012). Performance measurement for GSCM includes inter-organizational environmental issues (Hervani et al., 2005).

According to resource dependency theory, firms synergistically combine their own resources with those of other firms to create a resource bundle that is unique and hard to imitate (Harrison et al., 2001). Such interdependent relationship-specific capabilities are superior to what the individual firms possess on their own. This leads to sustainable competitive advantage and improved organizational performance (Paulraj & Chen, 2007; Lee, Kim, & Choi, 2012).

Most of the suppliers around the world are SMEs which often have inadequate proactive environmental strategy and can be a weak link in the green supply chain (Sarkis & Dijkshoorn, 2007). SMEs often lack knowledge workers with expertise on environmental management systems (Lee, 2009). In Europe, a total of 76% of all corporations are SMEs which are responsible for 60% to 70% of all industrial pol-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

lution, 40% to 45% of CO2 emissions, 40% of water and energy consumption, and 70% of industrial waste production (Heras &Arama, 2010).

There is a direct link between GSCM practice implementation and business performance. Significant indirect relationships were found between GSCM practice implementation and business performance through mediating variables of operational efficiency and relational efficiency. The business performance is improved when GSCM enhances relational efficiency and operational efficiency, Figure 2 (Lee, Kim, & Choi, 2012). Firms need to leverage GSCM practices to facilitate both operational and relational efficiencies to gain greater competitiveness in the dynamic global market place Testa & Iraldo, 2010).

There is a lack of consensus on the impact of GSCM practices on business performance due to a lack of a unified framework for green practices and a variety of performance measures in use (Zhu et al., 2012; Laosirihongthong, Adebanjo, & Tan, 2013)). Implementing different GSCM practices in different settings can result in different performance outcomes (Koh et al., 2012).

Based on empirical studies on GSCM drivers from the manufacturing industries in Germany, Malaysia, India, Taiwan, China, the United Kingdom, and South Korea, three main drivers to implement GSCM emerge that include government regulations (27%), customer pressure/requirements (16%), and competition (14%). Competition includes marketing, product differentiation, competitive advantage, and brand reputation. Other drivers include social responsibility/ethics (6%), business benefits, organizational commitment, awareness, experience (6%), environmental collaboration with suppliers (5%), collaboration with the customers (3%), certification of supplier's environmental management systems (3%), ISO 14001 certification (2%), sustainability of resources (2%), lowered costs (2%) and return on investment (2%) (Jain & Sharma, 2014).

SUMMARY

GSCM has evolved to become a firm's competitive strategy to become eco-friendly, socially responsible and to achieve compliance with customer expectations, peer-pressure and government regulations. Corporate sustainability requires that the concerns for environment ("green") along with economic and social concerns be integrated into all the processes of a corporation including supply chain management (Luthra, 2014). The environmental NGOs, international environmental agreements, and environmental

Figure 2. Improvement in Business Performance through GSCM implementation (Adapted from Lee, Kim, & Choi, 2012)



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

legislation at the local and national level play a significant role in providing motivation to the firms to comply with the regulations.

The implementation of GSCM is specific to the industry sector, firm, and the country, and presents new challenges since the environmental regulation standards and their enforcement varies significantly from country to country. In today's globalized economy, corporations are increasingly demonstrating a convergence of supply chains and sustainability (Mollenkopf et al., 2009). GSCM is challenging because different countries involved in the supply chain may not have uniform "green" local regulations and standards. ISO 14001 certification of suppliers helps with managing global suppliers.

The firms' ability to implement green supply chains is becoming a powerful novel source of competitive advantage and good economic performance (Green et al., 2012; Rao, & Holt, 2005). At the firm-level, greening the boardroom helps gather support for firm's international environmental management systems, establishing trust among members of the supply chain, environmental auditing of the suppliers, green product design and development through innovation, green manufacturing through technology improvements, environmental friendly packaging and labeling, environmental friendly product distribution, environment friendly organizational culture, employee training for green initiatives, and effective use of internet and communication technologies for knowledge management. Context specific strategies for green supply chain management have to be created to enhance the firm's competitive performance.

REFERENCES

Andresen, S., & Boasson, E. L. (Eds.). (2012). *International Environmental Agreements: An Introduction (Environmental Politics)*. New York: Routledge Publishing.

Ashby, A., Leat, M., & Hudson-Smith, M. (2012). Making Connections: A Review of Supply Chain Management and Sustainability Literature, Supply Chain Management –. *International Journal (Toronto, Ont.)*, *17*(5), 497–516.

Bacallan, J. J. (2000). Greening the Supply Chain. *Business and Environment*, *6*(5), 11–12.

Baines, T., Brown, S., Benedettini, O., & Ball, P. (2012). Examining Green Production and Its Role within the Competitive Strategy of Manufacturer. *Journal of Industrial Engineering and Management*, *5*(1), 53–87. doi:10.3926/jiem.405

Bajdor, P., & Grabara, J. K. (2011). Implementing Green Elements into the Supply Chain – The Literature Review and Examples. Annales Universitatis Apulensis Series. *Oeconomica*, *13*(2), 584–589.

Cervera, C. M., & Flores, J. L. M. (2012). A Conceptual Framework for a Green Supply Chain Strategy. *Proceedings of the Global Conference on Business and Finance Proceedings*, *7*(2), 269-273.

Chao, C. M., Yu, C. T., Cheng, B. W., & Chuang, P.-C. (2013). Trust and Commitment in Relationships among Medical Equipment Suppliers: Transaction Cost and Social Exchange Theories. *Social Behavior and Personality*, *41*(7), 1057–1069. doi:10.2224bp.2013.41.7.1057

Cheng, F. H., Yeh, C. H., & Tu, C. W. (2008). Trust and Knowledge sharing in Green Supply Chains. *Supply Chain Management –. International Journal (Toronto, Ont.)*, *13*(4), 283–295.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chien, M. K., & Shih, L. H. (2007). Relationship between Management Practice and Organization Performance under European Directives such as ROHS – A Case Study of the Electrical and Electronics Industry in Taiwan. *African Journal of Environmental Science and Technology*, *1*(3), 37–48.

Emmett, S., & Sood, V. (2010). *Green Supply Chains: An Action Manifesto*. London: Wiley.

Environmental Performance Index (EPI). (2014). Retrieved from http://www.epi.yale.edu/epi

Gajdzik, B., & Grzybowska, K. (2012). Example Models of Building Trust in Supply Chains of Metallurgical Enterprises. *Metalurgija*, *51*(4), 563–566.

Ghobakhloo, M., Tang, S. H., Zulkifli, N., & Ariffin, M. K. A. (2013). An Integrated Framework of Green Supply Chain Management Implementation. *International Journal of Innovation*. *Management and Technology*, *4*(1), 86.

Green, K. W. Jr, Zelbst, P. J., Meacham, J., & Bhadauria, V. S. (2012). Green Supply Chain Management Practices: Impact on Performance. *Supply Chain Management*, *17*(3), 290–305. doi:10.1108/13598541211227126

Guang Shi, V., Lenny Koh, S. C., Baldwin, J., & Cucchiella, F. (2012). Natural Resource-based Green Supply Chain Management. *Supply Chain Management*, *17*(1), 54–67. doi:10.1108/13598541211212203

Gupta, V. K. (2006). *Firm Strategy and Knowledge Management in Strategic Supply Chain Relationships: A Knowledge-Based View* [Dissertation]. University of Missouri-Columbia.

Harrison, J., Hitt, M., Hoskisson, R., & Ireland, R. (2001). Resource Complementarity in Business Combinations: Extending the Logic to Organizational Alliances. *Journal of Management*, *27*(6), 679–690. doi:10.1177/014920630102700605

Heras, I., & Arana, G. (2010). Alternative Models for Environmental Management in SMEs: The Case of Ecoscan vs. ISO 14001. *Journal of Cleaner Production*, *18*(8), 726–735. doi:10.1016/j.jclepro.2010.01.005

Hervani, A. A., Helms, M. M., & Sarkis, J. (2005). Performance Measurement for Green Supply Chain Management. *Benchmarking*, *12*(4), 330–353. doi:10.1108/14635770510609015

Hsu, C. W., & Hu, A. H. (2008). Green Supply Chain Management in the Electronic Industry. *International Journal of Science & Technology*, *5*(2), 205–216. doi:10.1007/BF03326014

Hu, A. H., & Hsu, C. W. (2010). Critical Factors for Implementing Green Supply Chain Management Practice – An Empirical Study of Electrical and Electronics Industries in Taiwan. *Management Research Review*, *33*(6), 586–608. doi:10.1108/01409171011050208

International Standards Organization (ISO). (2014), Environmental Management (ISO 14000) and Social Responsibility (ISO 26000). Retrieved from http://www.iso.org/iso/home/standards.htm

Isaksson, M., & Nikolausson, H. (2014). Establishing an Environmentally Friendly Organizational Culture.

Jain, V. K., & Sharma, S. (2014). Drivers Affecting the Green Supply Chain Management Adaptation: A Review. *IUP Journal of Operations Management*, *13*(1), 54–63.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Khan, O., & Burnes, B. (2007). Risk and Supply Chain Management; Creating a Research Agenda. *International Journal of Logistics Management*, *18*(2), 197–216. doi:10.1108/09574090710816931

Ki Fiona Cheung, Y., & Rowlinson, S. (2011). Supply Chain Sustainability: A Relationship Management Approach. *International Journal of Managing Projects in Business*, *4*(3), 480–497. doi:10.1108/17538371111144184

Klassen, R., & Vachon, S. (2003). Collaboration and Evaluation in the Supply Chain: The Impact on Plant-Level Environmental Investment. *Production and Operations Management*, *12*(3), 336–352. doi:10.1111/j.1937-5956.2003.tb00207.x

Koh, S. C. L., Gunasekaran, A., & Tseng, C. S. (2012). Cross-Tier Ripple and Indirect Effects of Directives WEEE and RoHS on Greening a Supply Chain. *International Journal of Production Economics*, *140*(1), 305–317. doi:10.1016/j.ijpe.2011.05.008

Laosirihongthong, T., Adebanjo, D., & Choon Tan, K. (2013). Green Supply Chain Management Practices and Performance. *Industrial Management & Data Systems*, *113*(8), 1088–1109. doi:10.1108/IMDS-04-2013-0164

Lee, C. K., & Chen, S. H. (2010). Selecting the Most Feasible Strategy for Green Supply Chain Management. *The Business Review, Cambridge*, *14*(2), 141–146.

Lee, K. (2009). Why and How to Adopt Green Management into Business Organizations? *Management Decision*, *47*(7), 110–121.

Lee, S. (2008). Drivers for the Participation of Small and Medium-Sized Suppliers in Green Supply Chain Initiatives. Supply Chain Management. *International Journal (Toronto, Ont.)*, *13*(3), 185–198.

Lee, S. M., Tae Kim, S., & Choi, D. (2012). Green Supply Chain Management and Organizational Performance. *Industrial Management & Data Systems*, *112*(8), 1148–1180. doi:10.1108/02635571211264609

Li, Y. (2011). Research on the Performance Measurement of Green Supply Management in China. *Journal of Sustainable Development*, *4*(3), 101–107. doi:10.5539/jsd.v4n3p101

Liker, J., & Choi, T. (2004). Building Deep Supplier relationships. *Harvard Business Review*, December.

Luthra, S., Garg, D., & Haleem, A. (2013). Identifying and Ranking of Strategies to Implement Green Supply Chain Management in Indian Manufacturing Industry Using Analytical Hierarchy Process. *Journal of Industrial Engineering and Management*, *6*(4), 930–962. doi:10.3926/jiem.693

Luthra, S., Garg, D., & Haleem, A. (2014). Green Supply Chain Management: Implementation and Performance A Literature Review and Some Issues. *Journal of Advances in Management Research*, *11*(1), 20–46. doi:10.1108/JAMR-07-2012-0027

Manuj, I., & Mentzer, J. T. (2008). Global Supply Chain Risk Management. *Journal of Business Logistics*, *29*(1), 133–155. doi:10.1002/j.2158-1592.2008.tb00072.x

Mellat-Parast, M. (2013). Supply Chain Quality Management – An Interorganizational Learning Perspective. *International Journal of Quality & Reliability Management*, *30*(5), 511–529. doi:10.1108/02656711311315495

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Mollenkopf, D., Stolze, H., Tate, W. L., & Ueltschy, M. (2010). Green, Lean and Global Supply Chains. *International Journal of Physical Distribution & Logistics Management*, *40*(1/2), 14–41. doi:10.1108/09600031011018028

Mudgal, R. K., Shankar, R., Talib, P., & Raj, T. (2010). Modeling the Barriers of Green Supply Chain Practice: An Indian Perspective. *International Journal of Logistics Systems and Management*, *7*(1), 81–107. doi:10.1504/IJLSM.2010.033891

Muslan, N., Hamid, A. B. A., Tan, H., & Idris, H. (2013). Practices of Green Supply Chain Management (GSCM) Towards Manufacturing Sustainability. *International Proceedings of Economic Development and Research*, *66*, 74–80.

Mutingi, M. (2013). Developing Green Supply Chain Management Strategies: A Taxonomic Approach. *Journal of Industrial Engineering and Management*, *6*(2), 525–546. doi:10.3926/jiem.475

Pagell, M., Wu, Z., & Murthy, N. (2007). The Supply Chain Implications of Recycling. *Business Horizons*, *50*(2), 133–143. doi:10.1016/j.bushor.2006.08.007

Paulraj, A., & Chen, I. (2007). Environmental Uncertainty and Strategic Supply Management: A Resource Dependence Perspective and Performance Implications. *Journal of Supply Chain Management*, *43*(3), 29–42. doi:10.1111/j.1745-493X.2007.00033.x

Paulraj, A., Lado, A., & Chen, I. (2008). Inter-organizational Communication as a Relational Competency: Antecedents and Performance Outcomes in Collaborative Buyer-Supplier Relationships. *Journal of Operations Management*, *26*(1), 45–64. doi:10.1016/j.jom.2007.04.001

POWER SWOT. (2014). SWOT Analysis- POWER SWOT. Retrieved from http:/www.marketingteacher.com

Rahimifard, S., & Clegg, A. J. (2007). Aspects of Sustainable Design and Manufacture. *International Journal of Production Research*, *45*(18-19), 4013–4019. doi:10.1080/00207540701608511

Rao, P., & Holt, D. (2005). Do Green Supply Chains Lead to Competitiveness and Economic Performance*? International Journal of Operations & Production Management*, *25*(9), 898–916. doi:10.1108/01443570510613956

Sarkis, J. (2012). A Boundaries and Flow Perspective of Green supply Chain Management. *Supply Chain Management*, *17*(2), 202–216. doi:10.1108/13598541211212924

Sarkis, J., & Dijkshoorn, J. (2007). Relationship between Solid Waste Management Performance and Environmental Practice Adoption in Welsh Small and Medium Size Enterprises (SME's). *International Journal of Production Research*, *45*(21), 4989–5015. doi:10.1080/00207540600690529

Sharma, M. M. (2013). A Study on the Concept of Green Supply Chain Management. *Journal of Supply Chain Management Systems*, *2*(1), 1–7.

Simchi-Levi, D., Simchi-Levi, E., & Kaminsky, P. (1999). *Designing and Managing the Supply Chain: Concepts, Strategies and Case*. New York: McGraw-Hill.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Spekman, R. E., Spear, J., & Kamauff, J. (2002). Supply Chain Competency: Learning as a Key Component. *Supply Chain Management*, *7*(1), 41–55. doi:10.1108/13598540210414373

Srivastava, S. (2007). Green Supply Chain Management – A State of the Art Literature Review. *International Journal of Management Reviews*, *9*(1), 53–80. doi:10.1111/j.1468-2370.2007.00202.x

Swami, S., & Shah, J. (2011). Channel Coordination in Green Supply Chain Management: The Case of Package Size and Shelf-Space Allocation. *Technology Operation Management*, *2*(1), 50–59. doi:10.100713727-012-0005-y

Swami, S., & Shah, J. (2013). Channel Coordination in Green Supply Chain Management. *The Journal of the Operational Research Society*, *64*(3), 336–351. doi:10.1057/jors.2012.44

Testa, F., & Iraldo, F. (2010). Shadows and Lights of GSCM: Determinants and Effects of These Practices Based on a Multi-national Study. *Journal of Cleaner Production*, *18*(10/11), 953–962. doi:10.1016/j.jclepro.2010.03.005

United Nations Multilateral Environmental Agreement. (2013). *Negotiator's Handbook*. Pacific Region.

United Nations Multilateral Environmental Agreement. Negotiator's Handbook (2014). Retrieved from http://unfccc.int/resource/docs/publications/negotiators_handbook.pdf

Womack, J. P., & Jones, D. T. (2005). *Lean Solutions: How Companies and Customers Can Create Wealth Together*. New York: Simon and Schuster.

Youn, S., Yang, M. G. M., & Jungbae Roh, J. (2012). Extending the Efficient and Responsive Supply Chains Framework to the Green Context. *Benchmarking: An International Journal*, *19*(4/5), 463–480. doi:10.1108/14635771211257954

Yu, L. C., & Hui, H. Y. (2008). An Empirical Study on Logistics Services Provider Intention to Adopt Green Innovations. *Journal of Technology. Management and Innovation*, *3*(1), 17–26.

Zhu, Q., & Sarkis, J. (2007). The Moderating Effects of Institutional Pressures on Emergent Green Supply Chain Practices and Performance. *International Journal of Production Research*, *45*(18-19), 4333–4355. doi:10.1080/00207540701440345

This research was previously published in the Handbook of Research on Global Supply Chain Management edited by Bryan Christiansen, pages 402-418, copyright year 2016 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 15
The Role of a Strategic and Sustainable Orientation in Green Supply Chain Management

Kuo Ming Chu
Cheng Shiu University, Taiwan

ABSTRACT

The environmental problems we're facing today, with their growing severity and increasingly global nature, are often referred to as humanity's greatest challenge. This paper develops a model that identifies the antecedents and outcomes associated with sustainable supply chain management linkage. The model starts by identifying two antecedents (internal and external orientation) that firms may adopt in order to cope with their sustainability goals. The hypotheses are tested based on the major survey data from 342 Taiwanese and Chinese public corporations. This study not only demonstrates that both the internal supply chain and external environmental orientation exert a positive on green SCM, sustainability orientation, and alliance performance, but also, more importantly, they delineate how green SCM is practiced. This study also sheds light on the role of a sustainable orientation in strategic supply chain alliance's performance, and builds a comprehensive conceptual framework that fills some key gaps in previous research.

1. INTRODUCTION

The environmental issues we're facing today, with their growing severity and increasingly global nature, may be considered the most serious challenge that humanity will face in the coming years. Over the long run, economic development that relies on intensive depletion of natural resources cannot be considered sustainable, from either an environmental or an economic point of view. The turn toward a production model which has less of a negative impact on the environment may actually improve companies' profits by spurring innovations aimed at reducing environmental impact while providing economic benefits (De

DOI: 10.4018/978-1-5225-7915-1.ch015

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Marchi, 2012). However, there can also be dangers; the existing literature has reported the failure rate of alliances to be between 60% and 70% (Zhou & Lu, 2012; Lunnan & Haugland, 2008). Incompatibility of partners is a leading cause of these failures (Das & Teng, 2001; Lambe et al., 2002; Langfield-Smith, 2008). It is imperative that a strategy be utilized to maximize the benefits of cooperation while minimizing the risks. In recent decades, successful inter-firm collaboration has enabled firms to improve their competitive advantage and realize benefits that include such things as reduced costs, assessment of valuable resources, sharing risks and strengthening their market position (Groot & Merchant, 2000; Hagedoorn, 2002; Ding, Dekker, & Groot, 2013). An ideal model should draw upon the virtuous cycle induced by these successful collaborations.

Although the wider perspective of the green supply chain is an important step in determining its relationship to environmental sustainability, consideration of performance outcomes resulting from reducing the environmental impact of a firm's supply chain operations is a concept that has only recently gained momentum (Linton et al., 2007). Many companies have recognized the concept of green SCM, also known as supply chain environmental management. However, while sustainability has become a major challenge for firms, the goal of pursuing sustainability cannot be achieved by a single firm, as its performance will necessarily be affected by other links in the supply chain. Therefore, if overall success is the goal, it is essential to adopt green innovation and to implement Green Supply Chain Management (SCM) practices throughout the organizational value chains (Steger, 1993; Chiou et al., 2011). When properly integrated and planned, green SCM offers the opportunity to boost efficiency, value, and access to markets through improving a firm's environmental, social, and economic performance. In addition, the implementation of green SCM through internal and external environmental management contributes substantial benefits by enhancing corporate competitiveness and improving environmental performance (Chiou et al., 2011; Rao, 2002; Tukker et al., 2001). Of course, it is generally no simple matter to accomplish this, and some researchers have asserted that the attention given to the potential benefits of green SCM practices has actually raised more questions than answers (Linton et al., 2007; Carter & Rogers, 2008). This paper seeks to answer some of these questions by shedding some light on the role of sustainability in green SCM practices through identifying, the antecedents that cause firms to be sustainability oriented and the internal and external orientations which must be adopted in order to cope with the changes of the firms' business goals, and the impact of these practices on their green alliance performance.

2. LITERATURE REVIEW AND HYPOTHESES

2.1. Green SCM of Strategic Orientations

The Resource based view (RBV), in the context of environmental responsibility, suggests that firms recognize and apply strategic resources and capabilities to create unique and difficult to imitate practices that simultaneously reduce the impact of the firm's operations on the natural environment and create value for the firm (Hart & Dowell, 2010; Kirchoff, 2011). The idea of a green supply chain has always been thought of as a costly process in the past because it focuses on reducing unit cost instead of looking at the total landed cost with the onset of global trade. The focus will have to change from looking at the usage cost of an item of equipment (e.g. the cost per page of using a certain copier) to the life cycle cost of this part, equipment, or supply chain process. Therefore, Green SCM has gained popularity with

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

both academics and practitioners alike through its efforts towards reducing waste and preserving the quality of product-life and natural resources, including reducing cost and improving efficiency, mostly through the magic of 'sustainability.' The use of the term sustainability has become synonymous with the triple bottom line and is increasingly popular in the literature and among practitioners over the last several years (Carter & Rogers, 2008). In particular, a supply chain orientation and an environmental orientation must be clearly delineated and defined, and their existence in the firm explained using RBV. Table 1 shows some typical definitions of green supply chain management, and these definitions include some new ideas such as strategic transformation of enterprise and green supply chain design, leading to a great step forward in the theories of green supply chain theory and green supply chain management.

All of these green supply chain models have been created through the expansion of environmental elements into the traditional supply chain system in a manner that alters its fundamental orientation. An orientation is an underlying consciousness or latent philosophy that is considered the way in which a firm view and reacts to the business environment in which it exists (Kotler, 1997). Scholars have acknowledged for decades that a firm's strategic resources are considered to be unproductive in isolation; it is the exploitation of combinations of valuable resources that help firms create competitive advantage and improve performance (Newbert, 2008; Kirchoff, 2011). Thus, green SCM practices, as strategic resources, are in a path dependent relationship with both a firm's environmental orientation and its supply chain orientation. The following sections propose the relationships among an environmental orientation, a supply chain orientation, and green SCM practices.

2.1.1. Environmental Orientation: Green SCM Link

Alongside this, Banerjee (2002) maintained that environmental orientation is one of the two key factors by which firms can pursue corporate environmentalism. From a resource-based view, a firm's strategic orientation (e.g., environmental orientation) can be conceptualized as its valuable intangible resources that guide the development of green strategic practices, and consequently enhances alliance performance (Kirchoff, 2011; Ge & Ding, 2005). Firms that adopt an externally focused environmental orientation

Table 1. Definitions of green supply chain management

Authors	Definitions
Narasimhan & Carter (1998)	Green SCM refers to the efforts of purchasing departments in activities such as reducing pollutants, recycling, and materials substitution
Dan & Liu (2000)	Green SCM is a management mode that considers the environmental effects and the efficiency of resource utilization in the whole supply chain. It is based on green manufacturing theory and supply chain management techniques, involving suppliers, manufacturers, retailers and consumers. It aims to minimize the negative effects on the environment and to maximize the efficiency of resource utilization througout the whole production process.
Zsidisin & Siferd (2001)	Green SCM is a supply chain management technique used to solve the environmental problems within a company's production and service departments.
US-Asia Environmental Partnership (2003)	Activities in which an organization imposes its environmental requirements to its suppliers' production and processes should be called "Green supply chain management".
Zhu (2004)	Green SCM enterprises cooperate with their downstream and upstream partners, optimizing the environmental benefits from product design, material selection and retailing to recycling, improving both economic and environmental performance to achieve a sustainable supply chain.
Zhang, Abu, Thoo, & Kooi (2015)	A Green SC is an innovative supply chain that complies with social development trends. It integrates economic performance, environmental performance and resource efficiency into the entire spectrum of supply chain activities involving raw materials and component purchasing, manufacturing, packaging, distribution, retailing, and the subsequent recycling of the products.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

acknowledge the importance of developing strategic green management practices in the context of the external business environment (Menguc & Ozanne, 2005). Likewise, Chan et al. (2012) and Fraj-Andrés et al. (2009) also show that both internal and external environmental orientations serve as important determinants for firms' practice of environmental strategies, both at the strategic level and within the functional marketing area.

As regards external environmental orientation, its influence can be best explained by institutional theory. According to this theory, firms need to tackle different constraints imposed by various important institutions (North, 1990). From this perspective, it is likely that managers who perceive a strong need to respond to the environmental demands of salient stakeholders will be more inclined to engage in pro-environmental practices (e.g., green SCM) to cope with these demands. As this managerial perception, in turn, falls into the definition of Banerjee's (2002) environmental orientation, it is thus probable that this orientation exerts a positive impact on green SCM. Therefore, an environmental orientation as an antecedent to green supply chain management can be theoretically established, and the following hypothesis presented:

H_1: Environmental Orientation directly and positively contributes to Green SCM of Strategic Orientation.

2.1.2. Supply Chain Orientation: Green SCM Link

Min & Mentzer (2004) and Miocevic & Crnjak-Karanovic (2012) established a critical relationship between supply chain orientation and SCM. Notably, previous studies have identified supply chain orientation as an important antecedent to organizational performance that links the upstream and downstream processes (e.g., Hult et al., 2007; Min, Mentzer, & Ladd, 2007). The intent of green supply chain management is for a firm to work with its upstream and downstream supply chain members to act in a proactive way that focuses on the environmental impact of the entire supply chain system (Sarkis, 2003; Seuring & Müller, 2008). To be successful, these bundled resources need to have dynamic qualities and to be adaptable to the ever-changing business environment (Teece, Pisano, & Shuen, 1997; Sirmon et al., 2007).

Firms that integrate their upstream and downstream supply chain partners into green supply chain management practices will be more successful in these endeavors. Collaborative relationships and partnering with supply chain members facilitate the introduction of green supply chain management practices into firms (Klassen & Johnson, 2004; Vachon & Klassen, 2008). Therefore, supply chain orientation as a philosophy of strategically linking processes and flows throughout the supply chain with the involvement of supply chain members is needed for the implementation of green supply chain management practices as well (Klassen & Johnson, 2004; Hasan & Ali, 2015). Taken together, the above concepts suggest the following hypothesis:

H_2: Supply Chain Orientation directly and positively contributes to Green SCM of Strategic Orientation.

2.2. Sustainability Orientation

While the concept of sustainability has been increasingly discredited as a useful concept by itself, it appears to be serving some purpose when preceded by a delineating modifier like "*ecological*" or "*agricultural*" or "*economic*" (Morelli, 2011). Efforts have been made by members of various professions to give meaning to the term within the context of those respective professions. As defined by Shahidullah &

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Haque (2014), sustainability enterprises are those that attempt to integrate environmental, economic, and social considerations in a holistic manner. Sustainability is an inter-temporal concept, and thus, should be reflected by approaches highlighting development and time as well. After conducting a literature review on sustainable supply chain management, Seuring & Müller (2008) conclude that sustainability should cover three dimensions: social, economic and environment. Roxas & Coetzer (2012) define environmental sustainability orientation as the "*…overall proactive strategic stance of firms towards the integration of environmental concerns and practices into their strategic, tactical and operational activities.*" Economic sustainability should involve analysis to minimize the social costs of meeting standards for protecting environmental assets but not for determining what those standards should be. In order to pursue sustainability in green SCM, there are many practices firms may adopt. Firms have to more cautiously deal with issues like energy consumption, waste disposal, recycling, alternative energies, environmentally preferable products and service, and the like (Brown & Wilson, 2007; Li, Okoroafo, & Gammoh, 2014).

The demand for sustainability in outsourcing is presented in the literature, however, the research that answers to this demand is lacking. Especially, there is an absence of research clearly linking the antecedents, goals, practices, and outcome of sustainability orientation in outsourcing practice (Li, Okoroafo, & Gammoh, 2014). Pagell & Wu (2009) conceptually developed and define a managerial orientation toward sustainability as the extent to which an organization is proactive and committed to economic, environmental, and social concerns in its decision making across its supply chain. Yang (2013) defines sustainability orientation as the extent to which an organization is proactive and committed to economic, environmental, and social priorities in its decision-making. Based on Carter & Rogers (2008); Seuring & Müller (2008) Li et al., (2014)'s definition for sustainable supply chain management, we define sustainable outsourcing as the strategic integration and achievement of a firm's social, environmental, and economic goals in its sourcing to a third-party entity. We investigate the antecedents that push firms to pursue sustainability orientation, the practices of the sustainability orientation, and its outcome using the triple bottom line approach to measure the economic, environmental and social performance of outsourcing.

The importance and necessity of sustainability orientation are well established in the literature and warrants continued research. Porter & Kramer (2006) show that for stigmatized industries, firms may pursue sustainability orientation as a form of insurance to temper public criticism in crisis by its reputation for social consciousness. The positive linkage between corporate environmental management and pertinent sustainabile performance indicators has been well recognized (Pullman et al., 2009; Yang, 2013). Li, Okoroafo, & Gammoh (2014) suggest that internally firms should devote themselves to sustainable product development, and externally firms should conduct sustainable oriented supply management in accordance with their sustainability goals. However, most research focuses on green/environmental issues; research on social aspects and the integration of the three dimensions of sustainability is still lacking. The demand for sustainability orientation in green SCM is presented in the literature, however, the research that answers to this demand is lacking. Especially, there is an absence of research clearly linking the antecedents, practices, and outcome of sustainability orientation in green SCM practice. Thus, this research investigates the role of sustainability orientation in green SCM by examining its antecedents, practices, and corresponding outcomes. As a result, the following hypotheses are presented:

H_3: Green SCM of Strategic Orientation directly and positively contributes to Sustainability Orientation.
H_4: Sustainability Orientation directly and positively contributes to Green Alliance Performance.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

2.3. Alliance Performance

Alliance performance is a complex, systems-level concept that becomes relevant only when its component parts are thoroughly understood down to the operational level. Multiple factors determine the performance outcome of international strategic alliances, ranging from the nature of the industry and institutional environment within which the alliance operates to the quality and commitment of the alliance management (Nielsen, 2002). An efficient alliance is one that can effectively manage conflicts and solve problems especially when unforeseeable changes arise. Such inter-firm partnerships allow managers to express their views and get their messages across without being forceful. It also leads to constructive conflict resolutions (Phan et al., 2002), enabling the parties to accomplish their original goals and enhance alliance performance. Integration of Yang (2013); Ince & Çemberci (2011); Hult et al. (2007); and Cheung (2005) defined alliance performance and identified two dimensions: relationship value and perceived supply chain performance. As a result, strategic orientation seems to be an antecedent of green supply chain management, and so the following hypothis is presented:

H_5: The combination of resources through the path dependence of a Strategic Orientation as antecedents to Green SCM and Sustainability Orientation, directly and positively contributes to Green Alliance Performance.

2.3.1. Relationship Value

Following Lapierre (2000) and Cheung (2005), the relationship value construct in this study is defined as the difference between the benefits and the sacrifice (the total costs, both monetary and non-monetary perceived by buyers/or suppliers) in terms of their expectations (Slater & Narver, 1992; Zeithaml, 1988). Sacrifices are the overall monetary and non-monetary costs a firm invests or gives to an exchange partner in order to complete a transaction or to maintain a relationship with an exchange partner. Non-monetary costs can be defined as the time/effort/energy invested or conflicts endured by a firm to obtain products or services or to establish a relationship with an exchange partner (Lapierre, 2000). In an effort to develop guidelines for combining several dimensions proposed in previous studies (see Lapierre 2000; Moller & Torronen, 2003; Corsaro & Snehota, 2010) to form an overall measure of relationship value, they concluded that, to capture the various facets of the construct, research should rely on multidimensional scales of relationship value in business markets rather than overall measures of the construct. In this study, construct relationship value is explored from the perspectives of both the buyers and sellers.

2.3.2. Perceived Supply Chain Performance

Research in supply chain management has received a great deal of attention and has risen to prominence over the last decade (Cooper, Ellram, Gardner, & Hanks, 1997; Antai, 2011). In a supply chain context, as proposed by Mentzer et al. (2001), the outcomes of purposively managing a supply chain are improved customer value and satisfaction as well as profitability. These can all lead to a differential advantage. Supply chain management is about competing in value-collaboration with customers and suppliers in order to create a position of strength in the marketplace based upon the value delivered to the end consumer, as well as to supply chain partners. As firms increase their participation in the global economy, developing supply chain management strategies through which to improve the performance of the entire

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

value chain (all functional activities) is becoming increasingly critical. Thus, we can conclude that an understanding of the entire supply chain is critical to identifying and delivering value that improves the competitiveness of the chain as a whole (Slater & Narver, 1994; Woodruff, Locander & Barnaby, 1991).

Linked firms within supply chains share the same responsibility in regard to coordination of value, understanding, creation, and delivery across the whole supply chain (Flint, 2004). Thus, this study proposes that inter-firm knowledge sharing between customers and suppliers is the first step in value understanding, as step that should enhance the effectiveness and efficiency of value creation and delivery. H_1 and H_2 are concerned with the relationship between both an environmental orientation and green supply chain management and a supply chain orientation and green supply chain management. Hypotheses *5a* and *5b* are concerned with the relationship between green supply chain management and the two dimensions of alliance performance. Given the theoretical implications of strategic resource configurations, manifested through the hypothetical relationships already described, three additional hypotheses are needed to show the relationship between the combination of strategic resources and alliance performance.

H_{5a}: The combination of resources through the path dependence of an Environmental Orientation and a Green Supply Chain Orientation as antecedents to Green SCM, directly and positively contributes to Relationship Value.

H_{5b}: The combination of resources through the path dependence of an Environmental Orientation and a Green Supply Chain Orientation as antecedents to Green SCM, directly and positively contributes to Perceived Supply Chain Performance.

3. METHODOLOGY

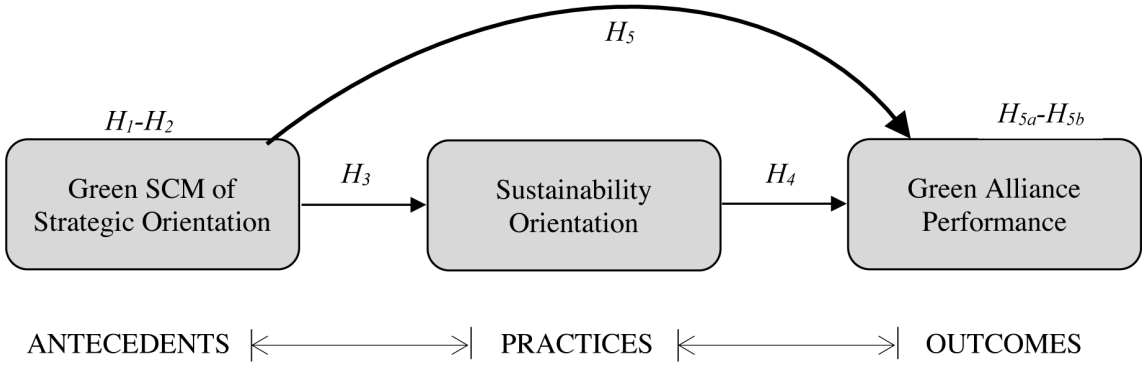
3.1. Data Collection

All of these internal and external factors (see Figure 1) push firms to pursue sustainability in their green SCM practice. Below we will discuss the different drivers of firms' sustainability orientation. All the hypotheses depicted in Figure 1 were empirically tested through the use of mail survey data collected from a database obtained from the Taiwan Stock (TSE-854 companies) and Over the Counter (OTC-969 firms) Exchanges. The sample was selected from managers of corporate planning departments, R&D, and marketing departments who have participated in the implementation of a particular strategic alliance case. The target firms of this study are all companies listed in the stock exchanges of either Taiwan or China, excluding companies in the services industry. 1,350 companies were involved. For these target companies, this study required the respondents to be engaged in supply chain management with Asian partners (domestic, Big China – Mainland China and Hong Kong, and other Asian countries). Specifically, supply chain, logistics, operations, and purchasing managers at the Managerial, Vice Presidential or Director levels were targeted. The selection criteria are based on job titles, responsibilities, perceived knowledge of supply chain management processes and firm performance.

Overall, three reminder e-mails were sent at equally distributed time intervals. This procedure resulted in 741 unique visitors to the survey website (39.5% of qualified potential respondents actually assessed the survey). 368 respondents submitted their completed responses (49.7% of the 741 who accessed the site or 25.8% of the 1,814 targeted respondents). The remaining 47.6% of potential respondents dropped off quickly or within the first few pages of the survey.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 1. Research framework



3.2. Descriptive Analysis

Information regarding the sampled firms is provided in Table 2. The majority of the survey participants are from the electronics industry (40.35%). The industrial products industry and medical/ pharmaceutical industry contributed 28.07% and 13.74% of the respondents, respectively. Other industries include appliances, automotive, apparel/ textile, and aerospace, among others. Approximately 77% had held their positions for more than 11 years. Overall, the average respondent had approximately 14.5 years of

Table 2. Characteristics of the firms

Description	Frequency	Percentage	Description	Frequency	Percentage
Type of Industry			**Establishment for**		
Electronics	138	40.35	*Less than 5 years*	2	0.58
Industrial Products	96	28.07	*6 - 10 years*	76	22.22
Chemicals/plastics	24	7.02	*11 - 15 years*	115	33.63
Pharmaceutical	47	13.74	*More than 15 years*	149	43.57
Others	37	10.82	**Total Employees**		
Annual Sales			*Less than 500*	65	19.01
Less than 50 million	35	10.24	*501 - 1000*	138	40.35
51 - 200 million	84	24.56	*1001 - 2000*	84	24.56
201 – 1,000 million	89	26.02	*More than 2000*	55	16.08
More than 1 billion	134	39.18			
Times for alliance with current partner			**Partners' Country of Origin**		
Newly established	5	1.46	*Taiwan*	193	56.44
1 – 3 times	128	37.43	*Asia*	96	28.07
4 – 6 times	96	28.07	*American*	31	9.06
More than 6 times	113	33.04	*European*	22	6.43

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

related experience. Annual sales statistics for the companies represented by the survey participants was also collected. Nearly 65% of the firms had annual sales exceeding NT$ 201 million, and 70% of the firms had more than 500 employees. Only 1.46% of the firms had newly established alliances with current partners, while almost 33% had engaged in alliances more than 6 times. Finally, domestic partners dominated this study (56.44%), and Asia (28.07%).

3.3. Measures

To develop the survey instrument, a pool of items was identified from the literature for measuring the constructs of the research model. Data from a survey sample were used to assess the instrument's validity and reliability, and to test the hypothesized relationships of the research model. All measures of the survey instrument were developed from the literature. All scales reported in this section have single factor structures (PCA, Varimax). Response scales range from 1 (strongly disagree) to 7 (strongly agree), unless stated otherwise. Data was collected online. Prior to estimating the structural models, the measurement model was assessed separately for each model in the full sample. All data analyses were performed using SPSS statistical software, version 19.0. Descriptive statistics were used to describe the characteristics of the variables interest. Standard Pearson correlation and regression procedures were used to examine the interrelationships among the study variables. *P* values less than or equal to 0.05 were considered significant. To assess the validity of our measurement model, we checked for content validity and internal consistency. Content validity between the items and the existing literature was determined by interviews with many MBA students and experts in Taiwan and with a pretest of the model. Information about Cronbach's α values, means, standard deviations, and correlations between scales is to be found in Tables 3 and 4.

Table 3. The Cronbach's α values for composite variables and the correlation matrix

Variable (Number of Items per Dimension)	α	Mean	SD	EO	SCO	SO	RV	PSCP
Environmental Orientation (EO) (8)	0.87	4.89	1.22	0.57				
Supply Chain Orientation (SCO)(5)	0.89	4.77	1.18	0.36**	0.59			
Sustainability Orientation (SO)(9)	0.84	5.02	1.48	0.21**	0.32**	0.64		
Relationship Value (RV)(8)	0.85	5.30	1.57	0.19**	0.28**	0.17**	0.57	
Perceived Supply Chain Performance (PSCP) (7)	0.91	5.66	1.59	0.23**	0.39**	0.31**	0.29**	0.72

Note: Diagonal elements are the square root of the average variance extracted (AVE). ** represents that the correlations are significant at 0.01 or above, * represents that the correlations are significant at 0.05 or above.

Table 4. Results of factor analysis and reliability tests

Factors	No. of Items	Factor Loading	Item-to-total Correlation
Environmental Orientation (EO)	8	0.685-0.814	0.524-0.846
Supply Chain Orientation (SCO)	5	0.701-0.825	0.496-0.798
Sustainability Orientation (SO)	9	0.754-0.869	0.698-0.793
Relationship Value (RV)	8	0.612-0.837	0.525-0.870
Perceived Supply Chain Performance (PSCP)	7	0.902-0.968	0.786-0.839

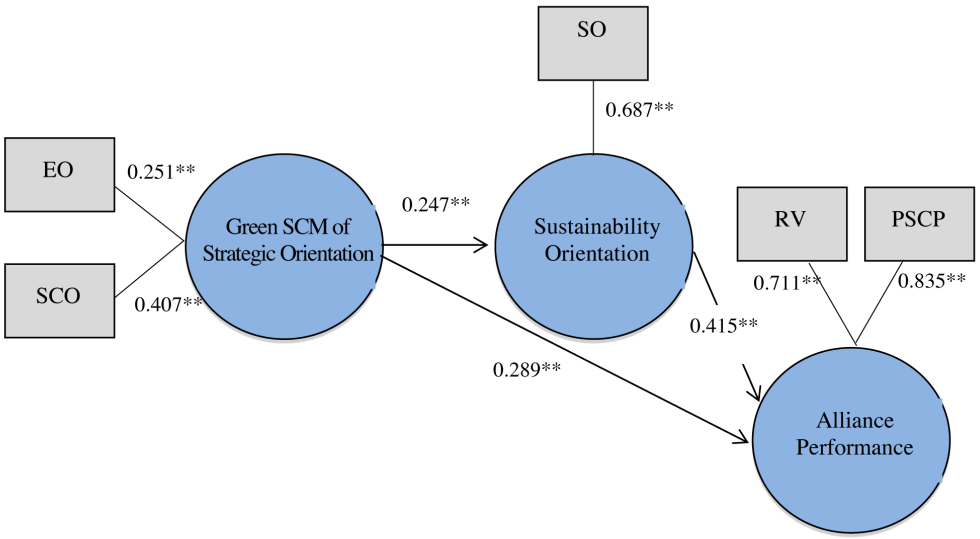
EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Tables 3 and 4 present the results of factor analysis as well as those for the reliability tests for measurements of green supply chain management, Sustainability Orientation, and alliance performance. All variables within a factor tend to have a high coefficient of item-to-total correlation. This suggests a high degree of internal consistency for each dimension. In addition, the high coefficient of Cronbach's α on each factor further confirms the reliability of the measurement items.

4. RESULTS

Based on the previous chapter, the results of factor analysis show that each research item has a high factor loading and Cronbach alpha. Therefore, this study uses the second order factor to test the full model by using SEM. The structural model results are presented in Figure 2 and the standardized regression weights and fit statistics for the structural model are summarized in Table 5. It can be seen that the chi-square value of 275.92 with 174 degrees of freedom is acceptable at the 0.05 significance level. In addition, the *GFI* is 0.937, the *AGFI* is 0.946, and the *RMSEA* = 0.041. These fit indices indicate a good fit for this model. As the overall goodness of fit is promising, it seems worthwhile to further identify the magnitudes and significance of the path structural coefficients of the model.

Figure 2. Structural model tested



Notes:

1. χ^2 (df) =275.92 (174); p < .05; GFI (RMR) = .937 (.047); CFI (RMSEA) = .939 (.041)
2. EO = Environmental Orientation, SCO = Supply Chain Orientation, SO = Sustainability Orientation, RV= Relationship value, PSCP = Perceived Supply Chain Performance

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 5. Structural model statistics

Hypothesized Relationship			Estimates	Result
Environmental orientation (EO)	(+) →	Green SCM of Strategic Orientation	0.251**	*H_1 Supported*
Supply chain orientation (SCO)	(+) →	Green SCM of Strategic Orientation	0.407**	*H_2 Supported*
Green SCM of Strategic Orientation	(+) →	Sustainability Orientation (SO)	0.247**	*H_3 Supported*
Sustainability Orientation (SO)	(+) →	Alliance Performance	0.415**	*H_4 Supported*
Green SCM of Strategic Orientation	(+) →	Alliance Performance	0.289**	*H_5 Supported*
Green SCM of Strategic Orientation	(+) →	Relationship Value	0.711**	*H_{5a} Supported*
Green SCM of Strategic Orientation	(+) →	Perceived Supply Chain Performance	0.835**	*H_{5b} Supported*

4.1. Summary of Hypotheses Tests

The following hypotheses were tested:

4.1.1. Hypotheses Related to Antecedents of Green SCM of Strategic Orientation

H_1: Environmental Orientation directly and positively contributes to Green SCM of Strategic Orientation

The path from environmental orientation (EO) to green SCM of strategic orientation is significant (*$p<0.001$*), is in the direction hypothesized, and is strong (0.251). The data strongly supports the hypothesis that environmental orientation has significant direct effects on green SCM of strategic orientation.

H_2: Supply chain orientation directly and positively contributes to Green SCM of Strategic Orientation.

The path from Supply chain orientation to green SCM of strategic orientation is significant (*$p<0.001$*), is in the direction hypothesized, and is strong (0.407). The data strongly supports the hypothesis. In other words, if the level of environmental and supply chain orientation is high for a focal firm, the probability of obtaining a strategic alliance partner who has a specific level of green SCM of strategic orientation is also high.

According to these findings, it can be stated that the EO and SCO have a significant impact on the green SCM of strategic orientation. While the overall EO has a minor impact on the green SCM of strategic orientation, SCO has a great influence on the green SCM of strategic orientation. H_1 and H_2 support a significant relationship between the bundle of resources in the EO, SCO and green SCM of strategic orientation models in the configuration of EO and SCO as antecedents to green SCM of strategic orientation.

4.1.2. Hypotheses Related to the Practices for Green SCM of Strategic Orientation

H_3: Green SCM of Strategic Orientation directly and positively contributes to Sustainability Orientation.

The path from green SCM of strategic orientation to sustainability orientation is significant ($p<0.001$), is in the hypothesized direction, and is strong (0.247). Therefore, the hypothesis that green SCM of stra-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

tegic orientation has a positive effect on sustainability orientation is supported. The higher the level of green SCM of strategic orientation, the higher the level of sustainability orientation. The results shown in Table 5 thus indicate the importance of green SCM of strategic orientation in sustainability orientation.

H_4: Sustainability Orientation directly and positively contributes to Green Alliance Performance.

The path from need for sustainability orientation to green alliance performance is also significant ($p<0.005$), is in the direction hypothesized, but is not very strong (0.415). The data supports the hypothesis that sustainability orientation practices lead to an increase in green alliance performance.

4.1.3. Hypotheses Related to Outcomes of Green SCM of Strategic Orientation

H_5: Green supply chain management is positively associated with alliance performance.

The path from green SCM of strategic orientation to green alliance performance is significant ($p<0.001$), is in the direction hypothesized, but is not very strong (0.289). This hypothesis is supported by the data. H_{5a} and H_{5b} are concerned with the relationship between green supply chain management and two dimensions of alliance performance. The combination of resources through the path dependence of an environmental orientation and a green supply chain orientation as antecedents to green SCM, directly and positively contributes to relationship value and perceived supply chain performance. The paths are significant ($p<0.001$), are in the direction hypothesized, and are strong (0.711 and 0.835).

5. DISCUSSION

5.1. Summary of Results

The theoretical model hypothesized a direct, positive relationship between green SCM of strategic orientation and alliance performance. Support for the green SCM-firm performance relationships indicates that managers recognize the ability of green SCM practices to impact similar operational metrics of firm performance and operations, such as inventory turnover, order fulfillment, and stock availability (Kirchoff, 2011). The significance of the relationships found between green SCM and the two constructs of firm performance provides evidence of a more widespread proactive environmental strategy in the firms that participated in the survey. All organizations have an environmental strategy that ranges from resistant to proactive and determines which performance goals the firm will pursue (Aragon-Correa & Sharma, 2003).

Moreover, the high loading provides evidence that successful green SCM practices need to be supported by an underlying environmental corporate and economic culture or orientation (Klassen & Johnson, 2004; Min et al., 2007) in firms defined as EO and SCO, respectively. Orientation refers to the way firm views and reacts to the business environment in which it exists. Therefore, EO and SCO were both hypothesized as important antecedents to green SCM (Klassen & Johnson, 2004; Fraj-Andrés et al., 2009). Environmental management practices also bring positive sustainability performance. This also proves that the practice of releasing corporations' sustainability reports is valuable to firms in terms

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

of profit, protecting the environment, and serving the best interest of society. Strategic orientation to achieve sustainability pushes companies to change the design of products and processes to reduce waste and environmental harm while enhancing corporate image in terms of social responsibility. Therefore, managers who engage in supply chain initiatives to improve sustainability performance should look for alternative ways to integrate all three dimensions of sustainability into their supply chains. It would be worthwhile for corporations that are adopting sustainability initiatives to create sustainability orientation.

In the past, firms selected suppliers based on their economic performance, such as product quality, price, delivery speed and so forth. However, with sustainability orientation, firms can no longer focus only on financial terms when evaluating suppliers; they need to adopt sustainable criteria when looking at supplier's economic, environmental and social performance in order to achieve sustainable orientation (Amindoust, Ahmed, Saghafinia, & Bahreininejad, 2012; Li et al., 2014). As a result, we expect green alliance performance, in terms of environmental and social aspects, to be higher than those that are not sustainability oriented. The literature has shown that green SCM has a positive impact on supplier performance and firm performance (Paulraj, 2011; Li et al., 2014), so we expect sustainability oriented SCM to be positively associated with a firm's economic alliance performance.

5.2. Implications and Future Research

Green SCM has received increasing academic attention in recent years. Green SCM is seen as a major corporate initiative that not only represents more accurately whether a firm is genuinely devoted to ecologically responsible operations or is just engaged in 'green-washing' or 'Green Frenzy' projects. In addition, Green SCM has strong strategic implications for a firm's long-term sustainable growth. Therefore, developing green innovations is a win-win solution for the conflict between economic development and environmental protection. One of the important theoretical contributions of this research is defining and developing the concept of green SCM innovation strategy. This contribution is important for several reasons. First, it is based on multidisciplinary perspectives adding to our understanding of the phenomenon in the green supply chain context. Second, green SCM innovation strategies are conceptualized at the firm level of analysis in a holistic conceptual framework of interrelated antecedents, processes and outcomes. In addition, this study enriches this stream of literature by offering strong additional evidence, from a unique single firm, of the positive effects of green SCM on alliance performance.

Moreover, the inclusion of the EO and SCO construct in this paper contributes to the green SCM literature because both the operationalization and empirical testing of EO has previously only been investigated in the marketing and management literature. The findings here suggest that successful green SCM practices need to be supported by an underlying environmental corporate culture and economic culture or orientation (Klassen & Johnson, 2004; Min et al., 2007) in the firms that are defined in this research as EO and SCO, respectively. This contribution is important for several reasons. First, this study contributes to the recent debate on the performance implications of environmental orientation. It has been widely debated among academics and practitioners whether and how firms' adoption of an environmental and supply chain orientation could enhance their competitiveness. Unfortunately, to date the literature in this area is still rather mixed and far from adequate (Menguc & Ozanne, 2005). This study not only demonstrates that both the internal supply chain and external environmental orientations exert a positive and significant influence on green SCM and alliance performance, but also more importantly, delineates how green SCM practices contribute to this influence (Closs et al., 2011).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Finally, this paper has shed light on the role of sustainability orientation in green alliance performance by providing a framework that captures the antecedents, practices and outcomes of sustainability orientation, and calls for more research attention on sustainable SCM. Two antecedents that push firms to be sustainability oriented are identified. Two internal and external practices that could help firms to achieve their goal of being sustainable are suggested. Instead of SCM the non-green products to other countries, firms could adopt sustainable product designs that meet sustainability requirements so that not just that firm, but the whole supply chain could become sustainable. At the same time, it is also critical for firms to have green SCM, to select suppliers with sustainable standards, alliance performance using the preset standards, and develop the suppliers to share the common goal of sustainability orientation. In the area of SCM, it would be interesting to investigate the indicators of selecting suppliers with sustainability orientation, and if no current supplier meets the standards for sustainability, how to develop those suppliers to be sustainable-oriented. It would also be meaningful to study how capability emerges and diffuses in sustainable outsourcing.

5.3. Limitations

It is important to highlight the limitations of this study so that future researchers can attempt to overcome some of its shortcomings. To begin, this study deals with Taiwanese focal firms only. Future researchers may wish to attempt to test these hypotheses in similar markets, particularly the transitional economies of Asian neighbors. Secondly, this study contributes to the recent debate on the performance implications of environmental orientation. It has been widely debated among academics and practitioners whether a firm's adoption of an environmental orientation enhances competitiveness, and if so, how. Unfortunately, the literature on this topic, to date, is still rather mixed and far from adequate (Menguc & Ozanne, 2005). Finally, this study relied on self-reports. Although self-reports have been widely used and have been shown to be reliable, it would be enlightening to add external measures such as financial performance indicators through secondary data. Collecting dependent and independent variable data from different respondents would also help eliminate potential problems arising from common method bias. Another limitation is the generalizability of single research study results.

REFERENCES

Amindoust, A., Ahmed, S., Saghafinia, A., & Bahreininejad, A. (2012). Sustainable supplier selection: A ranking model based on fuzzy inference system. *Applied Soft Computing*, *12*(6), 1668–1677. doi:10.1016/j.asoc.2012.01.023

Antai, I. (2011). Operationalizing Supply Chain vs. Supply Chain Competition. Hanken School of Economics.

Aragón-Correa, J. A., & Sharma, S. (2003). A Contingent Resource-Based View of Proactive Corporate Environmental Strategy. *Academy of Management Review*, *28*(1), 71–88.

Banerjee, S. B. (2002). Corporate Environmentalism: The Construct and its Measurement. *Journal of Business Review*, *55*, 177–191.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Brown, D. & Wilson, S. (2007). The black book 'Green Fifty': The Top Environmentally Responsible Outsourcing Vendors of 2007.

Carter, C., & Rogers, D. (2008). A Framework of Sustainable Supply Chain Management: Moving Toward New Theory. *International Journal of Physical Distribution & Logistics Management*, *38*(5), 360–387. doi:10.1108/09600030810882816

Chan, R. Y. K., He, H. W., Chan, H. K., & Wang, W. Y. C. (2012). Environmental Orientation and Corporate Performance: The Mediation Mechanism of Green Supply Chain Management and Moderating Effect of Competitive Intensity. *Industrial Marketing Management*, *41*(4), 621–630. doi:10.1016/j.indmarman.2012.04.009

Cheung, M. (2005). Inter-Firm Knowledge Sharing and its Effect on Relationship Value: A Global Supply Chain Perspective. [Doctoral Dissertation]. The University of Tennessee, Knoxville.

Chiou, T. Y., Chan, H. K., Lettice, F., & Chung, S. H. (2011). The Influence of Greening the Suppliers and Green Innovation on Environmental Performance and Competitive Advantage in Taiwan. *Transportation Research Part E, Logistics and Transportation Review*, *47*(6), 822–836. doi:10.1016/j.tre.2011.05.016

Cooper, M., Lambert, D., & Pagh, J. (1997). Supply Chain Management: More than Just a Name for Logistics. *The International Journal of Logistics Management*, *8*(1), 1–13. doi:10.1108/09574099710805556

Corsaro, D., & Snehota, I. (2010). Actors and Change in Business Relationships and Networks. Industrial Marketing Management. *Special Issue on Change in Business Networks*, *39*(6), 986–995.

Dan, B., & Liu, F. (2000). Study on green supply chain and its architecture. *Journal of the Chinese Society of Mechanical Engineers*, *11*, 1232–1234.

Das, T., & Teng, B. (2001). Trust, Control and Risk in Strategic Alliances: An Integrated Framework. *Organization Studies*, *22*(2), 251–283. doi:10.1177/0170840601222004

Dawei, Z., Abu, B. A. H., Thoo, A. C., & Kooi, C. L. (2015). Green Supply Chain Management: A Literature Review. *Sains Humanika*, *5*(2), 15–21.

De Marchi, V., & Grandinetti, R. (2012). Who are the green innovators? An Empirical Analysis of Firm's Level Factors Driving Environmental Innovation Adoption. *Paper to be presented at the DRUID Society*.

Ding, R., Dekker, H. C., & Groot, T. L. C. M. (2013). Risk, partner selection and contractual control in interfirm relationships. *Management Accounting Research*, *24*(2), 140–155. doi:10.1016/j.mar.2013.04.007

Fraj-Andrés, E., Martínez-Salinas, E., & Matute-Vallejo, J. (2009). Factors Affecting Corporate Environmental Strategy in Spanish Industrial Firms. *Business Strategy and the Environment*, 500–514. doi:10.1002/bse.611

Ge, L., & Ding, D. Z. (2005). Market Orientation, Competitive Strategy and Firm Performance: An Empirical Study of Chinese Firms. *Journal of Global Marketing*, *18*(3-4), 115–142. doi:10.1300/J042v18n03_06

Groot, T., & Merchant, K. (2000). Control of International Joint Ventures. *Accounting, Organizations and Society*, *25*(6), 579–607. doi:10.1016/S0361-3682(99)00057-4

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Hagedoorn, J. (2002). Inter-firm R&D Partnerships: An Overview of Major Trends and Patterns Since 1960s. *Research Policy*, *31*(4), 477–492. doi:10.1016/S0048-7333(01)00120-2

Hart, S. L., & Dowell, G. (2010). A Natural-Resource-Based View of the Firm: Fifteen Years After. *Journal of Management*, *37*(5), 1464–1479. doi:10.1177/0149206310390219

Hasan, Z., & Ali, N. A. (2015). The impact of green marketing strategy on the firm's performance. *Social and Behavioral Sciences*, *172*, 463–470.

Hult, G. T., Ketchen, D. J., & Arrfelt, M. (2007). Strategic supply chain management: improving performance through a culture of competitiveness and knowledge development. *Strategic Management Journal*, *28*(10), 1035–1052. doi:10.1002mj.627

Ince, H., & Çemberci, M. (2011). The effect of interfirm knowledge sharing on supply chain and firm performance: a conceptual model proposal. *Journal of Global Strategic Management*, *9*(5), 50–61. doi:10.20460/JGSM.2011515812

Kirchoff, J. F. (2011). A Resource-Based Perspective on Green Supply Chain Management and Firm Performance. PhD Dissertation, University of Tennessee, 2011. http://trace.tennessee.edu/utk_graddiss/1046

Klassen, R., & Johnson, P. F. (2004). *Understanding Supply Chains: The Green Supply Chain*. Published by Oxford University Press.

Kotler, P. (1997). *Marketing management: Analysis, Planning, Implementation, and Control* (9th ed.). Upper Saddle River, NJ: Prentice-Hall.

Lambe, C. J., Spekman, R. E., & Hunt, S. D. (2002). Alliance Competence, Resources, and Alliance Success: Conceptualization, Measurement, and Initial Test. *Journal of the Academy of Marketing Science*, *30*(2), 141–158. doi:10.1177/03079459994399

Langfield-Smith, K. (2008). The Relations Between Transactional Characteristics, Trust and Risk in The Start-Up Phase of A Collaborative Alliance. *Management Accounting Research*, *19*(4), 344–364. doi:10.1016/j.mar.2008.09.001

Lapierre, J. (2000). Customer-Perceived Value in Industrial Contexts. *Journal of Business and Industrial Marketing*, *15*(2/3), 122–140. doi:10.1108/08858620010316831

Li, S., Okoroafol, S., & Gammoh, B. (2014). The Role of Sustainability Orientation in Outsourcing: Antecedents, Practices, and Outcomes. *Journal of Management and Sustainability*, *4*(3), 27–36. doi:10.5539/jms.v4n3p27

Linton, J. D., Klassen, R. D., & Jayaraman, V. (2007). Sustainable Supply Chains: An Introduction. *Journal of Operations Management*, *25*(6), 1075–1082. doi:10.1016/j.jom.2007.01.012

Lunnan, R., & Haugland, S. A. (2008). Predicting and Measuring Alliance Performance: A Multidimensional Analysis. *Strategic Management Journal*, *29*(5), 545–556. doi:10.1002mj.660

Menguc, B., & Ozanne, L. K. (2005). Challenges of the Green Imperative: A Natural Resource-based Approach to the Environmental Orientation-Financial Performance Relationship. *Journal of Business Research*, *58*(4), 430–438. doi:10.1016/j.jbusres.2003.09.002

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Min, S., & Mentzer, J. T. (2004). Developing and Measuring Supply Chain Management Concepts. *Journal of Business Logistics*, *25*(1), 63–100. doi:10.1002/j.2158-1592.2004.tb00170.x

Min, S., Mentzer, J. T., & Ladd, R. T. (2007). A Market Orientation in Supply Chain Management. *Journal of the Academy of Marketing Science*, *35*(4), 507–522. doi:10.100711747-007-0020-x

Miocevic, D., & Crnjak-Karanovic, B. (2012). The Mediating Role of Key Supplier Relationship Management Practices on Supply Chain Orientation- The Organizational Buying Effectiveness Link. *Industrial Marketing Management*, *41*(1), 115–124. doi:10.1016/j.indmarman.2011.11.015

Moller, K., & Torronen, P. (2003). Business Suppliers. Value Creation Potential: A Capacity-Based Analysis. *Industrial Marketing Management*, *32*(2), 109–118. doi:10.1016/S0019-8501(02)00225-0

Morelli, J. (2011). Environmental Sustainability: A Definition for Environmental Professionals. Journal of Environmental Sustainability, 1(1). Retrieved from http://scholarworks.rit.edu/jes/vol1/iss1/2

Narasimhan, R., & Carter, J. R. (1998). *Environmental Supply Chain Management. The Center for Advanced Purchasing Studies*. Tempe, AZ: Arizona State University.

Newbert, S. L. (2008). Value, Rareness, Competitive Advantage, and Performance: A Conceptual-Level Empirical Investigation of The Resource-Based View of The Firm. *Strategic Management Journal*, *29*(7), 745–768. doi:10.1002mj.686

Nielsen, B. B. (2002). How Do Firms Select Their Partner for International Strategic Alliances?: An Empirical Investigation of the Drivers of International Strategic Alliance Formation. Copenhagen Business School, Institute for International Økonomiog Virksomhedsledelse.

North, D. C. (1990). *Institutions, Institutional Change and Economic Performance*. Cambridge: Cambridge University Press. doi:10.1017/CBO9780511808678

Paulraj, A. (2011). Understanding the relationships between internal resources and capabilities, sustainable supply management and organizational sustainability. *Journal of Supply Chain Management*, *47*(1), 19–37. doi:10.1111/j.1745-493X.2010.03212.x

Phan, K. L., Wager, T., Taylor, S. F., & Liberzon, I. (2002). Functional Neuroanatomy of Emotion: A Meta-Analysis of Emotion Activation Studies in PET and fMRI. NeuroImage, 16, 331–348.

Porter, M. E., & Kramer, M. R. (2006). The Link Between Competitive Advantage and Corporate Social Responsibility. *Harvard Business Review*, *84*(12), 78–92. PMID:17183795

Rao, P. (2002). Greening the Supply Chain: A New Initiative in South East Asia. *International Journal of Operations & Production Management*, *22*(5/6), 632–655. doi:10.1108/01443570210427668

Roxas, B., & Coetzer, A. (2012). Institutional Environment, Managerial Attitudes and Environmental Sustainability Orientation of Small Firms. *Journal of Business Ethics*, *111*(4), 461–476. doi:10.100710551-012-1211-z

Safarzynskaa, K., Frenken, K., & van den Bergh, J. C. J. M. (2012). Evolutionary Theorizing and Modeling of Sustainability Transitions. *Research Policy*, *41*(6), 1011–1024. doi:10.1016/j.respol.2011.10.014

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Sarkis, J. (2003). A Strategic Decision Framework for Green Supply Chain Management. *Journal of Cleaner Production*, *11*(4), 397–409. doi:10.1016/S0959-6526(02)00062-8

Seuring, S., & Muller, M. (2008). From a Literature Review to a Conceptual Framework For Sustainable Supply Chain Management. *Journal of Cleaner Production*, *16*(15), 1699–1710. doi:10.1016/j.jclepro.2008.04.020

Shahidullah, A. K. M., & Haque, C. E. (2014). Environmental Orientation of Small Enterprises: Can Microcredit-Assisted Microenterprises be Green? *Sustainability*, *6*(6), 3232–3251. doi:10.3390u6063232

Sirmon, D. G., Hitt, M. A., & Ireland, R. D. (2007). Managing Firm Resources in Dynamic Environments to Create value: Looking Inside the Black Box. *Academy of Management Review*, *32*(1), 273–292. doi:10.5465/AMR.2007.23466005

Slater, S. F., & Narver, J. C. (1992). Superior Customer Value and Business Performance: the Strong Evidence for a Market-Driven Culture. Report Marketing Science Institute, Cambridge, MA.

Steger, U. (1993). The Greening of The Boardroom: How German Companies are Dealing with Environmental Issues. In R. Fischer & J. Schot, (Eds.), Environmental strategies for industry (pp. 147-166). Washington D.C.: Island Press.

Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic Capabilities and Strategic Management. *Strategic Management Journal*, *18*(7), 509–533. doi:10.1002/(SICI)1097-0266(199708)18:7<509::AID-SMJ882>3.0.CO;2-Z

Tukker, A., Charter, M., Haag, E., Vercalsteren, A., & Wiedmann, T. (2001). Eco-design: The state of implementation in Europe- Conclusions of a state of the art study for IPTS. *The Journal of Sustainable Product Design*, *1*(3), 171–181. doi:10.1023/A:1020564820675

US-AEP. (2003). The United States-Asia Environment Partnership. Retrieved from http://www.usaep.org/programmmms/industry/ind-greening.html

Vachon, S., & Klassen, R. D. (2008). Environmental Management and Manufacturing Performance: The Role of Collaboration in the Supply Chain. *International Journal of Production Economics*, *111*(2), 299–315. doi:10.1016/j.ijpe.2006.11.030

Woodruff, R. B., Locander, W. B., & Barnaby, D. J. (1991). Marketing in a Value-Oriented Organization. In M.J. Stahl & M. Gregory (Eds.), Competing Globally through Customer Value: The Management of Strategic Supra-systems. Westport, CT: Quorum.

Yang, M. G. (2013). Developing a Focal Firm's Sustainable Supply Chain Framework: Drivers, Orientation, Practices and Performance Outcomes. University of Toledo. Retrieved from http://utdr.utoledo.edu/theses-dissertations

Zeithaml, V. A. (1998). Consumer Perceptions of Price, Quality, and Value: A Means-End Model and Synthesis of Evidence. *Journal of Marketing*, *52*(July), 2–22.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Zhou, X. G., & Lu, M. (2012). Risk Evaluation of Dynamic Alliance Based on Fuzzy Analytic Network Process and Fuzzy TOPSIS. *Journal of Service Science and Management*, *5*(03), 230–240. doi:10.4236/jssm.2012.53028

Zhu, Q. H. (2004). *Green Supply Chain Management*. Beijing: Chemical Industry Press.

Zsidisin, G. A., & Siferd, S. P. (2001). Environmental purchasing: A framework for theory development. European. *Journal of Purchasing and Supply Management*, *7*(1), 61–73. doi:10.1016/S0969-7012(00)00007-1

This research was previously published in the International Journal of Sustainable Entrepreneurship and Corporate Social Responsibility (IJSECSR), 1(2); edited by Amulya Gurtu, pages 40-61, copyright year 2016 by IGI Publishing (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 16
CSR in Cultural Organizations: A Valorization Model

Lucia Aiello
Sapienza University of Rome, Italy

María del Pilar Muñoz Dueñas
University of Vigo, Spain

ABSTRACT

In this chapter, the authors approach the theme of the definition and classification of CSR for cultural organizations according to the major international literature review dealing with the issue. They argue for more theoretical discussion into the valorisation dynamics of CSR, drawing from the consideration that the CSR could be strategic for cultural organizations as a serious object of investigation despite its managerial and sustainability significance. Starting from the analysis of the main literature on CSR in cultural organizations context, the authors show a valorisation model. As a result, the aim of this chapter is to define the unique dynamics of the valorisation model for cultural organizations in a CSR perspective.

INTRODUCTION

The subject of the proposed work is the link between Cultural Organizations and CSR through the approach based on the value creation integrated into perspective of shared value between society and organization. The value society is the optimal value creation as a result; the idea for this work comes from the consideration of dimensions of CSR for cultural organizations and to links that can activated.

Culture considered a common good, an element of welfare for community, for all people, and as such, each individual has a responsibility to preserve, safeguard and value it. Culture has an exchange value too, and thus it is also a product (commodity, service, idea), and this requires economic, social and cultural models, consistent and shared, however, it mustn't disregard the definition of Cultural heritage by United Nations Educational, Scientific and Cultural Organization (UNESCO), which considers culture a good belonging to all mankind: «Everyone must be enabled to enjoy culture» and «Culture is world heritage». The cultural organizations must allow culture to finance itself through a process involving the quality artistic production, support of public and media, substantial public and private financing and

DOI: 10.4018/978-1-5225-7915-1.ch016

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

self-financing. The target audience, and then the target to be attained, is becoming more strategically important. An analysis of new and potential opportunities for «new markets space» must be realized to be able to exploit potential benefits. With reference to Management, to date, many studies have proved the strategic importance of CSR, and - in this work - within the processes of value creation of the CSR. As the analysis of cultural organizations shows, the CSR helps the processes of value creation of cultural product; so i.e. cultural enterprise, cultural association. In general, a part of the value added generated by a firm through its activities necessarily goes to the local system where it is situated, as it is transferred to other actors who are part of it, and vice versa. In particular, perspective of competitiveness development, value creation means the strengthening of tangible and/or intangible property in the area and that, as mentioned, determines its terms of competitiveness. There is a literature as well as wide empirical evidence on the ways in which the presence and behavior of firms affect, or may affect, the factors of economic attractiveness in the geographical context they belong to.

Below are the most significant among these modes:

1. Development of quality of human resources.
2. Knowledge transfer to certain local actors.
3. Acquisition of products/services from local businesses.
4. Pulling of local companies in the competitive international contexts.
5. Improving the image/reputation of area.
6. Improvement of quality of local supply with special reference to that of intermediate goods and high value services.
7. Support to share capital, as the cultural sponsorship and strategic partnerships.
8. Contribution in the realization of infrastructural investments.
9. Improvement of the level of sustainability (social, environmental, economic) of local production system.

All aspects can be affecting by CSR. The connection of CSR management and cultural organizations needs an integrated approach involving the analysis of literature (desk) and analysis of practical cases (field).

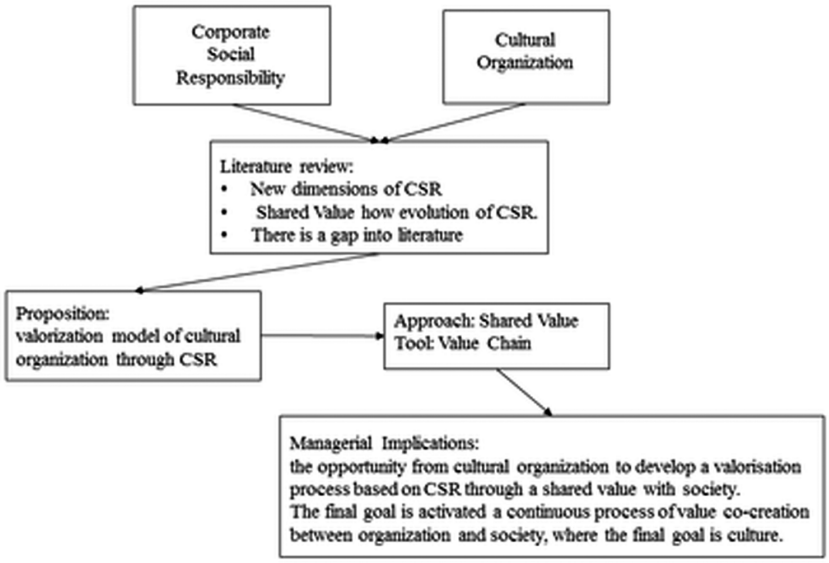
In literature, there is a gap on CSR analysis in valorization process of cultural organizations. Some studies pay attention on role of CSR into value chain and some authors, as Carroll (2003), put in evidence the process of value creation for organizations and society. There is not any suggestion about the relationship between CSR and value chain that include the valorization of cultural organizations.

According to explored gaps, this chapter propose a new framework to study and consider the active role of CSR into value chain of organizations into shared value approach, from this starts a proposition of a valorization model for cultural organizations.

The characteristic feature of this publication is the theoretical analysis that has made it possible to develop an integrated approach including CSR's management and cultural organizations (Aiello, 2014). This approach is important in order to recognize a common perspective to investigate, create and propose a model for the link between CSR and cultural organizations mainly through shared value. The study of literature, in particular, allowed us to recognize the relationship, which is the proper approach to know the contents, meaning and components of the phenomenon investigated. The perspective adopted is to deepen the theoretical framework of cultural organizations through the «lens» of shared value in order to propose a CSR management for cultural organizations based on both theories of reference and

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 1. Research design



empirical analysis of case studies. This chapter focuses on the CSR and Cultural Organizations through valorizations model that based on value chain. Value chain defines how the organization creates value for its and stakeholders, environment and society.

The analysis of CSR into value chain of cultural organizations and this integration can be considered as a method to reach new model: a valorization model. The object under investigation is the cultural organizations in an integrated and social responsibility's configuration. The question study is: which role and which value has CSR into value chain? The proposition supported is that the CSR to be valorization element for cultural organizations in a multilevel configuration, making shared value approach; thus CSR could be input, philosophy and output of valorization processes in value chain.

The objective of the publication is a proposition of valorization model of cultural organization that based on CSR in a multilevel configuration into value chain. The question below study is mapping the CSR in value chain of cultural organization through the valorization model in shared value approach. The figure one presents the research design.

Thus, in line with research design the research objectives are to design rounded background in CSR for valorization of cultural organizations; to reflect the role of CSR into value chain; to study the link between CSR configurations and value creation and shared value; to suggest a valorization model of cultural organizations through CSR in shared value approach.

BACKGROUND

The main authors defy easy definition of culture (Knight, 1999). The term cultural industries (Power et al, 2004) encompasses a wide variety of commodified activities, including the mass media (print and broadcast media and advertising), film, new media, art, design, music, and architecture. Conversely, although it is an important area of research and of economic activity, there has been a significant gap

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

in systematic studies of these industries (Aiello, 2014; Powder, 2002; Scott 2000; Pratt 1997; Sadler 1997; DiMaggio and Hirsch 1976).

The dissemination of culture, different governments have sought to provide support for their maintenance and growth. The more complicated questions are for the debate around culture in considering if whether culture is good or service and also, whether culture from different countries constitute like or directly competitive or substitutable products. Culture is core business of more and different organizations, which are to be treated but arguments will possible continue as to whether culture is a good or service (Löhr. 2010; Bernier, 2005).

Culture is a value also, so it is a complex (good, service, idea, value) and this value is economic, social, tangible and intangible (Aiello, 2014; Ferri et all., 2009; Voon, 2007; Scott, 2004; Lorente, 2002; Fuchs, 2002; Throsby, 2001; Bryan et al., 2000; Weinstein et al., 2000).

The culture in the society has been subject an increasing economic interest in recent years. Although, it is quite problematic to understand exactly its role, because of perhaps the most difficult step is to define what exactly is. Culture has a value but it is difficult monitoring and define it.

Furthermore, the value and role of culture into society play a crucial role, in fostering the value creation for society, and the valorisation of cultural organizations.

Changing culture organization policy is reshaping the role of value chain in the value creation. The benefits of cultural production are likely much larger than they might appear at first glance, given that they contribute to valued social goods like national identity and social cohesion as well as for business.

In literature, it proposed a theoretical framework of cultural enterprises (Solima, 2006). The framework defines the cultural organizations performing, activity of prevalent artistic and cultural content, in order to achieve an objective of social order, "the community's cultural growth". The organization wishes an adequate tangible and intangible asset, which is an appropriate working capital to achieve its institutional mission. A cultural organization configured in order to management level, cultural activities and cultural heritage; and value chain process, production, creation, and/or supply.

The value chain process could not generalized for all cultural enterprises but it depends on the type of cultural enterprise. The considerations set out above highlight some critical elements of cultural organizations, particularly, the specificity and peculiarity of each cultural organizations and therefore, the value chain configuration.

Several authors argued on different aspects of the complexity of culture and cultural enterprises or industrial (Solima, 2006; Bollo, 2008; Colbert; 2004; Hesmondhalgh, 2002). Precisely for these reasons, Solima, in dealing on cultural enterprise, chooses only some of the possible configurations, pointing out that they are only part of the complex landscape of cultural goods and activities. The configurations of cultural enterprise considered by the author are theatres and opera foundations, libraries, archives, museums and archaeological sites, festivals called actors of the system (Solima, 2004: 55-83). In different overview, cultural features then considered a unique character to embed into an organization both for the enhancement of culture identity in the global market and for the fulfilment of everyone's experiences. The cultural creation, in fact, is a consistent mix of single elements; giving to it size and values. According to Colbert (2003), art and culture are any business at the base of which there is an act of artistic creation (Colbert et al., 2004).

According to a previously study (Aiello, 2014) the cultural organizations are classified in "strict sense" and "broad sense". In first categories, there is performing arts, especially of those in which the core business is a direct contact between the artist, his art and the consumer. In "broad sense" categories,

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

there is the cultural industry and the media – film industry, discography – core business is an art product coming from a production and/or distributive process.

The main difference between tow classifications is the value chain, which based on direct or indirect contact between the public and the arts. Cultural organizations share a social objective, namely the common cultural growth with a view to enhancing the economic value of both a recording or film product and a museum. This involve an economic but social, also, value.

Thus, cultural value is recognized at a powerful factor on brand image and is extensively accepted as one of the central approach in understanding value chain, which determines different choices of consuming and shared value (Park et al, 2009).

Scott (2000) considers the cultural organizations an important and growing element of contemporary economic systems, thus are becoming increasingly prominent in post-industrial societies (Currid 2006; Kloosterman 2004; Throsby 2001; Scott, 2000; Lash et al., 1994; Zukin 1998). Cultural organizations can identify through different levels:

1. Service outputs that focus on entertainment, edification, and information, where the culture is the core product (i.e. recorded music, museums).
2. Manufactured products that focus the culture how essence of product, where the culture is the philosophy of core product (i.e. jewellery or fashion clothing).

The social value is part of culture organizations, which provide share understanding among people in a society that allows them to predict and coordinate social activities and cultural values (Pratt, 2008; McGregor, 2000; Stanwick et al, 1998).

Thus, this different level shifts to description of value chain towards the involvement the CSR (Weber, 2008).

For nature of cultural organization we can show which Gholami) consider a <<reciprocal dependence between an organization and society>> (2011: 148), the author consider the indicators that influence this relationship.

In this view it is important to clarify in detail the elements involved in the process of value chain flexibility (Zhang et al, 2002), the main dimensions of CSR and the link with the context in which this are expresses for shared value. Thus, in the following sections we describe all the components, which contribute to delineate the valorization model, starting from the different value chain typologies in line with CSR into shared value approach.

CSR IN SOCIAL VALUE PERSPECTIVE FOR CULTURAL ORGANIZATIONS

Sustainability meets present needs without compromising the ability of future generations to meet their need. The Green paper defines CSR essentially a concept whereby companies decide voluntarily and beyond the law to achieve social and environmental objectives during the course of their daily business activities, contributing to a better society and cleaner environment. Since companies that behave in a socially desirable way will also gain financial advantages, corporate performance now means both financial and social performance. Within this context, networking means creating and governing the relationships, interactions and exchanges with others in an organized and conscious way. CSR is strategic key for Cultural Enterprise into dynamic and interactive environment (Carroll, 1999).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

In the following paragraph we deep on these arguments.

CSR value is a significant issue in valorisation process, but it related some role are still challenging. The value changes in the cultural organizations evolution, process and develops a valorisation process through CSR policies. By applying the notions of social value, the cultural organizations introduced to characterize the valorisation on based multilevel. Based on these concepts, CSR and social value measured by a new <<framework value creation cycle>> proposed from Gholami (2011) that is consisted of four dimensions: economic, legal, ethical, and philanthropic dimensions. Thus, the CSR value calculating, in according to author, through a stratification of four dimensions:

- **Economic:** Personal saving rate; business saving rate; inflation rate; manufacturing/supply/distributions lead-time.
- **Legal:** Anti-trust; labour training laws; human right.
- **Ethical:** Codes of conduct; corruption; money laundering.
- **Philanthropic:** Donor attrition; donor acquisition; gift processing time; stewardship calls.

This point of view of CSR value, the construction of dimensions and the build a model of valorisation are insightful for both researchers and practitioners

The economic dimensions focus on create exploiting making per share, stress the position of resilient competitive, and embrace a high level of operational effectiveness. This framework suggests personal saving rate, business saving rate, inflation rate, and manufacturing lead-time indicators to measure the economic dimension. The legal responsibilities dimension, for author, highlight that the process of business should implement the vision and mission of their economic permitting to legal requirements. These tasks are important, because to move in a style uniform of government and law's expectation.

The ethical responsibilities focus on businesses takes that to do what is right, just and fair. Moral rules should define as suitable performances (McGuire et al, 1988) in the organizations and society (Aras et al, 2010).

Gholami (2011: 150) affirms that these responsibilities are important due to the prospects of social mores and ethical norms and recognition ethical or moral norms accepted by society (some variables codes of conduct, corruption, and money laundering). The last dimensions, philanthropic responsibilities named *discretionary responsibilities* highlight be a good corporate citizen, thus resources for community and increase quality of life as a basic indicator for community thus, donor attrition, donor acquisition, gift processing time and stewardship calls as crucial variables estimation philanthropic responsibilities within society (Gholami, 2011: 148-154).

Some authors analyse the concept of Shared Value (SV) (Cacia et al., 2015; Christiansen, 2008; Ashley, 2009; Barton, 2011). Porter and Kramer (2011) expanded the idea that the shared value connected with social responsibility. Actually, companies' responses to the CSR concept verified and sometimes found severely inadequate (Camilleri, 2013). The authors propose that Shared Value guarantees that what is virtuous for business is also virtuous for society; SV emphases on the joining between social and economic development. They define SV as «policies and operating practice that enhance the competitiveness of a company while simultaneously advancing the economic and social conditions in the communities in which it operates» (2011:6).

The connection with cultural organizations is that the shared value could considered applicable to equally profit and non- profit organizations as well as to cultural organizations also. In literature emerges

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

that the social drive of SV represents an higher form of entrepreneurship able to create a positive cycle of prosperity (Cacia et al., 2015).

Porter and Kramer (2006) suggested the SV how strategic dimension of CSR policies, the authors proposed a "new hybrid business models" (Michelini, et al., 2011).

The concept of creating social value clarifies a profounder relationship between business and society and delivers great push to developing social organizations (Yang et al, 2014; Alter, 2007; Kramer, 2005). Wood and Leighton (2010) defined social value as referring to the wider non-financial impacts of programs, organizations and interventions, including the wellbeing of individuals and communities, promotion of social capital and protection of the surrounding environment.

This research considers all the perspective analyzed more interesting; in a perspective of a new model of valorization for cultural organization through CSR, no theory can excluded but integration between them contributes to the proposal of the model of valorization.

Thus, this chapter propose an exploitation of CSR, shared value is a new perspective of CSR dimension, thus economic, legal, ethical, philanthropic dimensions must considered the shared value creation between organization and society.

CSR CONFIGURATIONS IN VALUE CHAIN

The analysis of value chain has underlined three typologies, which depend from CSR's role in shared value:

1. Value chain driven by CSR in creating value. CSR is an input.
2. Value chain based on CSR in value creation. CSR is a philosophy
3. Value chain has among CSR goals to create social value. CSR is an output.

In reference to CSR, the value chain is dynamic and based on three different typologies, in fact even the cultural organization is a mix between the all needs of every levels and the degree of complexity depends on the characteristics of both the organization and value chain. In the figure, both elements have divided into two main variables, respectively: 1. intensity; 2. pervasiveness; 3. shared value capability.

The intensity of CSR increases with the involvement of both secondary and primary value chain activities. The pervasiveness of CSR increases if connection between the organization and the reference society increases. CSR's shared value capability increases if the connection between CSR and shared value of the organization's value chain increases.

The model assumes that the variables of the intensity, pervasiveness and shared value capability influence the degree of complexity of value chain, thus CSR plays a crucial role in the configuration of the value chain.

Corporate Social Responsibility is the responsibility of business firms to ensure the development of the society within which they conduct their operations, even though the efforts in this direction may not bring the firms immediate monetary returns. Corporate social responsibility is getting unbelievably well-liked just lately as a result of mixture of public, ecological, in addition to economic deliberations of which plays a big aspect to make judgments constitutions in addition to operations connected with business. Corporate Social Responsibility is a significant subject for any organization ambitious for long lasting protract (Schwartz et al, 2003). At the same time as it is a more often than not designed concept,

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

there is ever-increasing stress on companies to make a positive participation to people, thus to create shared value with them and with society as a whole.

The scientific value concerns a new approach to Corporate Social Responsibility, focusing on the concept of the value chain (Kaplinsky et al, 2001). The work will represent an important contribution to organizational model (Daft et all, 1993), outlining a new perspective of considering CSR within the relationship between companies and the society as a whole in shared value area. Therefore, CSR requires new model to manage (De Witte et al, 2006).

Corporate Social Responsibility is, by its title, an obligation of a moral, social, and in some country statutory. In the most world, vice versa, it so looked upon as a voluntary decision. It is however, expected that many countries will follow suit in recognizing CSR as an important tool of development. In Cultural Enterprise the social element is part of it, never contribution puts in evidence such as CRS can developed as part of culture. The value of chapter is to highlight what CSR models can developed into a cultural enterprise in which the social element is characteristic.

Cultural Organizations include a wide range of activities; culture is not only art but also the greatest meaning of our pastimes, habits, images, and institutions, perspectives on the world, collective memory and our bilingualism and multiculturalism. From the analysis of the main literature on cultural organizations and the evolution of CSR, the proposal for this contribution emerges mapping three types of value chains where CSR has a specific role in relation to the predominant characteristics of cultural organization in a shared value.

In this perspective, this research is approaching the theme of defining and classifying the valorisation model for cultural organizations through CSR in the value chain according to major international authors dealing with the issue, knowing that CSR is the heart of the chain of value for cultural organizations.

In this perspective, CSR should carefully note, well known, widespread and attractive and diffused in the management of cultural organizations.

According with the main literature, cultural organizations have as core business intangible goods (Lampel et al., 2000). Although the stress on the intangible nature of culture has been largely debatable in the past, in light of the existence of a reciprocal relationship between culture and society. According to more spread definition, cultures are goods and services that include arts, visual arts, heritage conservation (museums, galleries, and libraries), cultural industries (broadcasting, film, and recording) and festivals. This feature differentiates the logic of CSR policies in relation to the type of organization, i.e. size (Udayasankar, 2008: 171).

Therefore, in cultural organizations the CSR exposed to value chain. In this respect, there are mainly three aspects, which are involved around the central component: 1. CSR is an input of value chain; 2. CSR is a philosophy that involves the whole of value chain. These aspects are mainly spinning off organizations, related the role of CSR into value chain. Therefore, corporate social responsibility plays a strategic role into value creation process and shared value between organization and society.

Businesses that have an advantage usually come from a number of activities along the value chain. A sustainable benefit is not a single activity, but many, and reconfiguring the chain often serves to create a new advantage. In this way, the company reflects through its value chain a differentiated way of acting over its competitors.

Although differentiation is an important element, its sources often not well understood: companies consider sources that are capable of influencing differentiation too restrictively. With this contribution, we consider a broader way to identify new sources of benefit, such as CSR.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Usually, organizations focus on product or marketing differentiation instead of realizing that it can potentially manifest itself in every area of the value chain.

The starting point for generating value is to determine what has value not only for the customer or the reference environment but also for the company.

The CSR in value chain determine, therefore, the degree of three different configurations of value chain, which has been elaborated in the figure 2.

Generally, an enterprise creates value because it justifies a premium price (or preference at the same price) by two mechanisms: decreasing its costs or improving its performance. In fact, through the CSR-based value-added process in the shared value approach, the mechanisms that are activated are much deeper, as there is a shared common goal that reinforces the link between organization, society and the reference environment.

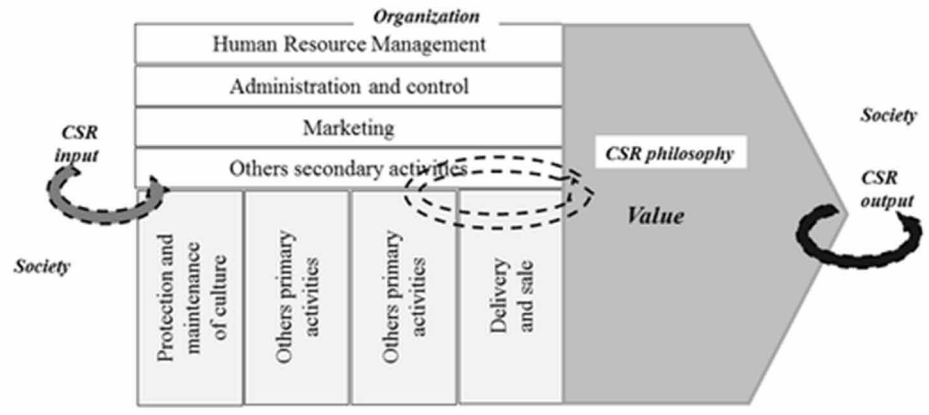
The valorization model presents into figure two aims to consider the role of CSR into valorization process of cultural organization. The model starts from value chain of organization; second step is the configuration of CSR into value chain: input, philosophy and output.

Configuration of CSR as input (dashed gray arrow); CSR policies aim to increase the value chain of other cultural organizations (i.e. donation to other cultural organizations, Della Valle at Colosseo for restructuration). Configuration of CSR as philosophy (dashed transparent arrow); CSR policies involved organization all, the whole chain of value, primary and secondary activities, and relationship with society, supported by CSR policies (i.e. Cucinelli that the share of workers in the division of profits and CSR is mission of organization). Configuration of CSR as output (dashed black arrow); CSR policies aim at defining the culture of social responsibility (i.e. Olivetti that design and construction of new industrial buildings, offices, houses for employees, canteens, kindergartens, giving rise to an articulated system of social services).

If there are all CSR's configuration, we could goal the integration CSR policies, where the complete circle of shared value process is based on CSR.

The perception that the market and all stakeholders have on organization and its products can therefore be as important as the differentiation effort that the enterprise accomplishes through its value chain. If this goes through a shared value, such as that of social and cultural responsibility, the process of valorization is facilitated.

Figure 2. CSR in value chain



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Once you find the sources of value for the buyer, you will have to identify the cost of the existing and potential differentiation sources. This implies choosing a configuration of the value generating activities that it creates for those who purchase a higher value differentiation than the cost of the differentiation supported by the enterprise; check that the chosen differentiation strategy is sustainable against erosions or imitations; reduce the costs of activities that do not affect the form of differentiation that you have chosen.

This will reduce the vulnerability of those who have opted for differentiation based on CSR policies than competitors relying on their value chain on other mechanisms because value sharing strengthens the link between organizations, society, and reporting environment.

Cultural organizations, which have CSR policies in its value chain, can pursue shared value opportunities on three levels: input, philosophy and output of valorization processes in value chain. Thus, CSR could be an input of value chain; for example "Colosseo" that has found from Della Valle (Italian Fashion Firm, shoes production). CSR could be a philosophy that involves the whole of value chain, from human resource management (employees are involved into profit sharing) at branding process (consumer process is the base of the social responsibility of organization); CSR is the way by which organizations improve the quality, quantity, cost and reliability of inputs value-creation processes. There is acting simultaneously in the economic and social development. CSR could be an output into value chain, thus, it is the way to operate in society and to compete and thrive. Redefining productivity in the value chain is the way businesses can improve the quality, quantity, cost and reliability of organization processes.

Based on theoretical conceptualization, combined with some cultural organizations that applied CSR policies, on develop a valorization model framework for approaching CSR in a value chain of cultural organizations. In particular, we aim to highlight the influence of CSR through new configurations on value creation and stress the role of CSR in value chain process.

The valorization model that we propose in section that follows start from this consideration and the configurations of value chain.

VALORIZATION MODEL

The CSR affecting the cultural organizations, joined to the responsibility has transformed the current organizational environment for most organizations, for example cultural organizations. Value chain defines valorizations is now more dependent on continuous value chain development and enhancement, so CSR becomes a central element in valorizations model. Furthermore, the valorizations of cultural organizations closely intertwined. The valorizations needs a successful value chain, both to create force element for the cultural organizations and to provide critical assets and a supportive setting and, also, CSR needs successful valorizations to provide creation opportunities. In literature, the main model on CSR's orientation is 3C-SR model (Meehan et al, 2006). The authors propose that into model must are three component, which are commitments, connections and consistency; weakness in one of these three areas will result in a failure to adequately achieve a real corporate responsibility orientation and building competitive strategies around social resources. Already Waddock and Graves (1997) have demonstrated the link between social welfare benefits and financial performance.

However, this scenario calls for a configuration of value chain, which includes valorization engagement methods and shifts the central goal of companies into creating CSR's value. This aim becomes more influential especially for those organizations that operate in culture through new approach that enable value chain from the perspective of social dimension.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Cultural organizations increasingly have needs of gathering ideas for innovations and providing solutions to existing problems and/or for maintaining the competitive advantage.

While both phenomena are not new, their overlapping requires considerable attention in practice, related to the culture opportunities and benefits that have been enabled by CSR policies. Corporate social responsibility presents a number of potential applications, open to future developments and seem to provide new model and ways to enable this in practice and to create new value chain.

Shared Value effects on preconceiving reputation on society, redefining efficiency in the value chain and allowing culture development. The first one allows organization to meet social needs through CSR. Redefining efficiency in the value chain and enabling culture development in the value chain, in its place, represents the way by which firms can improve the quality, quantity, cost and reliability of inputs value-creation processes. Thus, acting simultaneously in the economic and social development. The last one is the way in which organizations operate in society, to compete and thrive. Organizations need a strong valorization that includes responsibility (World Bank, 2012). The SV opportunities at each level will vary by organizations, company and society, depending on how the company's particular business and strategy intersects with social issues (Porter, 2012).

The evolution of the culture era, which allows you to define the concept of culture's co-creation action, drives organizations to pursue emerging strategies that share the value chain (VC) along the social responsibility's orientation. The use of CSR is necessary because it allows:

1. Reputation, advantage of having greater attention from society.
2. Sharing, opportunity sharing, and interaction whit a network cultural-oriented.
3. Accessibility, this opportunity allows the consumer, suppliers, crowd and every individual outside – which can bring value added to the value chain – to be included, in the valorization model of organizations, dimension conceptual of CSR (Carroll, 1979).

Many authors (Kaplinsky et al., 2001) have analyzed the question of value chain, and the its definition evolved. Flexibility's role (Nair, 2005: 447–463) and the co-creation of value chain (Stevens, 2009) put in action the role of CSR. Thus, we can assert that in the value chain is possible that the traditional parts (workers, managers, suppliers, clients), can was pushed from CSR into shared value process (Peppard, et al., 2006; Mascarenhas et al., 2004; Parasuraman et al., 2000: 170).

The knowledge economy is undergoing a process of differentiation and spatial segregation leading to a constant rearrangement of the value chain of cultural organizations (Thierstein et al., 2008: 1113–1131).

This work considers the valorization of culture organizations through culture creation and diffusion at the social responsibility is a process happening within the value chain. In a first analysis, we can consider that the hybrid role of CSR (input, output, philosophy) in value chains seems to be a main reason for the concentration of shared value.

The research question is the proposition of the CSR into value chain as facilitator to co-creation of value shared into cultural organization. The co-creation, amplified by CSR, allows you to renew the existing models of the value chain, this allows to have input from society and, therefore, an active role of all actors of the value chain. The internal and external society, which was static subject of the process, is now active subject.

This depends that general views on value creation are evolving toward an integration between internal and external at value chain of organization view, which focuses more intently on collaborations aimed at the sharing of specialized competencies among actors functioning in a network, thus CSR, also. The

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

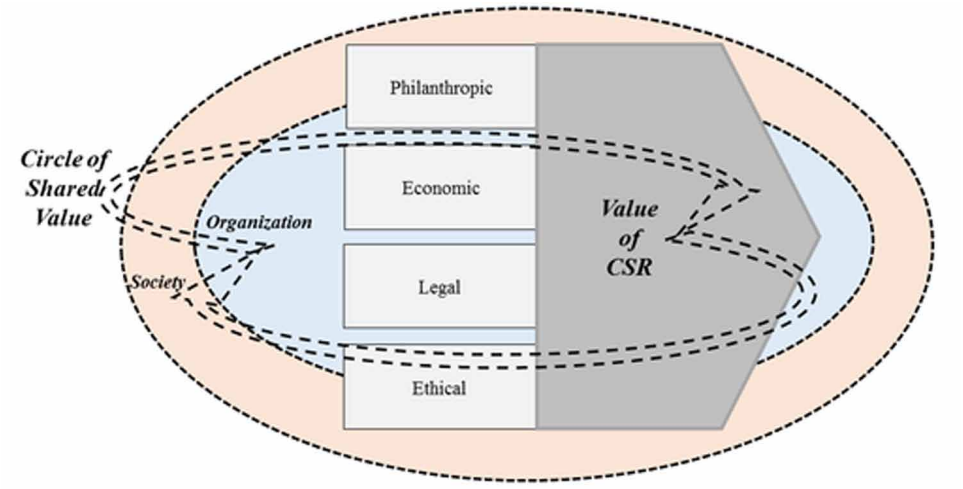
contemporary view of value creation based on CSR, into shared value approach as value co-creation, pushes to consider that CSR has a strategic role into vale chain, this is true and more strength in cultural organizations where culture is double value in CSR. The culture is the results of CSR policies and of value chain. Along the value chain, horizontally or vertically, between different subjects there is sharing information and knowledge that impact on value creation. Thus, we can affirm that there is a link between pervasiveness and depth of CSR and value co-creation capacity of organization; the competency, transformation CSR value into shared value that they have considered there is shows a value co-creation between internal competencies and external capabilities, not only but stakeholders but all society.

The study of valorization of cultural organization requires the CSR into shared value approach, because it is cross functional and involves several actors, they have different competencies and different relationships (involving suppliers, customers, institutions, society, others). In accordance with this perspective, co-creation value chain affects the capacity to create adds value for organization and society. Certainly then this convergence towards value creation and shared value creation links CSR processes into value chain. Thus, the CSR must be pervasive and depth. Since, the CSR creates confidence and social identity. The shared value management practices are fundamental because the logic based on the social responsibility, which we proposed through this work, is the input of culture, philosophy of organization and output of social responsibility of value chain, be-directional to shared value between organization and society involved.

The role of the CSR on valorization of cultural organization based on integration main literature review on CSR and value chain, on verifying that the value of co-production requires a shared value approach. CSR policies allow ability to start the valorization of organization and society, in a reciprocity link.

The valorization model of cultural organization start from the framework of value creation cycle proposed from Gholami (2011). Thus, valorization model consider the four dimensions that the author proposed; economic, legal, ethical, and philanthropic; at this dimensions we adjoins the shared value between organization and society, which is able to activate a continuous circle of increasing value (figure n. 3).

Figure 3. Valorization model, CSR in circle of shared value perspective



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The CSR value calculating through the stratification of dimensions (the four rectangles light gray in the figure); economic (personal saving rate; business saving rate; inflation rate, manufacturing/supply/distributions lead-time), legal (anti-trust; labor training laws; human right), ethical (i.e. codes of conduct; corruption; money laundering), philanthropic (donor attrition; donor acquisition; gift processing time; stewardship calls). These dimensions of CSR, in this study, are goal through shared value circle. The organization activates CSR policies whose dimensions create value. In the shared value approach that we proposed through this work the value of CSR is increased by the virtuous and continuous shared value circle between organization (oval light blue) and society (oval light orange).

CONCLUSION AND FUTURE RESEARCH DIRECTIONS

The advent of a new cultural economy has been increasing. It now accounts for substantial shares of income and employment in a wide range of countries and offers important opportunities to local economic development. This is the first reason why cultural organizations have to be involved from to CSR policies for this ability to create both development for countries and value for enterprise as well as allow different stakeholders to participate in various ways in a new cultural economy. The cultural organizations seem to be moving steadily into a world that is becoming more and more cosmopolitan and eclectic in its modes of it possible think the culture and social responsibility. In this work, we have concentrated on the clarification of the main concepts related to cultural organizations and CSR in shared value approach.

The scientific value concerns the proposition of new model to valorization of cultural organizations through CSR, which is a matter under investigation by different studies as management analysis.

The advanced approach to the study concerns the valorization model; the analysis of CSR is not just about responsibility in some area of organizations; the CSR is not instrument only, but it is an element of value chain. The study intends to be an important contribution to management, in particular to cultural organizations.

The society into cultural organizations has a fundamental role, it not element of environment only but also subject of creation share value capability.

The potential impact of the study is to provide public and/or private organizations a support for realizing a projects of total social responsibility, as a value added offered to meet new needs and creating innovative and potential motivations to CSR policies. The purpose of the study is to advance both scientific literature and practical and operational management of valorization of cultural organizations. The CSR has an active role into value chain, which proves the main assumptions track: 1. Shared value can be activated through the total corporate social responsibility; 2. The CSR has an active role in value chain of cultural organizations.

The work proposes a valorization model for cultural organization through new assumptions that we have taken from the integration between literature review on CSR and cultural organizations.

From the considerations presented so far on the cultural organizations as well as the analysis of the CSR into shared value approach, there have been two main results:

1. There is a relationship between the valorization of cultural organization and its capability of shared value whit society. The point of view is CSR as an active element of the value chain in shared value approach.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

2. The configurations of CSR have a different role on valorization process of cultural organizations in relation to position of CSR in value chain.

The phenomenon analysed is cultural organization; the object of investigation is the construction of a model of valorisation. The main implication management is the opportunity from cultural organization to develop a valorisation process based on shared value of culture and of social responsibility with society. The final goal is activate a continuous cultural process of co-creation between organization and society.

REFERENCES

Aiello, L. (2014). *Management of Cultural Products: E-Relationship Marketing and Accessibility Perspectives*. IGI Gobal Pubblishing.

Alter, K. (2007). *Social enterprise typology*. Virtur Ventures LLC.

Aras, G., Aybars, A., & Kutlu, O. (2010). Managing corporate performance: Investigating the relationship between corporate social responsibility and financial performance in emerging markets. *International Journal of Productivity and Performance Management*, *59*(3), 229–254. doi:10.1108/17410401011023573

Ashley, C. (2009). *Harnessing core business for development impact*. Overseas Development Institute, Background Note.

Barton, D. (2011). Capitalism for the long term. *Harvard Business Review*, *89*(March), 54–91.

Bernier, I. (2005). Trade and Culture. In The World Trade Organization: Legal, Economic and Political Analysis. Academic Press. doi:10.1007/0-387-22688-5_64

Bryan, J., Hill, S., Munday, M., & Roberts, A. (2000). Assessing the role of the arts and cultural industries in a local economy. *Environment & Planning*, *32*(8), 1391–1408. doi:10.1068/a32168

Camilleri, M. A. (2013). *Creating shared value through Strategic CSR in Tourism*. LAP Lambert Academin Publishing.

Carroll, A. (1979). A three-dimensional conceptual model of corporate performance. *Academy of Management Review*, 497–505.

Carroll, A. (1999). Corporate social responsibility. *Business & Society*, *38*(3), 268–295. doi:10.1177/000765039903800303

Christiansen, N. (2008). *Creating Shared Value through basic business strategy, Development Outreach*. Washington, DC: World Bank.

Colbert, F. (2003). The Sydney Opera House: An Australian Icon. *International Journal of Arts Management*, *5*(2).

Colbert, F. (2004). *Marketing delle arti e della cultura*. Milano, Italy: ETAS.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Colbert, F., Nantel, J., Bilodeau, S., Rich, J. D., & Bacchella, U. (2004). *Marketing delle arti e della cultura*. Milano, Italy: ETAS.

Daft, R., & Lewin, A. (1993). Where are the theories for the" new" organizational forms? An editorial essay. *Organization Science*, 1.

De Witte, M., & Jonker, J. (2006). Management models for corporate social responsibility. Heidelberg, Germany: Academic Press.

DiMaggio, P., & Hirsch, P. (1976). Production organizations in the arts. In R. Peterson (Ed.), *The production of culture* (pp. 73–91). London: Sage.

Fuchs, G. (2002). The multimedia industry: Networks and regional development in a globalized economy. *Economic and Industrial Democracy*, *23*(3), 305–333. doi:10.1177/0143831X02233002

Gholami, S. (2011). Value creation model through corporate social responsibility (CSR). *International Journal of Business and Management*, *6*(9), 148. doi:10.5539/ijbm.v6n9p148

Hesmondhalgh, D. (2002). *The cultural industries*. London, England: Sage.

Hirsch, P. M. (1972). Processing Fads and Fashions: An Organization-Set Analysis of Cultural Industry System. *American Journal of Sociology*, *77*(4), 639–659. doi:10.1086/225192

Kaplinsky, R., & Morris, M. (2001). *A Handbook for Value Chain Research*. IDRC.

Kloosterman, R. C. (2004). Recent Employment Trends in the Cultural Industries in Amsterdam, Rotterdam, The Hague and Utrecht. A first exploration. *Tijdschrift voor Sociale en Economische Geografie*, *95*(2), 243–252. doi:10.1111/j.0040-747X.2004.00304.x

Knight, T. (1999). The Dual Nature of Cultural Products: An Analysis of the World Trade Organization's Decisions Regarding Canadian Periodicals. *University of Toronto Faculty of Law Review*, *57*(2).

Kramer, M.R. (2005). *Measuring Innovation: Evaluation in the Field of Social Entrepreneurship*. Foundation Strategy Group.

Lampel, J., Lant, T., & Shamsie, J. (2000). Balancing act: Learning from organizing practices in cultural. *Organization Science*, *11*(3), 263–269. doi:10.1287/orsc.11.3.263.12503

Lash, S., & Urry, J. (1994). Economies of signs and space. London: Sage.

Löhr, I. (2010) *Review of Voon, Tania, Cultural Products and the World Trade Organization*. H-Soz-u-Kult: H-Net Reviews.

Lorente, J. P. (2002). Urban cultural policy and urban regeneration: The special case of declining port cities in Liverpool, Marseilles, Bilbao. In D. Crane, N. Kawashima, & K. Kawasaki (Eds.), *Global culture: Media, arts, policy, and globalization* (pp. 93–104). New York: Routledge.

Mascarenhas, O. A., Kesavan, R., & Bernacchi, M. (2004). Customer value-chain involvement for co-creating customer delight. *Journal of Consumer Marketing*, *21*(7), 486–496. doi:10.1108/07363760410568707

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

McGregor, S. (2000). Using social and consumer values to predict market-place behaviour: Questions of congruency. *Journal of Consumer Studies & Home Economics*, *24*(2), 94–103. doi:10.1046/j.1365-2737.2000.00152.x

McGuire, J., Sundgren, A., & Schneeweis, T. (1988). Corporate social responsibility and firm financial performance. *Academy of Management Journal*, *31*(4), 854–872. doi:10.2307/256342

Meehan, J., Meehan, K., & Richards, A. (2006). Corporate social responsibility: The 3C-SR model. *International Journal of Social Economics*, *33*(5/6), 386–398. doi:10.1108/03068290610660661

Michelini, L., & Fiorentino, D. (2011). New business models for creating Shared Value. *Social Responsibility Journal*, *8*(4), 561–57. doi:10.1108/17471111211272129

Nair, A. (2005). Linking manufacturing postponement, centralized distribution and value chain flexibility with performance. *International Journal of Production Research, 43*(3), 447–463.

Parasuraman, A., & Grewal, D. (2000). The impact of technology on the quality-value-loyalty chain: A research agenda. *Journal of the Academy of Marketing Science*, *28*(1), 168–174. doi:10.1177/0092070300281015

Park, H. J., & Rabolt, N. J. (2009). Cultural value, consumption value, and global brand image: A cross-national study. *Psychology and Marketing*, *26*(8), 714–735. doi:10.1002/mar.20296

Peppard, J., & Rylander, A. (2006). From value chain to value network: Insights for mobile operators. *European Management Journal*, *24*(2), 128–141. doi:10.1016/j.emj.2006.03.003

Porter, M. (2012). *The New Competitive Advantage: Creating Shared Value*. Presentation at the HSM World Business Forum CSV. Retrieved from http://www.isc.hbs.edu/pdf/2012-1003--The_New_Competitive_Advantage.pdf

Porter, M. E., & Kramer, M. R. (2006). Strategy and society: The link between corporate social responsibility and competitive advantage. *Harvard Business Review*, *84*(12), 78–92. PMID:17183795

Porter, M. E., & Kramer, M. R. (2011). The Big Idea: Creating Shared Value (Digest Summary). *Harvard Business Review*, *89*(1/2), 62–77.

Power, D., & Scott, A. J. (Eds.). (2004). *Cultural Industries and the Production of Culture*. London, England: Routledge.

Pratt, A. (1997). Cultural industries: Guest editorial. *Environment & Planning A*, *29*, 1911–1917. doi:10.1068/a291911

Pratt, A. C. (2008). Creative cities: The cultural industries and the creative class. *Geografiska Annaler. Series B, Human Geography*, *90*(2), 107–117. doi:10.1111/j.1468-0467.2008.00281.x

Sadler, D. (1997). The global music business as an information industry: Reinterpreting economies of culture. *Environment & Planning A*, *29*(19), 19–36.

Schwartz, M., & Carroll, A. (2003). Corporate social responsibility: A three-domain approach. *Business Ethics Quarterly*, *13*(4), 503–530. doi:10.5840/beq200313435

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Scott, A. (1996). The craft, fashion, and cultural products industries of Los Angeles: Competitive dynamics and policy dilemmas in a multisectoral image-producing complex. *Annals of the Association of American Geographers*, *86*(2), 306–323. doi:10.1111/j.1467-8306.1996.tb01755.x

Scott, A. J. (2000). *The cultural economy of cities: Essays on the geography of image-producing industries*. London: Sage.

Scott, A. J. (2004). Cultural-Products Industries and Urban Economic Development: Prospects for Growth and Market Contestation in Global Context. *Urban Affairs Review*, *39*(4), 461–479. doi:10.1177/1078087403261256

Solima, L. (2006). *The cultural enterprise. Processes and management tools*. Roma, Italy: Carrocci Editore.

Stanwick, P., & Stanwick, S. (1998). The relationship between corporate social performance, and organizational size, financial performance, and environmental performance: An empirical examination. *Journal of Business Ethics*, *17*(2), 195–204. doi:10.1023/A:1005784421547

Stevens, E. (2009). Co-création de valeur et communautés d'utilisateurs: Vers un renouvellement des modèles de chaine de valeur et d'innovation. *Revue Management et Avenir*, *28*, 230.

Thierstein, A., Lu Thi, S., Kruse, C., Gabi, S., & Glanzmann, L. (2008). Changing Value Chain of the Swiss Knowledge Economy: Spatial Impact of Intra-firm and Inter-firm Networks within the Emerging Mega-City Region of Northern Switzerland. *Regional Studies*, *42*(8), 1113–1131. doi:10.1080/00343400802154557

Throsby, D. (2001). *Economics of culture*. Cambridge, UK: Cambridge University Press.

Udayasankar, K. (2008). Corporate social responsibility and firm size. *Journal of Business Ethics*, *83*(2), 167–175. doi:10.100710551-007-9609-8

Voon, T. (2007). *Cultural Products and the World Trade Organization*. Cambridge, UK: Cambridge University Press. doi:10.1017/CBO9780511674501

Waddock, S., & Graves, S. (1997). The corporate social performance-financial performance link. *Strategic Management Journal*, *18*(4), 303–319. doi:10.1002/(SICI)1097-0266(199704)18:4<303::AID-SMJ869>3.0.CO;2-G

Weber, M. (2008). The business case for corporate social responsibility: A company-level measurement approach for CSR. *European Management Journal*, *26*(4), 247–261. doi:10.1016/j.emj.2008.01.006

Weinstein, B. L., & Clower, T. L. (2000). Filmed entertainment and local economic development: Texas as a case study. *Economic Development Quarterly*, *14*(4), 384–394. doi:10.1177/089124240001400405

Wood, C., & Leighton, D. (2010). *Measuring Social Value: The Gap between policy and practice*. London, UK: Demos.

World Bank. (2012). *Creating Shared Value in India: case studies*. Prepared for *Shared Value workshop participant*.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Yang, C.-L., Huang, R.-H., & Lee, Y.-C. (2014). Building a performance assessment model for social enterprises-views on social value creation. *Science Journal of Business and Management*, *2*(1), 1–9. doi:10.11648/j.sjbm.20140201.11

Zhang, Q., Vonderembse, M. A., & Lim, J. S. (2002). Value chain flexibility: A dichotomy of competence and capability. *International Journal of Production Research*, *40*(3), 561–583. doi:10.1080/00207540110091695

Zukin, S. (1998). Urban lifestyles: Diversity and standardization in spaces of consumption. *Urban Studies (Edinburgh, Scotland)*, *35*(5-6), 825–839. doi:10.1080/0042098984574

This research was previously published in Corporate Social Responsibility for Valorization of Cultural Organizations edited by María del Pilar Muñoz Dueñas, Lucia Aiello, Rosario Cabrita, and Mauro Gatti, pages 140-162, copyright year 2018 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 17
Green Growth Intervention on Employment Generation in India:
Dynamic CGE Model Approach

Anandajit Goswami
The Energy and Resources Institute (TERI), India

Saswata Chaudhury
The Energy and Resources Institute (TERI), India

ABSTRACT

This article highlights the possible impacts of green growth strategies and interventions on skilled and unskilled employment generation in India. Additionally, it indicates how income generation from selected green growth-related potential interventions can have a ripple effect on selected development indicators, like literacy rates, infant mortality rates, poverty. Job creation might translate to an economic gain for households of different income class across rural and urban India both in the short and long-term. This economic gain can thereafter reduce the level of inter-household and intra-household inter-temporal inequality levels with complementary and effective wealth distribution policies. In the long run, this reduction in the inequality level can create a positive impact on the social sustainability.

INTRODUCTION

The tradeoff between economic growth led development and environment leads to the formulation of the notion of green growth which is a sustainable development path where economic growth takes place without causing environmental, resource degradation, income and wealth distribution inequalities. Thus, green growth policies of developing countries are becoming more important which is intended to resolve both the environmental challenges, economic and income inequalities as well as the enduring unemployment problems inherent in many developing countries (Deschenes, 2013). Green growth

DOI: 10.4018/978-1-5225-7915-1.ch017

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

integrated development path of India has been accepted and debated in the recent past within policy circles. Thirteenth Finance Commission of India for the first time recognized the need for such an integrated development path with minimal impact on the use of natural resources. An inclusive green growth pathway for a developing country like India with high inequalities has to comprise of policies and implementation plan of new job creation across different sectors of the economy. Often, green growth pathways create structural macroeconomic tradeoffs if it leads to a reduction in sectoral shares in GDP with subsequent impacts on employment, migration, urbanization (Dercon, 2014). Tradeoffs can be created based on the degree and nature of focus of green growth interventions on areas related to agriculture, trade, technology, infrastructure and urban development. Often a focus in a particular domain in a particular way through government support, policy mechanisms, specific programmes or market-based incentives can lead to a slowdown in the growth process leading to a poverty reduction thereby increasing the social costs of green growth (Dercon, 2014).

It is therefore essential to observe and analyse these tradeoffs from a macroeconomic framework by understanding the interlinking tradeoffs of any green growth-related intervention within the economy of a developing country like India. Such an understanding will help in creating a roadmap for the sectoral interventions as a part of a green growth strategy of a developing country in the short, middle and long-term thereby leading to an inclusive development path. Several macro-level models like Computable General Equilibrium models can provide these indicative directions and can be applied to understand the tradeoffs for a long-term inclusive development pathway. One area in which they can be applied is to understand the basic nature of job creation from sectoral interventions of a green growth strategy of a developing country after assessing the various tradeoffs. Such an understanding will also help in shaping up an inclusive development path by assessing the various sectoral inter-linkages through job creation. This is due to the fact that job creation is an integral component of an inclusive development path. However, job creation has to be necessarily also be complemented by income and wealth distribution policies. Creation of job opportunity, skill enhancement within a green growth path can have the potential to address the challenge of unemployment in India. More than 90% of Indian working population is engaged in the casual and informal workforce due to unavailability of the expected job in organised sector (Hajela, 2012). Owing to the absence of the expected job, often there is a kind of voluntary, frictional unemployment too which is existing within the country. There is also an issue of mismatch between the expectation of the job givers and job seekers regarding the required skill set for a job due to which voluntary and frictional unemployment is rising. This in a way, then also has developmental consequences by impacting the state of happiness, the satisfaction of the job seekers.

The dearth of sufficient skilled workers makes the issue more challenging and contributes to this mismatch of expectation regarding skill sets of job seekers. The conventional vocational training schemes have not been adequately successful to create skill and its spillover effects across different sectors of the Indian economy. Skill shortage, therefore, has aggravated the existing voluntary, involuntary and frictional unemployment challenge within the economy. Further, divide between organized and unorganized sector in terms of skill requirements has also increased in the Indian economy. It has also increased in terms of employment generation within the Indian economy.

On one side, employment in the factory sector increased from 8.5 million in 2004–05 to 13.4 million in 2011–12. However, the total growth of manufacturing employment has fallen down in India after the mid-2000s especially in small firms complemented by an increased informalisation within the organized manufacturing sector. Such a fall has often been related to the increased use of imported components

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

and automated technologies. Parallelly, public and private investment as a proportion of the GDP has gone down in the recent past leading to a slowing down in the manufacturing employment within India.

Currently, only about 5% of the workforce has marketable skills, as compared to 50% to 60% in some developed countries like Japan. The recent initiative of 'Skill India' under Pradhan Mantri Kaushal Vikas Yojana (PMKVY, 2018) by the central government has the potential and aim to address this challenge. The gravity of this challenge is going to increase within the backdrop of inclusion of 12 million persons who are expected to join the workforce every year (IMACS, 2010). This establishes the need for creating both jobs, skill within the Indian economy to address future developmental goals.

Therefore, with this background, it is important to assess the potential of green growth interventions and strategies in addressing skilled, unskilled job creation in the Indian economy to reduce the organized and unorganized sector divide, fall in job creation for ensuring a long-term development pathway with a centralized focus on income inequality reduction within the economy. However, inequality exists in terms of differential access to various resources (like natural, infrastructure, health, public and private), wealth. This paper will however only ponder about the income inequality dimension. Once the income inequality aspects of the different social classes are addressed it can contribute to the development needs of people of the country by impacting a broad section of the population which includes women, youth, farmers, rural population and slum dwellers that can benefit from such job creation (ILO, 2010, p.3,4). Analysis of the quarterly survey on job creation in India shows a gap of 43.15% (Indian Express, 2014). Therefore, this adds to the seriousness of focusing on job creation for the Indian economy as a policy imperative to address income inequality and development path. Policy focus to create jobs in certain sectors of the economy while the country is growing can address this income inequality.

Green building and renewable energy are some of the key sectors of such green growth intervention other than natural resource management and resource, material and autonomous energy efficiency improvement across sectors of the economy. Creation of skilled jobs in green building and renewable energy sector can also address and strengthen implementation of measures recommended by the subgroup (created in August 2009) of the task force on "Climate Change and Green Jobs". Measures of the subgroup to create green jobs under Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) (add reference) through the promotion of mitigation measures like enhancement of renewable energy and energy efficiency interventions within the country (ILO, 2010a) can be strengthened by these green growth-promoting measures.

It will also consolidate and accelerate the addressing of the Article 41 of the Indian Constitution. Article 41 deals with providing a non-justiciable right to work under directive principles of state policy. MGNREGA in 2005 mentioned that the state through its economic capacity can actually convert nonjusticiable rights to work into justiciable ones with a focus on skill development (ILO, 2010b, p.3). Green growth and development intervention creates skilled jobs across rural households of India. Therefore, it has scope, potential to feed into this policy, human rights space embedded within the constitution of India.

Literature Review

Tracing back, the literature (Goulder, 1995, p. 290) indicates the direction of impact of carbon taxes on probable GDP loss, labour supply, productivity, environmental health, factor returns. A recent study by Deschenes (2013), portrays a detailed literature review regarding the impact of green growth policies on employment. However, the study failed to make a definitive conclusion about the likely final impact on

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

employment as the impact can vary across time horizons. While in short run, there may be significant employment loss in carbon-intensive sectors, in the long-run, the net employment effects may be null or even positive due to full mobility, substitutability of factors like labour and capital across sectors. Moreover, the study acknowledges that empirical methods can identify only short-run impacts while for measuring long-run economy-wide effects, models like CGE (Computable General Equilibrium) may be preferable. However, there are few studies (Greenstone, 2002, Popp, 2002, and Walker, 2011) which identified long-run effect through empirical methods. In case of China, Wang et al. (2013) found that CDM projects resulted in approximately 99,000 net direct jobs losses while at the same time it created around 3.08 million indirect jobs. On the other hand, Wang et al. (2009) analyse the economic impact of different climate policies using dynamic CGE in case of China. Similarly, Bohringer et al. (2012), measured the labour market impacts of the green growth policy (feed-in tariff) in case of Canada through CGE model. The paper found that the policy has successfully made a positive impact on employment in the 'green' sectors like renewable energy, however, it also indicated that it may increase unemployment in few areas and reduce overall labour force participation. In case of Korea, the economic and environmental impact of green growth policy has been analysed by Hwang et al. (2012). Applying input-output analysis, the impact of green energy investment has been analysed by Markaki et al. (2013) for the Greek economy. Recently, using a dynamic CGE model, Van Heerden et al. (2016) analyses the economic and environmental effect of a carbon tax in case of South Africa. However, studies of similar nature do not exist in the current context of Indian macroeconomic situation.

It is evident from the literature that India needs to transit from traditional fossil fuel based economy to a clean and renewable energy based economy to achieve inclusive energy security in a gradual way (TERI, 2009). Owing to the rising energy demand, and inadequate renewable energy supply to meet the full energy demand, dependence on coal-based electricity will exist for some time. However, gradually the dependence can be reduced through larger renewable energy capacity addition and generation.

Promotion of the renewable energy sector can be a key measure of the green growth strategies for the country in future. So, in a way it will have two-pronged effects: a) On one hand it will enhance India's energy security and at the same time, b) it can create new jobs for an inclusive development pathway.

Dai et al (2016) highlighted and substantiated this fact through a dynamic CGE model mentioning that investment in the renewable energy sector can generate economic impacts and environmental co-benefits by 2050 without imposing substantial macroeconomic costs. The study shows through a dynamic CGE model that significant green growth interventions can positively impact growth of upstream energy sector, reshape the energy industry and can lead to a reduction in emissions of CO_2 (carbon dioxide) and air pollutants such as NOx, SO_2 along with the potential of generating 4.12 million jobs by 2050 from renewable energy-related upstream industries.

However, existing literature on India does not have a mention of the impact of a green growth and development policy or intervention on the degree, level of rural and urban household skilled and unskilled job creation that can have developmental implications for the country and states of India. This paper, therefore, attempts to fill up that gap in the literature through next sections. It starts with a set of research questions, followed by a modelling framework and final findings, policy directions derived from the modelling analysis and results.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

RESEARCH QUESTIONS

The paper deals with the following research questions:

1. What can or might be the impact of interventions like an increase in investment and economic activity in the renewable energy and green building sector on job creation across rural and urban household income classes?
2. What can be the policy interventions through which potential of this job creation can be realized in the country?

Above research questions are explored through the following methodological processes and model framework. During the course of the study, the 'green sector' has been defined as a sector that uses renewables and produces output in a resource and energy efficient way.

MODEL FRAMEWORK

Model Structure

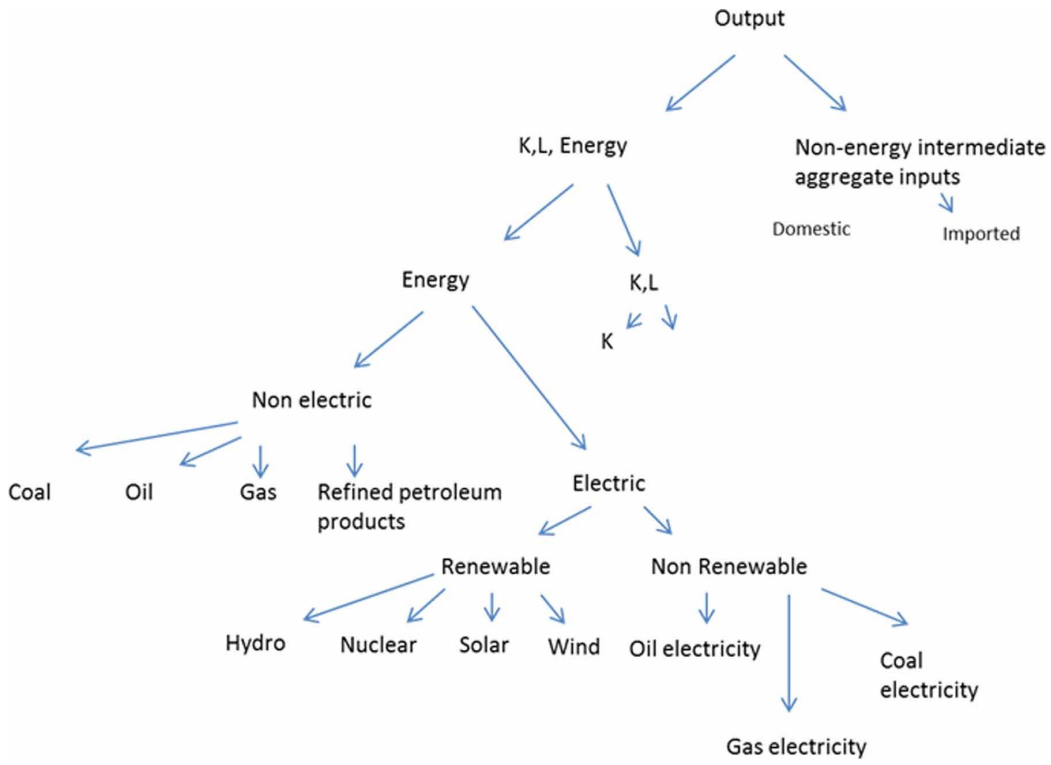
The model framework comprises of a Social Accounting Matrix (SAM) based national level dynamic recursive Computable General Equilibrium (CGE) model. A social accounting matrix accounts for the flow of goods and services within all the sectors of the economy and also within the rural and urban households. In this case, the flow is accounted by means of the value of money which is flowing from one sector to the other including the rural and urban households.

A recursive dynamic CGE model is constructed in this case. This is because, in the policy parlance, perfect foresight approach of an intertemporal, rational expectation based CGE model might not work. Changes of policy interventions are realized in an economy with a lag and moreover, there is always an interactive adaptation of policy measures by agents (which can be the sector players or household representatives or any other agent of a macroeconomy) within an economy. A perfect foresight based dynamic CGE model will not take into account this behavioural nature of agents in an economy. Therefore, a recursive dynamic CGE model is chosen. Moreover, recursive nature of the model adjusts the response of every agent within the economy in the next time period by taking cognizance of the policy signals coming out in an earlier period. As policy implementation works with lagged effects within an economy, this kind of recursive model is being built. Agents of the economy adjust to create an equilibrium between the supply and demand side by means of changes in factor prices which impact the supply and demand of goods and services within the economy.

The SAM constructed for our dynamic CGE model comprises of sectors like green building, biomass, solar, hydro, wind, nuclear. 43 sectors have been included in the national level social accounting matrix (SAM). It also includes sectors like paddy, wheat, cereals, cash crops, industry, services spanning across primary, secondary and tertiary segments of the Indian economy using national accounts statistics. In order to construct this, input-output table of 2007–08 released by Ministry of Statistics and Programme Implementation (MOSPI) has been used. The core nested structure of the model is explained in Figure 1.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 1.



DATA INPUTS IN THE MODEL

Model Data

This section highlights how the data for every sector of the model is integrated into the building up process of the recursive dynamic CGE model. Agriculture sector data of the model has been constructed by applying latest National Account Statistics, Economic Survey data. Data regarding the fossil fuels and petroleum products have been obtained from the input-output table of 2007 - 08. The latest input-output table of 2011 has some issues with base shifting owing to which the earlier input-output table of 2007 – 08 has been considered. Further, this data has been validated with Ministry of Petroleum and Natural Gas reports.

Green building sector data has been built up for the CGE model by applying information from sources like Green Rating for Integrated Habitat Assessment (GRIHA), TERI, Central Public Works Department (CPWD), Agence Française de Développement (AFD) reports and building audit reports of TERI. For household data, the decile MPCE (marginal per capita expenditure) class data from the latest National Sample Survey (NSS) round (68th round) was considered. Further, from decile class, five rural and urban classes were formed using NSS round (68th round). Capital formation data was available from National Accounts Statistics. Labour data for different sectors have been collected from Annual Survey of Industries (ASI), the government of India publication for the year 2007-08. Total labour value figures in terms of emoluments for most sectors were collected from ASI.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 1. Interconnection between savings, investment, employment, and sectoral outputs

A 1% increase in employment	A 1.2% increase in savings which highlights that the savings propensity of households in India can be elastic with green growth interventions	Changes in sectoral outputs of Indian economy (will emerge from CGE based endogenous model using the changes in savings as a scenario)
A 1% increase in savings	A .99% increase in investment which indicates that not all of the savings of households get translated to investment owing to different gestation lags	Changes in sectoral outputs of Indian economy (will emerge from CGE based endogenous model using the changes in investment as a scenario)
A 1% increase in employment	A 1.69% increase in investment which indicates the potential of investment and capital formation from green growth and development led employment generation	Changes in sectoral outputs of Indian economy (will emerge from CGE based endogenous model using the changes in investment as a scenario)

Source: Macroeconomic Model Estimates, RBI Statistics.
Note: Savings measured by household financial savings, investment measured by gross domestic capital formation.

Labour value for remaining sectors has been calculated based on sectoral relationship. The value of labour has been created by estimating the proportion of labour employed in a particular sector. Further, the labour wages (indexed by inflationary adjustments) have been considered to get a value of the labour in a particular sector. Moreover, this value is further distributed across different sectors of the economy by considering their composition and contribution in the particular sector.

For instance, labour value of construction sector has been distributed among green, non-green construction sectors based on their composition in total construction. Within labour, a division between skilled, unskilled labour was done. In order to do that, sector-specific skill – unskilled labour ratio was worked out. Further, employment levels of sectors of the economy were available from National Accounts Statistics. Using skilled – unskilled ratio, the presence of skilled and unskilled labour in each sector was obtained.

Interconnection Between Savings, Investment, Employment, and Sectoral Outputs

Every CGE model works on a closure rule. In our recursive dynamic model, the closure rule is defined by a savings and investment equilibrium condition within the macroeconomy of India. Therefore, to maintain equilibrium, whenever, savings will change, investments will change which will thereafter impact the factor prices finally leading to a variation in sectoral employment and outputs. The interconnections between savings, investment, employment and sectoral outputs are highlighted in Table 1.

In order to introduce dynamism (recursive) into scenario-based CGE model, the saving-investment closure rule was brought in the model. Savings and Investments in an economy create a multiplier with a lagged effect and hence bring in a change with a recursive effect within the households and sectors of the economy.

The total public, government and household savings have been proxied for savings. The gross domestic fixed capital formation has been proxied as an indicator of investment variable.

The interconnection between savings, investment, employment and sectoral outputs of the recursive dynamic CGE model is built up through a time series-based error-corrected, co-integration method based econometric analysis. This econometric estimation leads to the formation of elasticity of savings, investment in employees These elasticities are then further plugged into the model as scenarios to understand

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

the economy-wide impacts under a savings and investment closure rule. The interconnected nature of impacts on selected macroeconomic variables is highlighted in Table 1.

This nature of response between the savings and investment was also done outside the model to understand and calibrate the closure rule of the model and to capture the macrostructural changes that can happen within the economy due to causal changes in savings and investments. Investments can change more exogenously: however, it can then lead to endogenous household saving changes. For instance, government programmes and policies related to attainment of 175 GW renewable energy target can lead to several exogenous investments in the economy. This can then bring about endogenous changes in household savings to maintain a savings and investment equilibrium closure rule.

Given this broader macroeconomic context, the next section highlights the impact of green growth and development interventions in the renewable energy and green building sector on skilled, unskilled job creation arising from the CGE model in order to create a relevance to the future national policy discourse on green growth and development.

CGE RESULTS AND DISCUSSION

The dynamic CGE analysis suggests that an increase in an economic activity within the solar sector can have a potential to lead to a *3.2% increase* in the national level GDP. This posits a probable high potential of the solar sector to create economic multipliers across the economy owing to green growth interventions and strategies. Further, a similar increase in economic activity through investments in biomass, wind sector can lead to a 0.4% and 0.1% increase in national level GDP in terms of the economic output and activities. The rise in GDP will happen due to an increase in direct and indirect demands across sectors of the economy owing to a potential rise in the investment which will generate new demand for goods and services in the economy. The latest policy push of the government in the promotion of renewable energy sector viz. solar and wind also bears evidence to that fact.

To illustrate this narrative, as per latest government release (MNRE, 2017), India became fourth and sixth largest country in terms of wind and solar installed capacity respectively. Moreover, within last three and a half years, about 27 GW capacity additions took place in India under grid-connected renewable power. Almost half of it (12.87 GW) was contributed by Solar followed by wind energy (11.7 GW). In addition to that, as reported by the government of India, in the third quarter of 2017, while coal-based power capacity was shrunken (due to retire of some aging thermal plants) by 1. 1 GW, there was a growth of 1.6 GW in solar power capacity (Clean Technica, 2017a). In line with this, recently, the Finance Minister Arun Jaitley has highlighted an allocation of approximately US $790 million (INR 5,020 crore) for the expansion of various renewable energy technologies for the financial year 2018-19 (Sustainability Outlook, 2018). This shows an increase in allocation in comparison to the earlier years.

Moreover, Ministry of New and Renewable Energy (MNRE) is expected to commission 15.62 GW of new renewable energy capacity in 2018-19. The targeted capacity addition is 7.3% larger than the capacity addition target set for 2017-18. There is a target of the addition of 11 GW of solar power capacity, up from nine GW in 2017-18 (Clean Technica, nd). This reflects a clear indication of government initiative of Green India through an increase in investment and economic activity in renewable sector specifically in the solar sector. This investment push in the renewable energy sector viz. solar and wind is also meant for generating demand for new goods and services. Therefore, this is expected to create

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

a social benefit of employment generation and an environmental benefit of a reduction in emissions in the medium and long-term.

At the national level, investments in the green sector (like renewable energy) can also have a potential to increase the factor returns (a 20% increase in investment in the green sector of renewable energy can lead to a 0.2% increase in the factor returns) and can lead to skilled, unskilled job creation within households across different income classes. For that, rural (five for rural) and urban (five for urban) households of India have been divided into five different classes based on monthly per capita expenditure data of households emerging from the 68th round of NSSO (National Sample Survey Organisation) data.

A new activity generation through investments in the green building sector might be able to create seven skilled and 14 unskilled jobs in the highest rural household classes for per 100 households. Skilled and unskilled job creation is four and eight for the highest urban household class for per 100 households measured in terms of monthly per capita expenditure.

Green building is a futuristic/upcoming economic activity, but it is very much a specialized, specific material intensive industry. Thus, in the initial stage, there is a lesser requirement for skilled personnel compared to the unskilled job requirement. However, as the industry matures the chance, the potential for more and more skill (as well as unskilled) personnel might increase. Moreover, an investment in the green building sector has a spillover effect in terms of enhancing its job creation potential and impact within the rural household classes. It not only enables new skilled and unskilled employment in the urban sector but it also generates higher unskilled job creation per 100 households for rural household classes. This also hints towards some possible migration from rural to urban areas. This can happen due to the creation of unskilled jobs through investments in green building sector (assuming that the green building largely comes up in urban areas of the country). Broadly, an investment in all green sectors (as identified in the national level CGE model) leads to 174 unskilled and 87 jobs for highest rural income class (r5) and 128 unskilled and 32 skilled jobs for highest urban income class (u5). Clearly, green growth interventions have a larger spillover effect in terms of job creation for rural households in comparison to urban households. This is happening due to a skill shortage in rural India in terms of the identified green sectors. Therefore, a skill generation in the rural sector has larger implications for the rural households in comparison to the urban sector. Further, the rural-urban migration complemented by a large scale informalisation in the organized sector of the urban economy is not allowing the trickle effect of new skill generation to be percolated to the same extent into the urban households in comparison to the rural sector of the economy. These two factors are going hand in hand to enable a larger spillover effect in rural India. Essentially, skill being more scarce in rural India due to these factors has a higher investment return in the rural sector in comparison to the urban sector. The returns to investment in skill in rural India are higher due to its scarcity enabled by large-scale migration, organized and unorganized sector divide and a large-scale unorganised segment in the urban sector of India. These narratives also need to be integrated into the Skill India Mission of India for its larger success.

Additionally, the degree of job creation goes up as one moves up in the income class ladder within the rural and urban households. These preliminary results also hint towards the inter and intrahousehold growing inequality debates within the country.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Specific Results

Some of the results showing household level skilled, unskilled job generation owing to green growth and development interventions in the agriculture, renewable energy provision, industry, green building sector for a reference scenario baseline case (in 2015) is indicated in Figure 2.

Over the time horizon, the level of skilled and unskilled employment generation is shown by the Figure 3. To project the future level of skilled and unskilled employment generation, three scenarios are constructed.

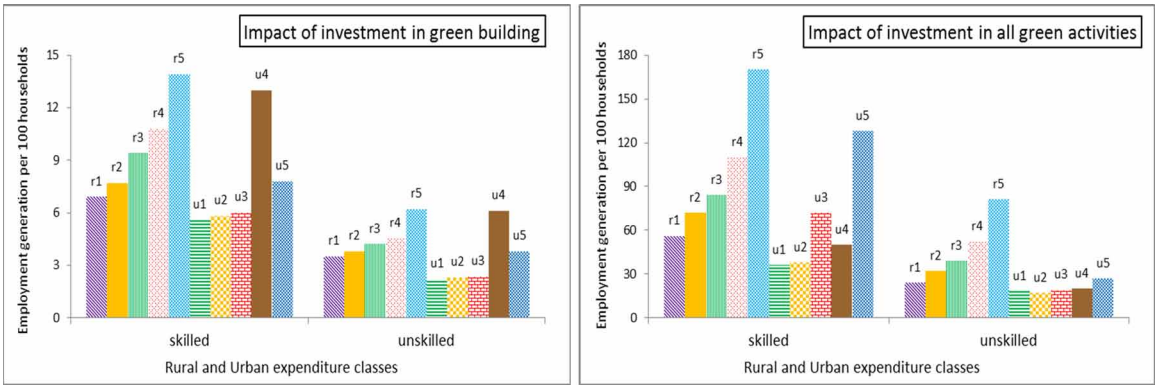
These scenarios include:

1. Reference (A scenario where business as usual policy measures are continuing which means that the declared renewable energy and green building implementation targets are in mind for implementation in the long term),
2. Policy (Green growth intervention related policies (like Skill India Mission, Renewable Energy Promotion Targets in sectors like solar, hydro, biomass, wind, Energy Efficiency and Natural Resource Management Policies) are implemented along with the associated employment generation schemes), and
3. Ambitious scenario (Government is a little more optimistic and active in terms of implementing the green growth-related interventions and its associated skilled and unskilled employment generation schemes).

This level of employment generation along the above-mentioned path (as shown in Figure 3) through interventions in renewable energy, green building, energy efficiency and natural resource management domains can have a significant contribution to the development of people and can impact the economic and social domains of sustainability.

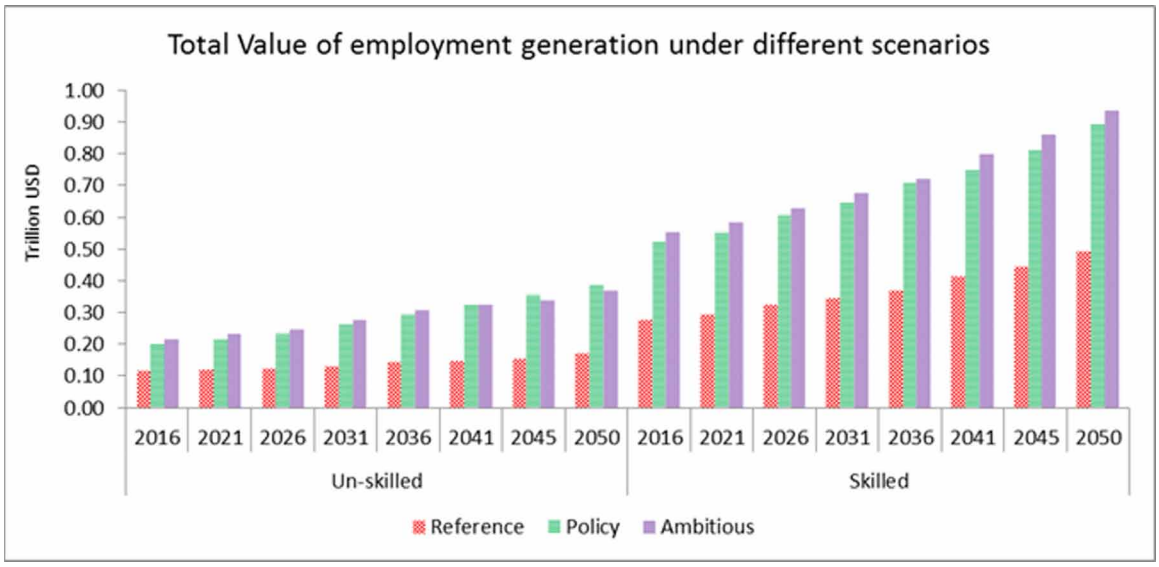
Having outlined the above potential, the next section will discuss the specific sector of green building and its possible contribution to the employment generation opportunities within the Indian economy. This is because; close to 30% of the total primary energy consumption in India is catering to the building sector. With a rise in future economic growth and policies to promote the service sector driven economic

Figure 2. Rural and urban household class-wise unskilled, skilled job creation (r5, u5 denotes the highest income class in the ascending order) (Source: Model Estimates)



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 3. Scenario-wise skilled and unskilled employment generation in India (Source: Model Estimates)



growth, the energy consumption is expected to increase in the building sector. The next section further elucidates on this sector and its implications on employment while the service sector of the Indian economy grows in future. This is expected to happen by means of reducing energy consumption in green buildings while their demand increases in future due to a rise in overall economic and service sector growth.

Green Building and Employment Opportunities

The building construction industry at present contributes about 10% of Indian GDP and is expanding rapidly at over 9% per year spurred largely by the strong growth in the services sector (Jindal, 2016). This fast pace growth rate is resulting in rapid urbanization, high demand for related infrastructure and thus an increasing demand for energy.

In 2020 almost 500 Million people will be living in Urban India. It is expected that 4127 Million m^2 of real estate space (which includes residential, retail, offices, hotels, health care and education sectors) will be built from 2012 to 2020 (Jindal, 2016).

Electricity consumption by buildings has grown at an average growth rate of 9% in the last 10 years (2001-11). Assuming the same growth, it will lead to more than doubling of electricity consumption in 2019-20 compared to 2010-11. The residential sector constitutes 22% of energy consumption in the building sector and commercial sector constitutes 8% of energy consumption in building sector (Jindal, 2016). As per the same study, 25% of electricity consumption in a commercial building is contributed by lighting while the 55% is contributed by heating, ventilation, and air conditioning (HVAC). While existing (2012 estimate) electricity savings in a commercial building is 8,700 GWH (7.4 million tonnes of CO_2), there is the potential of 90,000 GWH in 2021 from upcoming commercial buildings.

The above study also indicates that while the use of 'efficient glass and roof 'can save approx. 5% of energy, 'energy efficient lighting system' can save about 10% energy. Use of 'energy efficient chillers, pumps and fans' can save up to 15-20% of energy in the commercial building. Combining all potential

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

saving sources, the existing energy saving potential is 67,000 MWH/year assuming that there are 100% energy efficient commercial buildings. This saved energy is sufficient to electrify more than 12,000 rural houses.

Green buildings have various elements like insulation on the wall, roof, double glazed windows, lighting controls and high-performance air conditioning system for ensuring the low energy consumption in green buildings. Although market of energy efficient products is still immature in India, in the last few years there has been a noticeable improvement in the market in terms of availability of products. Energy efficient electrical appliances/equipment of many leading companies/ brands are now available in the market. With the rising demand for insulation materials, high-performance glass, heat reflective paints, energy efficient masonry units, etc., the number of manufacturers and suppliers of these materials is also slowly increasing. As per the information provided by some of the leading manufacturers the sales for Rockwool, polyurethane (insulation materials) has been growing at an average 18% annually and sales of Autoclaved Aerated Concrete Block has been growing at an average 15% annually, in the last five years.

However, there is still a huge market potential for energy efficient products, equipment and technologies, in India. As the green building movement in India will gain momentum, there will be a rise in the construction of green buildings resulting in an increase in the demand for energy efficient products in India. Table 2 highlights a potential pattern of this increase in demand for future.

The green building sector, therefore, has a potential for creating employment opportunities in the sector by means of generating demand for a new set of goods and services. Installation and commissioning of these appliances, devices in the green buildings will require skilled and unskilled labour which in a way is expected to generate further employment in future.

Therefore, a promotion of the green building sector, can not only lead to skilled and unskilled job creation: it can also lead to energy savings. Through this promotion, economic, environmental and social domains of sustainability can, therefore, be addressed in the long run and therefore green building promotion can also be one of the key measures of green growth and development strategies within the country. Further, once the income of the people rises and trickle down across the households, it can lead to a rise in the literacy rates and other developmental indicators (Table 2).

Along with the promotion of green building, green growth and developmental interventions also include measures like the promotion of natural resource management in the agriculture sectors, autonomous energy efficiency improvement. These measures can impact developmental indicators for different time frames (2011, 2020, 2030) by different degrees.

To capture those impacts, three scenarios viz. reference, policy and ambitious are constructed to understand the different degree of impact. A back of the envelope developmental indicator function is

Table 2. Estimated demand for energy efficient building materials

	2011 (Observed – Actual Data)	2020 (Projected Potential)	2030 (Projected Potential)
Annual demand for roof insulation (Million sqm)	3.3	9.4	22.2
Annual demand for wall insulation (Million sqm)	2.8	4.6	7.1
Annual demand for high-performance glass (Million sqm)	8.5	13.8	21.2
Annual demand for T-5 (Million units)	2.16	5.94	19.44
Annual demand for LED (Million units)	1.74	4.81	15.74

Source: Authors' estimates.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

constructed which essentially captures the changes in developmental indicators for different varying levels of income which are created and generated within the economy.

Further, such scenario specific results and directions for future policy making are explained in Table 3. As indicated in Table 3, green growth and development measures through agriculture and natural resource management techniques, structural changes within industry and infrastructure sector bring about a change in the poverty by uplifting people above the poverty line. This happens because the income generated from green growth interventions and new investments get distributed across the rural households through effective policies and institutional mechanisms. Inequality within the rural households can then go down owing to that. Once the inequality levels go down, it is expected, that a rise in income, creates a rise in the aspiration of households to get educated. However, this also has to be backed by the availability of right primary schools, teachers at the local level and a mechanism to ensure that people attend schools, learn and get educated. With a rise in education, the awareness of people regarding health and better quality of life increases. This thereby positively impacts the health indicators like infant mortality rates.

From a modeling perspective, the increase in the income from green growth interventions in agriculture, renewable energy, industry, buildings sector, is fed into an interphase model (which is the back of the envelope model) as an input with development indicators as an outcome variable. In the interphase model, outputs of the CGE model (like household level income, skilled and unskilled job creation over time) feed in as an input. This, therefore, gives rise to a change in the development indicators as an output from the interphase model after considering the CGE model outputs as input variables over time. The theoretical context and hypothesis behind this are that an inclusive, sustainable, green growth is expected to trickle down to the lower classes of the society through strong institutional support structures and mechanisms and can reduce the level of inequality across different layers of the society. So, this hypothesis is assumed to be true and then tested through a scenario specific analysis in our case. However, in a real situation, policy and institutional failures can hinder this trickling down and can impinge upon an inclusive developmental path arising from a sustainable, green growth pathway through reduction of inequality across the social layers.

Given, this background context, Table 3 highlights that a reduction in the inequality level raises aspirations of people belonging to the marginal classes of rural and urban households and they start

Table 3. Scenario-wise impact of green growth and development measures on developmental indicators

Indicator	Units	Reference Scenario	Policy Scenario		Ambitious Scenario		Latest Figure
		2007	2020	2030	2020	2030	2015
Literacy rate (total)	% of people ages 15 and above	62.75	66.40	70.65	71.82	78.16	71.96
Literacy rate (adult male)	% of people ages 15 and above	75.19	76.33	80.29	80.7	86.85	80.94
Literacy rate (adult female)	% of people ages 15 and above	50.82	55.91	61.5	57.43	64.9	62.98
Infant Mortality Rate	under 5 (per 1000 live births)	72.1	34.11	13.41	32.97	12.96	45.2
Poverty	millions of persons BPL	250	9.3	8.37	8.09	7.28	269
LCIG Report Poverty	millions of persons BPL	250		8		8	
LCIG Report IMR	under 5 (per 1000 live births)			14.8		14.8	
Number of skilled job creation	In lakhs	27	61	70	63	74	
Number of Unskilled job creation	In lakhs	11	24	29	26	31	

Source: Modeling Estimates.
Source of recent data on literacy rate is https://www.statista.com/statistics/271335/literacy-rate-in-india
Recent data on Infant mortality rate is https://data.worldbank.org/indicator/SH.DYN.MORT?locations=IN
Recent data on poverty is https://www.rbi.org.in/scripts/PublicationsView.aspx?id=16603

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

striving for better education which gets reflected in the improved literacy rates within male and female for different scenarios over the time frame - 2020 and 2030.

The latest figures for literacy rates indicate that India has already achieved the projection for the ambitious scenario by 2015, five years before the targeted time. On the other hand, latest figure on IMR indicates that there is huge scope to achieve even the ambitious scenario. Finally, the latest poverty figure may be high in absolute term, but India has performed well in terms of percentage of poverty eradication in the last few decades. All the above figures indicate that 'ambitious' scenario may be achieved with proper execution of suitable policy instruments. On the other hand, job creation (both skilled and unskilled) in 2015 has been 135 thousand (Orfonline, 2018). This needs urgent attention of policymakers.

The dynamic CGE modeling analysis conducted indicates that job creation from green buildings has the potential to generate a savings multiplier for rural and urban households. As the economy grows with a focus on green industries, there would be demand for sector-specific skilled jobs which in turn would enhance wages of related employees and lead to more savings formation in net terms (considering some loss from potential non-green sector). All these, in turn, would have an overall impact on the economy and developmental indicators such as income, employment, improved infrastructure, and clean energy. These will have positive implications for the economic, environmental and social domains of sustainability.

All these findings provide a long-term direction to the country's macro-planning and green growth and development roadmap by addressing the economic, environmental and social domains of sustainability through a progressive transformation from agriculture-based economy towards green, ecologically and socially sustainable, energy efficient industry and service sector.

Green growth and development interventions are expected to create more employment for people from the agriculture sector, raise their skill levels and generate more skilled and unskilled jobs for them in the industry and service sector (which includes the construction sector) of the growing economy. This in a way in the long term will create larger economic and social sustainability which can be feed into the broader policy discourse of green job creation as explained in the next section of this paper.

CONCLUSION AND WAY FORWARD

The results emerging from the modeling analysis feeds into the policy discourse of green job creation that has been formulated by United Nations Environment Programme (UNEP), International Labour Organization (ILO, 2010a, ILO, 2012), International Organization of Employers (IOE), International Trade Union Confederation (ITUC) in 2007.

Results of the model indicate the potential of income, skilled and unskilled employment generation from green growth interventions in the renewable energy and green building sector. The solar sector has the potential of creating economic multipliers. Green buildings can also lead to the creation of skilled and unskilled employment generation. This in a way adds to the policy discourse and context of green jobs. In this regard, one needs to go back a little to the recent past and ponder upon the policy interventions made in the area of – "Climate Change and Green Jobs". The government of India had a task force established on "Climate Change and Green Jobs" in the recent past.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The Government of India task force on "Climate Change and Green Jobs" created a subgroup in August 2009, which emphasized on the need to create green jobs under MGNREGA through the promotion of mitigation measures like enhancement of renewable energy and energy efficiency interventions within the country (ILO, 2010 a, b). The national skill development corporation focuses, emphasizes the development of resident skill for employment generation in next 10 years in India (NSDC, 2010). In order to generate employment and skills, the council indicates to focus on sectors receiving the support of state and central government. It also indicates that skill and jobs in the area of services related to plumbing, repair mechanics and electrician services will grow more in future with a rise in the renewable energy and green building sector of India. A green growth intervention in sectors like green building and the solar sector has the scope of generating specific skill-based livelihoods. A recent study (Tyagi 2017) has indicated that by 2017, green employment creation by renewable energy (RE) sector has achieved the predicted target (approx. 1.4 Million) set for 2020 by MNRE and CII. Another recent study (by IREDA, Deloitte, and INAE) has indicated that by 2022, more than 1.1 million skilled employees are required to achieve a solar target of 100 GW. However, as per CEEW and NRDC, approximately one million full-time employment (FTE) will be generated by 2022.

This will then contribute to the National Skills Development Mission and its task of achieving a targeted 500 million skilled employment generation by 2022. This humongous target may not be achieved but all the above statistics indicate a positive potential of employment generation by green growth and development strategies in Indian context in the long run. Even a minuscule achievement of this target through green growth interventions like the promotion of green buildings will pave a long way in addressing the sustainability goals of the country in the long run. In order to achieve the long-term sustainability goals of a developing country marked with distinct contrasts and inequality, this targeted implementation and achievement will be imperative for future to create a society with equal opportunities for every section of the social milieu in India. This can only happen when the social, economic and environmental goals and domains of sustainability are balanced and promoted at the same time.

ACKNOWLEDGMENT

The authors will like to thank Ms. Shailly Kedia for her research guidance, research and editorial content and directions, Dr. Prodipto Ghosh, Dr. Sanjib Pohit, for CGE model building-related guidance, mentorship and Mr. Nitya Nanda for a detailed review of the paper. The authors also express their gratitude to Mr. Tarun Garg for the research guidance provided with respect to the building sector. All views expressed in the paper are personal and the authors are solely responsible for any inadvertent errors in the paper. Authors will also like to acknowledge the support of Global Green Growth Institute in conducting this research.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

REFERENCES

Authority, C. E. (2012). *All Indian Electricity Statistics*. New Delhi: Central Electricity Authority.

Böhringer, C., Rivers, N. J., Rutherford, T. F., & Wigle, R. (2012). Green jobs and renewable electricity policies: Employment impacts of Ontario's feed-in tariff. *The B.E. Journal of Economic Analysis & Policy*, *12*(1). doi:10.1515/1935-1682.3217

Clean Technica (2017a). India Aims to Add 15.6 Gigawatts of Renewable Energy Capacity In 2018–2019. Retrieved 30th Dec., 2017 from https://cleantechnica.com/2018/02/07/india-aims-add-15-6-gigawatts-renewable-energy-capacity-2018-19/

Clean Technica (2017a). India Doubles Solar Capacity Addition In Q3 2017, Thermal Capacity Contracts, Retrieved from https://cleantechnica.com/2017/11/24/india-doubles-solar-capacity-addition-q3-2017-thermal-capacity-contracts/

Commission, P. (2012). *Towards faster and more inclusive growth: an approach to the 11th five year plan*. New Delhi: Planning Commission.

Council, N. S. (2010). *Skills Gap Study of the North East*. New Delhi: National Skill Development Council.

Dai, H., Xie, X., Xie, Y., Liu, J., & Masui, T. (2016). Green growth: The economic impacts of large-scale renewable energy development in China. *Applied Energy*, *162*, 435–449. doi:10.1016/j.apenergy.2015.10.049

Dercon, S. (2014). Is green growth good for the poor? *The World Bank Research Observer*, *29*(2), 163–185. doi:10.1093/wbro/lku007

Deschenes, O. (2013). *Green jobs (No. 62)*. IZA Policy Paper.

Goulder, L. H. (1995). Effects of carbon taxes in an economy with prior tax distortions: An intertemporal general equilibrium analysis. *Journal of Environmental Economics and Management*, *29*(3), 271–297. doi:10.1006/jeem.1995.1047

Greenstone, M. (2002). The impacts of environmental regulations on industrial activity: Evidence from the 1970 and 1977 clean air act amendments and the census of manufactures. *Journal of Political Economy*, *110*(6), 1175–1219. doi:10.1086/342808

Hajela, R. (2012). *Shortage of Skilled Workers: A Paradox of the Indian Economy. Compas: SKOPE*. University of Oxford.

Hwang, W. S., Kang, J., & Oh, I. (2012). *A CGE Analysis on the Economic and Environmental Effects of Green Growth Policy in Korean (No. 4112)*. EcoMod.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

ILO (2010a). Green jobs creation through sustainable refurbishment in the developing countries.

ILO (2010b). MGNREGA: A review of decent work and green jobs in Kaimur District in Bihar.

ILO. (2012). Greening the Rural Economy and Green Jobs: Decent Work in the Rural Economy. Policy Guidance Notes. Retrieved from http://www.ilo.org/wcmsp5/groups/public/---ed_emp/---emp_policy/documents/publication/wcms_437196.pdf

Indian Express Limited. (2014)., Job creation down 43.15% in Q3 as economy slows. Retrieved from http://indianexpress.com/article/business/business-others/job-creation-down-43-15-in-q3-as-economy-slows/

Jindal, A. (2016). TERI-UTC Center of Excellence (CoE) on Energy Efficient Buildings in India. Retrieved on 26th Oct. 2017 from http://grihaindia.org/grihasummit/tgs2016/presentations/19feb/existing-buildings/Ashish_Jindal.pdf

Limited, I. M. (2010). *The Skill Development Landscape in India and Implementing Quality Skills Training*. New Delhi: ICRA Management Consultancy Services Limited.

Markaki, M., Belegri-Roboli, A., Michaelides, P., Mirasgedis, S., & Lalas, D. P. (2013). The impact of clean energy investments on the Greek economy: An input-output analysis (2010–2020). *Energy Policy*, *57*, 263–275. doi:10.1016/j.enpol.2013.01.047

MNRE. (2017), Year End Review 2017 –MNRE, Press Information Bureau, Government of India. Retrieved from http://pib.nic.in/newsite/PrintRelease.aspx?relid=174832

Orfonline (2018): Retrieved on 18th April, 2018 from https://www.orfonline.org/research/two-years-of-modi-govt-lack-of-job-creation-major-weak-point/

PMKVY. (2018), What is PMKVY? Retrieved on 26th April, 2018, from http://pmkvyofficial.org/index.aspx

Popp, D. (2002). Induced innovation and energy prices. *The American Economic Review*, *92*(1), 160–180. doi:10.1257/000282802760015658

Sustainability Outlook. (2018): India Aims to Add 15.6 Gigawatts of Renewable Energy Capacity In 2018–2019, Retrieved from http://www.sustainabilityoutlook.in/news/india-aims-add-156-gigawatts-renewable-energy-capacity-2018%E2%80%932019-762238

TERI. (2009). India's energy security: new opportunities for a sustainable future. New Delhi: The Energy and Resources Institute (TERI).

Thomas, J. J. (2010). An uneasy coexistence: the new and the old in Indian industry and services. A new India, 71-96.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Van Heerden, J., Blignaut, J., Bohlmann, H., Cartwright, A., Diederichs, N., & Mander, M. (2016). The economic and environmental effects of a carbon tax in South Africa: A dynamic CGE modelling approach. *South African Journal of Economic and Management Sciences*, *19*(5), 714–732. doi:10.4102ajems.v19i5.1586

Walker, W. R. (2011). Environmental regulation and labor reallocation: Evidence from the Clean Air Act. *The American Economic Review*, *101*(3), 442–447. doi:10.1257/aer.101.3.442

Wang, C., Zhang, W., Cai, W., & Xie, X. (2013). Employment impacts of CDM projects in China's power sector. *Energy Policy*, *59*, 481–491. doi:10.1016/j.enpol.2013.04.010

Wang, K., Wang, C., & Chen, J. (2009). Analysis of the economic impact of different Chinese climate policy options based on a CGE model incorporating endogenous technological change. *Energy Policy*, *37*(8), 2930–2940. doi:10.1016/j.enpol.2009.03.023

This research was previously published in the International Journal of Sustainable Entrepreneurship and Corporate Social Responsibility (IJSECSR), 2(2); edited by Amulya Gurtu, pages 39-60, copyright year 2017 by IGI Publishing (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 18
Contextual Relationship Among 3 C's and Innovative Green Procurement Practices Using ISM and Its Validation Using MICMAC Analysis

Surajit Bag
Tega Industries South Africy Pty. Ltd., South Africa

ABSTRACT

This paper argues for the use of Interpretive Structural Modeling in building a theory of innovative green procurement practices. Earlier researchers have conducted vast studies related to the hard dimensions of green procurement practices. However, there is a dearth of studies focusing particularly on the soft dimensions of green procurement practices. To address the gap in existing literature, this study first systematically reviews the green procurement literature. Secondly, these dimensions were refined through expert interviews from the manufacturing sector. Thirdly, it illustrates the use of ISM method to find the contextual relationship of elements. The ISM model was finally validated using MICMAC analysis. The current study is unique from two perspectives. Firstly, Resource dependence theory was used as a theoretical lens to study the links between elements. Secondly, it integrated innovation and green procurement practices for the purpose of investigation. The findings show strong associations between 3C's (Collaboration, Coordination, and Cooperation) and innovative green procurement practices. The paper concludes with managerial implications and directions for future research.

1. INTRODUCTION

Resource Dependence Theory (RDT) suggests that member firms within the supply chain should coordinate and collaborate to achieve superior performance. Under RDT the most important assumption is that firms cannot be fully independent with regards to strategically critical resources for survival (Sarkis et al., 2011).

Under Green procurement practices, the eco-design of products and materials recovery is outstanding organizational resources requiring partnership with key suppliers to extract performance benefits

DOI: 10.4018/978-1-5225-7915-1.ch018

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

(Zhu et al., 2005). From the RDT viewpoint, customer and supplier relationships are important links for firms to reduce the uncertainty surrounding their operating environment (Carter and Rogers, 2008).

While establishing theoretical foundations for three Cs' and innovative green procurement practices, the following research question is proposed: Do Collaboration, Coordination, and Cooperation create value in improving innovative green procurement practices of the firm?

There are few brilliant studies available in the area of supplier relationship management, supplier integration, and collaboration and has been discussed further to understand the breadth and depth of study available in the area of sustainable procurement.

Bag (2016a) studied the interrelationship between green strategy, supplier relationship management and supply chain performance. Important variables such as supplier integration, ethics, trust, culture and flexibility have been considered in the study to develop supplier relationship model. Green purchasing positively influences flexible systems which in turn reduces operational cost. Bag (2016b) also argued that flexible procurement systems are key to supply chain sustainability. In that study, the important variables considered were supplier integration, supplier responsiveness, and strategic sourcing. The findings suggest that manufacturing organizations having a strong sourcing policy successfully integrate suppliers. This helps in a greater level of flexibility and develops more innovative products successfully. It was also suggested that trust and collaborative efforts between buyers and suppliers improve delivery and product quality, which enhance customer satisfaction and considered as a move towards sustainability.

In another recent study, where Bag and Anand (2016) examined the importance of innovation leadership in cultivating sustainable supply chain practices of an organization. One interesting finding from the study is that empowering junior managers and creating innovation culture among employees facilitate green practices.

The above studies are some of the recent exceptional work in the area of sustainable practices where different links have been examined. However, the missing link in all the past studies is the role of 3 Cs' in influencing innovative green procurement practices.

Firms mostly emphasis on innovation for creating eco-friendly designs, reducing the level of wastage, and value addition. Firms apply different tools and techniques to measure the performance of green practices which generally differ from the conventional practices.

The gaps which emerged from the review of the literature has further motivated to pursue the current study. It will be interesting to understand the underlying mechanics and interrelationships of three Cs' and innovative green procurement practices.

The manuscript has been organized as follows. First theoretical background and research framework are presented. Then research objective and methodology are discussed, and analysis and findings are explained. Finally, the manuscript concludes with a discussion of managerial implications, limitations and suggested future research.

2. LITERATURE REVIEW

A literature review is an important part of any research study. Traditional review approach mostly lacks thoroughness, quality, and information which ultimately make less meaningful to supply chain practitioners. Here the author attempts to use the process of systematic review for exploring the subject and understanding the links. The systematic literature review (SLR) process creates transparency and assists in developing the research question. Earlier SLR was mainly used by researchers in the area of medical sciences, but recently SLR has gained popularity in the area of management sciences. Some of

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

the recently published papers which adopted SLR techniques are (Chakrabarty & Dubey, 2014; Bag & Anand, 2014 a; 2014b; Dubey and Ali, 2014; Dubey & Gunasekaran, 2014a, b; Srivastava & Dubey, 2014). The steps of a systematic review of literature followed in the present study have been adopted based on the guidelines of Tranfield et al. (2003).

Stage 1: Planning the review

In this stage, the researcher conduct studies to assess the breadth and depth of the existing literature and to draw up the boundaries of the topic. The current review focuses on articles published in reputed peer review journals. To set up a time span, a starting position was set at 1990. Library database (EBSCO) was used through a keyword search using keywords "Resource Dependence theory", "Green Procurement", "Collaboration" "Cooperation" and "Coordination". As the literature is interlinked when one thread is picked up, the others were also easy to identify. Finally, only the important selected papers relevant for the present study has been considered for the current study. The list of citations is presented at the end of the study.

Phase 0: Identification the need for a review

The objective of conducting the review is to identify the research gaps from published literature and further develop the problem statement, research questions and research objective for the present research. There are studies available in the area of supplier relationship management, supplier integration, and collaboration, but none of the studies address the importance of 3 Cs' in influencing innovative green procurement practices. Let us understand particularly why the term "innovative green procurement practices" has been used for the study; the underlying reason is that any firm practicing green practices basically performs out of the box thinking; i.e., innovation. Firms are innovating new ways to come out with eco-friendly designs, reduce wastage, reclaim, add value and also save costs. Firms use different tools and techniques to measure performance under green practices which differ from the traditional or standard practices. If we consider any top firm practicing sustainable practices such as Apple, Dell, Ford and Toyota, we can see the approaches of individual firms are different from each other, although the ultimate objective is to save natural resources and reduce carbon footprint. Innovation and green practices are intertwined, and no common, or standard practice can yield the same result to the firm. The central concept is to innovate and come out with better ideas for sustainability. In this study, Resource Dependence Theory is used as a theoretical lens to disseminate further and enhance the existing knowledge base. It is interesting to note that resource scarcity can generate huge risks both internally and externally. Therefore, the author felt the need to identify the interrelationships among innovative green practices and the internal (internal cooperation, internal coordination) and external (supplier collaboration) dimensions. The present study will generate rich insight mainly for the procurement professionals practicing green practices or who are thinking of commencing such practices. The findings will help in developing practical tools for green performance measurement.

Phase 1: Preparation of a proposal for review

Researchers have carried out a detailed review of research articles published in *IJPM, IJPR, IJPE, JOM, AMR, SMR* and other reputed journals to develop building blocks for the present study.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Phase 2: Development of a research protocol

In this step the conceptual discussion of the research problem and a statement of the problems' significance are presented.

The starting point is the innovative green procurement practices. Since natural resources are widely used, there are chances of resources becoming scarce and expensive to acquire. In that scenario, firms need to innovative for sourcing alternate resources. Here firms deviate from the standard practices and adopts the best practices which enhance the brand image in the business world. As per RDT, scarcity can occur internally or externally (Leblebici et al., 1991). When firms have unskilled manpower with poor cooperation and without any coordination may result in resource scarcity. Externally if the firm does not collaborate with customers and suppliers, then the firm might run out of resources and which generally becomes costlier to acquire at the last moment. Also the growth in demand for the eco-designed product increase the demand for the resource. In the case of scarcity of the input resource the firm cannot manufacture the product. Competitive pressures also restrict firms in raising the prices of final products. The internal and external forces compound together and act on the firm. This is a burning problem for the firm and often results in unsuccessful green procurement practices and financial losses.

As per the NSF (2010) study, existing green initiatives have mainly focused on investment in new technology and developing energy saving equipment and facilities. Such initiatives are valuable, but they tend to ignore the green production economics, interaction, and coordination where the flow of products to final customers engages multiple firms in long and complex supply chains. Therefore, the present study is necessary to bring out the richness of 3 C' and its importance in enhancing innovating green procurement practices in today's complex supply chain structure operating under uncertainty.

Stage 2: Conducting a review

In this turbulent business scenario, every supply chain practitioner is struggling to mitigate the risks. The level of uncertainty is more due to long and complex supply chains (Applequist et al., 2000; Juttner et al., 2003 and Kleindorfer and Saad, 2005). In this scenario, every supply chain practitioner spends their time majorly in aligning supply chain strategies with product uncertainties (Lee, 2002). The problem has aggravated with tight competition in the market and strict government regulations. This has raised the question of firm's sustainability and created difficulty to stay in the business (Walker, 2008; Wagner and Bode, 2008). To change the game and remain in business, supply chain practitioners innovated and shifted the focus towards triple bottom line concept and focusing on environmental, social and economic aspects of business sustainability (Carter and Rogers, 2008; Dubey & Bag, 2014; Dubey et al., 2015). Further, they adopted green procurement practices where firms emphasize the reduction of wastage; material substitution through environmental sourcing of raw materials and reduce usage of hazardous materials. Basically, green procurement focuses on life cycle thinking whereas the traditional procurement system used to focus only on costs (Kaiser et al., 2001). In response to the internal and external changes firms have instituted socially responsible buying process (Cater et al., 1998). Currently, green procurement is considered as a noble approach to improving the performance of firms (Hamner & del Rosario 1998; Dubey et al., 2013; Dubey et al., 2014a). Green procurement is controlled by the internal and external forces and the balance between the two forces is necessary for successful green procurement practices. The internal forces are the forces within the firm, and the external forces are basically supplier and customer pressures. From the internal viewpoint the team coordination and cross-functional cooperation

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

among members are necessary for running any projects successfully (Pinto and Pinto, 1990). The tasks and roles embedded in driving innovative green practices as well as rules and procedures to coordinate the project needs the attention of members (Tjosvold, 1988; Hoegl et al., 2004). It is the responsibility of top management to cultivate effective communication, cooperation and trust to achieve rapid milestones in green procurement (Kerzner, 2013).

Also, it is essential to understand the external forces such as supplier pressures and customer pressures. The strict regulations drive firm to form an alliance with suppliers and integrating suppliers into environmental management practices. Green procurement demands environmentally conscious suppliers who have implemented ISO 14000. This necessitates firms in developing environmental policy and environmental supplier evaluation criteria (Green et al., 1996; Green et al., 1998; Chen, 2005; Zhu et al., 2005; Zhu & Sarkis, 2006; Zhu & Sarkis, 2007; ElTayeb et al., 2010; Dubey et al., 2013). Supplier collaboration is an important component of green procurement. Collaborative strategies facilitate closer cooperation between buyer and supplier firms, provides flexibility in handling projects (Bowen et al., 2001). It was found that firms achieved the greatest success in innovative green practices when suppliers are physically involved with buyer's plant and also when the buyer spend maximum time in the supplier's plant (Simpson and Power, 2005). In some of the earlier studies, researchers have used the term innovative practices under green procurement practices such as innovative packaging based on customers' willingness to buy biodegradable packages and they even discussed on green firms being innovative in their environmental practices and innovative approaches in managing waste at source. There is evidence in certain papers where discussions have been done on ways to bring innovative green products in the market (Green et al., 1996; Min and Galle., 1997; Min and Galle., 2001).

The research gaps which evolved from the review of literature have been presented to further develop the research objectives for the present study.

The first gap is that existing studies mainly focused on identifying green procurement drivers and barriers. There is a lack of studies considering the soft dimensions of green procurement such as collaboration, coordination, and cooperation.

Although existing studies discussed innovative approaches and its importance for environmental practices there is hardly any study where scholars have argued that innovation and green procurement are intertwined. This can be considered as the second research gap.

Thirdly, no existing study explains the contextual interrelationships between innovative green practices and the 3 Cs'. There are existing studies showing links between resource dependency theory and green practices (Cooper and Ellram, 1993; Carter and Carter, 1998; Buvik., 2001; Carter and Rogers, 2008; Zhu et al., 2008; Sarkis et al., 2011; Sarkis, 2012; Lee et al., 2012). However, there is a scope for further intensifying the theory and extending the knowledge base.

2.1. Research Objectives

The SLR has revealed the research gaps and provides direction for developing the following research objectives:

- To identify the leading soft dimensions influencing innovative green procurement practices.
- To identify the contextual relationships between innovative green procurement practices and the leading soft dimensions.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

3. RESEARCH METHODS

The research design is the most critical step in any research study. The research design is different for both qualitative and quantitative approaches. Some of the seminal papers available in the area of qualitative research design under management sciences are (e.g., Eisenhardt,1989; Mays & Pope, 1995; Eisenhardt & Graebner, 2007; Verd, 2004; Suering, 2008; Stock & Boyer, 2009). From existing literature, it is seen that case study research is the most popular technique under qualitative approach. Therefore, keeping in mind the qualitative approach for the present study we have several options for addressing the research objectives. However, the author adopted the ISM methodology for identifying the contextual relationships between identified variables. The reason for adopting ISM methodology is basically to generate a robust model from the complex links and for which ISM is the perfect tool. The ISM methodology is interpretive from the fact that as the expert group decides whether one variable enhances another variable, therefore an overall structure is extracted from the relationships of the variables and is further validated using MICMAC analysis. ISM has gained popularity in the branch of supply chain management and the seminal work available are (Mandal & Deshmukh, 1994; Singh et al., 2003; Luthra et al., 2011; Pfohl et al., 2011; Shahabadkar, 2012; Sushil,2012; Attri et al., 2013; Dubey & Ali, 2014; Srivastava & Dubey, 2014; Bag & Anand, 2014a, 2014b; Bag., 2014; Dubey et al., 2014b; Dubey & Singh, 2015).

3.1. Finding Variables From Literature Review

As a result of the review, 30 variables were found to be influencing innovative procurement practices. A problem-solving group was formed comprising seven experts from manufacturing sector. The group was asked to analyze the listed variables, take out the repeated ones and rearrange the list including the ones thought to be valid in relation to the Indian context. The first tour resulted with reducing each of the variables to 22. Through the second tour 18 and the third tour total 15 variables were determined. The final variables were presented in Table 1 and will be further used in developing the ISM model.

4. DATA ANALYSIS

In this step, the contextual relationship between variables with respect to the pairs of variables was examined. To investigate the relations between fifteen variables, a questionnaire was developed. The questionnaire was sent to twelve referees, who are working in the position of senior supply chain manager in the manufacturing sector. The questionnaire was tested for content validity. The instrument developed in this study demonstrates the content validity as the selection of measurement items was based on both, an exhaustive review of the literature and detailed evaluations by senior managers during pre-testing.

4.1. Developing the Structural Self-Interaction Matrix (SSIM)

For developing SSIM in Table 2, the below symbols have been used to denote the direction of relationships between variables (i and j):

V: i lead to j but j does not lead to i

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 1. Final list of variables

Construct	Variables	Source
Innovative Green Procurement Practices	Innovative capability	Min & Galle, 2001; Zhu et al., 2007
	Wastage reduction	Dubey et al., 2013
	Materials recovery	Min & Galle, 1997; Zhu et al., 2008
	Create value for customers	Hartmann et al., 2006; Bag, 2014
	Better customer retention	www.ic.gc.ca/logistics
	Successful compliance	www.ic.gc.ca/logistics
	Enhanced risk management	www.ic.gc.ca/logistics
	Differentiate services	www.ic.gc.ca/logistics
Coordination	Internal integration	Pinto & Slevin, 1987; Ford, 1995
	Information sharing	Gonzalez & Bharosa, 2009; Andersen et al., 2000
Collaboration	Governance	Thomson & Perry, 2006
	Organizational Autonomy	Thomson & Perry, 2006
	Mutuality	Thomson & Perry, 2006
Cooperation	Problem solving	Mahama, 2006
	Willingness to adapt to changes	Mahama, 2006

Table 2. Structural self-interaction matrix

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
1	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**V**	**V**	**V**	**V**	**V**	**V**	**V**	
2	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**V**	**V**	**V**	**V**	**V**	**A**		
3	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**V**	**V**	**O**	**V**	**V**			
4	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**V**				
5	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**					
6	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**O**	**V**						
7	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**O**							
8	**A**	**A**	**A**	**A**	**A**	**O**	**O**								
9	**A**	**V**	**V**	**V**	**V**	**V**									
10	**V**	**V**	**V**	**V**	**V**										
11	**V**	**V**	**V**	**V**											
12	**V**	**V**	**V**												
13	**V**	**V**													
14	**V**														
15															

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

A: i do not lead to j but j lead to i
X: i lead to j and j lead to i
O: i and j are unrelated to each other

4.2. Develop Reachability Matrix

The SSIM has been converted into a binary matrix, i.e., the reachability matrix (Table 3) by substituting V, A X and O by 1 and 0. The substitutions of '1' and '0' is done as below:

1. If the (i, j) entry in the SSIM is V, then the (i,j) entry in the reachability matrix becomes '1' and (j,i) entry becomes '0'
2. If the (i, j) entry in the SSIM is A, then the (i,j) entry in the reachability matrix becomes '0' and (j,i) entry becomes '1'
3. If the (i, j) entry in the SSIM is X, then the (i,j) entry in the reachability matrix becomes '1' and (j,i) entry also becomes '1'
4. If the (i, j) entry in the SSIM is O, then the (i,j) entry in the reachability matrix becomes '0' and (j,i) entry also becomes '0'

4.3. Transitivity Principle

In this step, the concept of transitivity is introduced so that some of the cells of the initial reachability matrix are filled by inference. Transitivity can be explained with the following example if element "i" relates to element "j" and element "j" relates to element "k", then transitivity implies element "i" relates to element "k". It also helps in maintaining the conceptual consistency. The final reachability matrix will then consist of some entries from the pair-wise comparisons and some inferred entries. The transitivity concept is used to fill the gap, if any. Following the above rules, the initial reachability matrix is prepared. After incorporating the transitivity concept as described above, the final reachability matrix is obtained Table 4.

4.4. Level Partitioning

The final reachability matrix obtained above in Table 4 is now partitioned into different levels. After the first iteration, the variable classified to level 1 are discarded, and the partitioning procedure is repeated on the remaining variable to determine the level 2. These iterations are continued until the level of each variable has been determined. The results for iterations 1 to 8 are summarized in Table 5.

4.5. Diagraph

From the final Reachability Matrix and level partitions, the structural model is generated using nodes and lines of edges. This graph is called digraph.

The analysis yields an ISM hierarchy in which Better customer retention (the top level); Create value for customers (second level); Enhanced risk management and Differentiate services (third level); Successful compliance (fourth level); Wastage Reduction (fifth level); Materials recovery (sixth level);

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 3. Initial reachability matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Driving Power (Y)
1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	8
2	0	1	0	1	1	1	1	1	0	0	0	0	0	0	0	6
3	0	1	1	1	1	0	1	1	0	0	0	0	0	0	0	6
4	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	2
5	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
6	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	4
7	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	3
8	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	3
9	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0	13
10	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	14
11	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	14
12	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	13
13	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1	12
14	1	1	1	1	1	1	1	1	1	0	0	0	0	1	1	11
15	1	1	1	1	1	1	1	1	1	0	0	0	0	0	1	10
Dependence power(X)	8	10	9	14	15	10	12	9	7	2	3	4	5	6	6	

Table 4. Final reachability matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Driving Power (Y)
1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	8
2	0	1	0	1	1	1	1	1	0	0	0	0	0	0	0	6
3	0	1	1	1	1	1*	1	1	0	0	0	0	0	0	0	7
4	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	2
5	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
6	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	4
7	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	3
8	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	3
9	1	1	1	1	1	1	1	1*	1	1	1	1	1	1	1*	15
10	1	1	1	1	1	1	1	1*	1	1	1	1	1	1	1	15
11	1	1	1	1	1	1	1	1	1	1*	1	1	1	1	1	15
12	1	1	1	1	1	1	1	1	1	1*	1*	1	1	1	1	15
13	1	1	1	1	1	1	1	1	1	1*	1*	1*	1	1	1	15
14	1	1	1	1	1	1	1	1	1	1*	1*	1*	1*	1	1	15
15	1	1	1	1	1	1	1	1	1	1*	1*	1*	1*	1*	1	15
Dependence power(X)	8	10	9	14	15	11	12	11	7	7	7	7	7	7	7	

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 5. Level partitioning

Variables	RS	AS	IS	Level
1	1,2,3,4,5,6,7,8	1,9,10,11,12,13,14,15	1	VII
2	2,4,5,6,7,8	1,2,3,9,10,11,12,13,14,15	2	V
3	2,3,4,5,6,7,8	1,3,9,10,11,12,13,14,15	3	VI
4	4,5	1,2,3,4,6,7,8,9,10,11,12,13,14,15	4	II
5	5	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15	5	I
6	4,5,6,7	1,2,3,6,9,10,11,12,13,14,15	6	IV
7	4,5,7	1,2,3,6,7,9,10,11,12,13,14,15	7	III
8	4,5,8	1,2,3,8,9,10,11,12,13,14,15	8	III
9	1,2,3,4,5,6,7,8,9,10,11,12,13,14	9,10,11,12,13,14,15	9,10,11,12,13,14	VIII
10	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15	9,10,11,12,13,14,15	9,10,11,12,13,14,15	VIII
11	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15	9,10,11,12,13,14,15	9,10,11,12,13,14,15	VIII
12	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15	9,10,11,12,13,14,15	9,10,11,12,13,14,15	VIII
13	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15	9,10,11,12,13,14,15	9,10,11,12,13,14,15	VIII
14	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15	9,10,11,12,13,14,15	9,10,11,12,13,14,15	VIII
15	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15	9,10,11,12,13,14,15	9,10,11,12,13,14,15	VIII

Innovative capability (seventh level) and Internal integration, Information sharing, Governance, Organizational Autonomy, Mutuality, Problem solving and Willingness to adapt to changes(bottom level). The resulting ISM model is illustrated in Figure 1.

4.6. MICMAC Analysis

The objective of MICMAC analysis is to analyze the drive power and dependence power of variables. Based on the drive power and dependence power the variables have been classified into four variables: autonomous variables, linkage variables, dependent and independent variables and presented in Figure 2.

The below Table 6 show the dependence and driving power of key variables which is derived from final reachability matrix (Table 4) of ISM steps.

4.7. Findings From MICMAC Analysis

Cluster 1: *Autonomous Variables*

These variables have a weak drive power and weak dependence power. In this cluster, we do not have any variables.

Cluster 2: *Dependence Variables*

These variables have a weak drive power but strong dependence power. In this cluster, we have seven variables: 2 (Wastage reduction), 3 (Materials recovery), 4 (Create value for customers), 5 (Better customer retention), 6 (Successful compliance), 7 (Enhanced risk management) and 8 (Differentiate services).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 1. ISM model

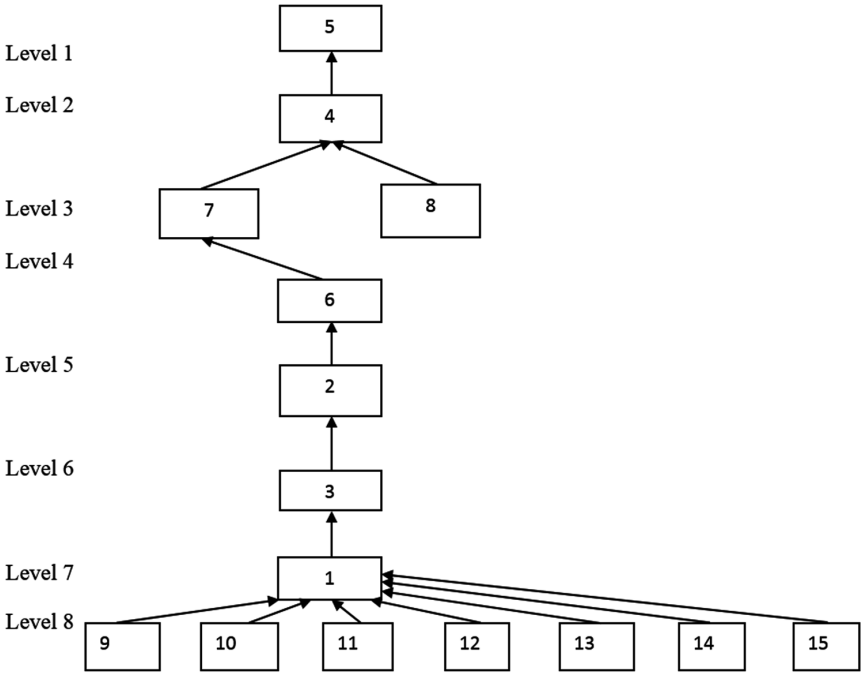
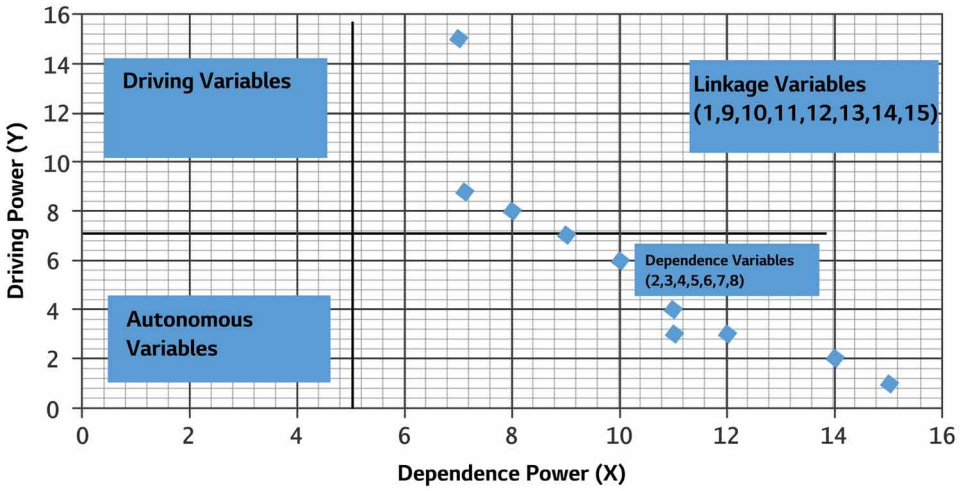


Table 6. Position coordinates of identified factors

Variables	Dependence Power (X)	Driving Power (Y)
1	8	8
2	10	6
3	9	7
4	14	2
5	15	1
6	11	4
7	12	3
8	11	3
9	7	15
10	7	15
11	7	15
12	7	15
13	7	15
14	7	15
15	7	15

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 2. MICMAC analysis



Cluster 3: *Linkage Variables*

These variables have a strong drive power as well as strong dependence power. In this cluster we have eight variables; i.e., 1 (Innovative capability), 9 (Internal integration), 10 (Information sharing), 11 (Governance), 12 (Organizational autonomy), 13 (Mutuality), 14 (Problem-solving) and 15 (Willingness to adapt to changes). Linkage variables are very sensitive and unstable. Any action on these variables will trigger an effect on other variables and also feedback on themselves.

Cluster 4: *Driving Variables*

These variables have a strong drive power but weak dependence power. In this cluster, we do not have any variables.

5. DISCUSSIONS

The current study argues that Collaboration, Cooperation, and Coordination are the leading soft dimensions influencing innovative green procurement practices. Secondly, the interrelationships have also been studied with respect to Resource dependency theory.

Organizations are generally interested in environmental collaboration with suppliers for successful adoption of green practices. Various case studies from European and Australian organizations have shown that green procurement practices have been used as a tool to gain a competitive advantage as it enhances operational and financial performance.

The success of innovative green procurement practices is dependent on wastage reduction at source, materials recovery program, creating value for customers, better customer retention, successful compliance, enhanced risk management and differentiated services. Firms should not ignore the linkage variables of innovative green procurement practices. Resources are scarce and costly to acquire. Under such

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

circumstances, it is essential for firms to create a collaborative practice based on information sharing and decision synchronization. In this dynamic situation, each partner has resources that other partners need and must be shared because knowledge and cross-functional collaboration are two fundamental resources for successful product innovation and green procurement practices.

6. CONCLUSION

The present study provides a systematic approach in developing a structural model for 3 Cs' and innovative green procurement. The ISM model has identified a hierarchy of factors for implementing innovative green procurement system in the organization.

The ISM modeling yields a hierarchy in which the top level element is better customer retention; Create Value for customers (second level); Enhanced risk management and Differentiate services (third level); Successful compliance (fourth level); Wastage Reduction (fifth level); Materials recovery (sixth level); Innovative capability (seventh level) and Internal integration, Information sharing, Governance, Organizational Autonomy, Mutuality, Problem solving and Willingness to adapt to changes(bottom level).

The ISM model explains the relationships where the most important elements are the bottom level elements. Supply chain practitioners need to focus specifically on these bottom level elements while developing innovative green procurement strategies. Ultimately it will boil down to value creation for customers and better retention of customers. The findings of the current study corroborate with some of existing studies such as (Gunasekaran et al., 2015; Whitelock, 2012; Uttam et al., 2012; Ninlawan et al., 2010; Anvuur & Kumaraswamy, 2008; Heuninckx, 2008).

6.1. Unique Contributions

The study has covered the background and methodology well. It provides a significant contribution in defining the leading soft variables and identifying the contextual relationships which will be important from the practical point of view. This study further extends the boundary of green procurement knowledge base.

6.2. Theoretical and Managerial Implications

The present study provides rich insights for procurement professionals willing to implement innovative green procurement practices. It provides a basic checklist as follows:

Collaboration with strategic suppliers is essential for the uninterrupted supply of alternate/environmental friendly products which is scarce and costlier to acquire. Moreover, spending time with suppliers will facilitate knowledge sharing and ultimately enhance innovation capability. This will help in mitigating risks and also develop trust among the members of supply chain network.

Cooperation among team members will improve problem-solving ability and employees will be flexible to adopt changes in process/system.

Coordination will improve information sharing and enhance innovative green procurement practices.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

6.3. Future Research Directions

The limitations of the current study involve the human intervention in the process which is basically the subjective judgment conducted through a decision maker's opinion. This model can be compared using alternate MCDM techniques such as Fuzzy TISM or Fuzzy DEMATEL method to compare the results obtained in the current study.

REFERENCES

Andersen, P. B., Carstensen, P. H., & Nielsen, M. (2000, September). Dimensions of coordination. In *LAP 2000. Proceedings of the fifth international workshop on the language-action perspective on communication modeling* (pp. 14-16).

Anvuur, A. M., & Kumaraswamy, M. M. (2008). Better collaboration through cooperation. In *Collaborative relationships in construction: developing frameworks and networks*, 107-128.

Applequist, G. E., Pekny, J. F., & Reklaitis, G. V. (2000). Risk and uncertainty in managing chemical manufacturing supply chains. *Computers & Chemical Engineering*, *24*(9), 2211–2222. doi:10.1016/S0098-1354(00)00585-8

Attri, R., Dev, N., & Sharma, V. (2013). Interpretive structural modelling (ISM) approach: An overview. *Research Journal of Management Sciences*, *2*(2), 3–8.

Bag, S. (2014). Developing a GSCM model for the Indian rubber goods manufacturing sector [Doctoral thesis]. University of Petroleum & Energy Studies, Dehradun, India.

Bag, S. (2016a). Green Strategy, Supplier Relationship building and Supply Chain Performance: Total Interpretive Structural Modeling approach. *International Journal of Procurement Management*, *9*(4), 398–426. doi:10.1504/IJPM.2016.077702

Bag, S. (2016b). Flexible procurement systems is key to supply chain sustainability, Journal of Transport and Supply Chain Management, 10(1). DOI: doi:10.4102/jtscm.v10i1.213

Bag, S., & Anand, N. (2014a). Modeling Soft Dimensions of FMS and Their Interrelationship Using ISM and MICMAC Analysis. *Prabandhan: Indian Journal of Management*, *7*(10), 43–54. doi:10.17010/pijom/2014/v7i10/59252

Bag, S., & Anand, N. (2014b). Modeling Green Supply Chain Management framework using ISM and MICMAC analysis. *African Journal of Business Management*, *8*(22), 1053–1065.

Bag, S., & Anand, N. (2016). The importance of innovation leadership in cultivating Sustainable Supply Chain Management and enhancing Organization Performance. *International Journal of Process Management and Benchmarking*, *6*(4), 469–490. doi:10.1504/IJPMB.2016.10000145

Bowen, F. E., Cousins, P. D., Lamming, R. C., & Farukt, A. C. (2001). The role of supply management capabilities in green supply. *Production and Operations Management*, *10*(2), 174–189. doi:10.1111/j.1937-5956.2001.tb00077.x

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Buvik, A. (2001). The industrial purchasing research framework: A comparison of theoretical perspectives from micro economics, marketing and organization science. *Journal of Business and Industrial Marketing*, *16*(6), 439–450. doi:10.1108/EUM0000000006019

Carter, C. R., & Carter, J. R. (1998). Interorganizational Determinants of Environmental Purchasing: Initial Evidence from the Consumer Products Industries. *Decision Sciences*, *29*(3), 659–684. doi:10.1111/j.1540-5915.1998.tb01358.x

Carter, C. R., Ellram, L. M., & Ready, K. J. (1998). Environmental purchasing: Benchmarking our German counterparts. *Journal of Supply Chain Management*, *34*(4), 28.

Carter, C. R., & Rogers, D. S. (2008). A framework of sustainable supply chain management: Moving toward new theory. *International Journal of Physical Distribution & Logistics Management*, *38*(5), 360–387. doi:10.1108/09600030810882816

Chakrabarty, A., De, A., & Dubey, R. (2014). A flexible approach towards multi-frequency re-engineering of the moving average convergence divergence indicator. *Global Journal of Flexible Systems Management*, *15*(3), 219–234. doi:10.100740171-014-0068-7

Chen, C. C. (2005). Incorporating green purchasing into the frame of ISO 14000. *Journal of Cleaner Production*, *13*(9), 927–933. doi:10.1016/j.jclepro.2004.04.005

Cooper, M. C., & Ellram, L. M. (1993). Characteristics of supply chain management and the implications for purchasing and logistics strategy. *The International Journal of Logistics Management*, *4*(2), 13–24. doi:10.1108/09574099310804957

Dubey, R., & Ali, S. S. (2014). Identification of flexible manufacturing system dimensions and their interrelationship using total interpretive structural modelling and fuzzy MICMAC analysis. *Global Journal of Flexible Systems Management*, *15*(2), 131–143. doi:10.100740171-014-0058-9

Dubey, R., & Bag, S. (2014). Antecedents of Green Manufacturing Practices: A Journey towards Manufacturing. In *Smart Manufacturing Innovation and Transformation: Interconnection and Intelligence: Interconnection and Intelligence*, 333.

Dubey, R., Bag, S., & Ali, S. S. (2014a). Green supply chain practices and its impact on organisational performance: An insight from Indian rubber industry. *International Journal of Logistics Systems and Management*, *19*(1), 20–42. doi:10.1504/IJLSM.2014.064029

Dubey, R., Bag, S., Ali, S. S., & Venkatesh, V. G. (2013). Green purchasing is key to superior performance: An empirical study. *International Journal of Procurement Management*, *6*(2), 187–210. doi:10.1504/IJPM.2013.052469

Dubey, R., & Gunasekaran, A. (2014a). Sustainable supply chain network design: a case of Indian company. *International Journal of Logistics Research and Applications*.

Dubey, R., & Gunasekaran, A. (2014b). Sustainable supply chain network design: a case of Indian company. *International Journal of Logistics Research and Applications*.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Dubey, R., Gunasekaran, A., Singh, S., & Singh, T. (2015). Building theory of sustainable manufacturing using total interpretive structural modelling. *International Journal of Systems Science: Operations & Logistics*.

Dubey, R., & Singh, T. (2015). Understanding complex relationship among JIT, lean behaviour, TQM and their antecedents using interpretive structural modelling and fuzzy MICMAC analysis. *The TQM Journal*, *27*(1), 42–62. doi:10.1108/TQM-09-2013-0108

Dubey, R., Singh, T., Ali, S. S., & Tiwari, S. (2014b). Contextual relationship among antecedents of truck freight using interpretive structural modelling and its validation using MICMAC analysis. *International Journal of Logistics Systems and Management*, *20*(1), 42–58. doi:10.1504/IJLSM.2015.065963

Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review*, *14*(4), 532–550.

Eisenhardt, K. M., & Graebner, M. E. (2007). Theory building from cases: Opportunities and challenges. *Academy of Management Journal*, *50*(1), 25–32. doi:10.5465/AMJ.2007.24160888

Gonzalez, R. A., & Bharosa, N. (2009, January). A framework linking information quality dimensions and coordination challenges during interagency crisis response. *Proceedings of the 42nd Hawaii International Conference on System Sciences HICSS'09*. IEEE.

Green, K., Morton, B., & New, S. (1996). Purchasing and environmental management: Interactions, policies and opportunities. *Business Strategy and the Environment*, *5*(3), 188–197. doi:10.1002/(SICI)1099-0836(199609)5:3<188::AID-BSE60>3.0.CO;2-P

Green, K., Morton, B., & New, S. (1998). Green purchasing and supply policies: Do they improve companies' environmental performance? *Supply Chain Management: An International Journal*, *3*(2), 89–95. doi:10.1108/13598549810215405

Gunasekaran, A., Subramanian, N., & Rahman, S. (2015). Green supply chain collaboration and incentives: Current trends and future directions. *Transportation Research Part E, Logistics and Transportation Review*, *74*, 1–10. doi:10.1016/j.tre.2015.01.002

Hamner, B., & del Rosario, T. (1998). Green purchasing: A channel for improving the environmental performance of SMEs. *Globalisation and the Environment Perspectives from OECD and Dynamic Non-Member Economies: Perspectives from OECD and Dynamic Non-Member Economies*, 75.

Hartmann, P., & Apaolaza Ibáñez, V. (2006). Green value added. *Marketing Intelligence & Planning*, *24*(7), 673–680. doi:10.1108/02634500610711842

Heuninckx, B. (2008). A primer to collaborative defence procurement in Europe: Troubles, achievements and prospects. *Public Procurement Law Review*, *3*, 123.

Hoegl, M., Weinkauf, K., & Gemuenden, H. G. (2004). Interteam coordination, project commitment, and teamwork in multiteam R&D projects: A longitudinal study. *Organization Science*, *15*(1), 38–55. doi:10.1287/orsc.1030.0053

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Jüttner, U., Peck, H., & Christopher, M. (2003). Supply chain risk management: Outlining an agenda for future research. *International Journal of Logistics: Research and Applications*, *6*(4), 197–210. doi: 10.1080/1367556031000162701 6

Kaiser, B., Eagan, P. D., & Shaner, H. (2001). Solutions to health care waste: Life-cycle thinking and" green" purchasing. *Environmental Health Perspectives*, *109*(3), 205–207. doi:10.1289/ehp.01109205 PMID:11333178

Kerzner, H. R. (2013). *Project management: a systems approach to planning, scheduling, and controlling*. John Wiley & Sons.

Khidir ElTayeb, T., Zailani, S., & Jayaraman, K. (2010). The examination on the drivers for green purchasing adoption among EMS 14001 certified companies in Malaysia. *Journal of Manufacturing Technology Management*, *21*(2), 206–225. doi:10.1108/17410381011014378

Kleindorfer, P. R., & Saad, G. H. (2005). Managing disruption risks in supply chains. *Production and Operations Management*, *14*(1), 53–68. doi:10.1111/j.1937-5956.2005.tb00009.x

Leblebichi, H., Salancik, G., Copay, A., & King, T. (1991). Institutional change and the transformation of inter organizational fields: An organizational history of the U.S. radio broadcasting industry. *Administrative Science Quarterly*, *36*, 33–363.

Lee, H. L. (2002). Aligning supply chain strategies with product uncertainties. *California Management Review*, *44*(3), 105–119. doi:10.2307/41166135

Lee, S. M., Tae Kim, S., & Choi, D. (2012). Green supply chain management and organizational performance. *Industrial Management & Data Systems*, *112*(8), 1148–1180. doi:10.1108/02635571211264609

Logistics and Supply Chain Management. (n. d.). Retrieved from http://www.ic.gc.ca/eic/site/dsib-logi.nsf/eng/Home

Luthra, S., Kumar, V., Kumar, S., & Haleem, A. (2011). Barriers to implement green supply chain management in automobile industry using interpretive structural modeling technique: An Indian perspective. *Journal of Industrial Engineering and Management*, *4*(2), 231–257. doi:10.3926/jiem.2011.v4n2.p231-257

Mahama, H. (2006). Management control systems, cooperation and performance in strategic supply relationships: A survey in the mines. *Management Accounting Research*, *17*(3), 315–339. doi:10.1016/j.mar.2006.03.002

Mandal, A., & Deshmukh, S. G. (1994). Vendor selection using interpretive structural modelling (ISM). *International Journal of Operations & Production Management*, *14*(6), 52–59. doi:10.1108/01443579410062086

Manufacturing- A Canadian Perspective. (2009, November). Retrieved from https://www.ic.gc.ca/eic/site/dsib-logi.nsf/vwapj/pg00032_eng.pdf/$file/pg00032_eng.pdf

Matos, S., & Hall, J. (2007). Integrating sustainable development in the supply chain: The case of life cycle assessment in oil and gas and agricultural biotechnology. *Journal of Operations Management*, *25*(6), 1083–1102. doi:10.1016/j.jom.2007.01.013

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Mays, N., & Pope, C. (1995). Qualitative research: Rigour and qualitative research. *BMJ (Clinical Research Ed.)*, *311*(6997), 109–112. doi:10.1136/bmj.311.6997.109 PMID:7613363

Min, H., & Galle, W. P. (1997). Green purchasing strategies: Trends and implications. *International Journal of Purchasing and Materials Management*, *33*(2), 10–17. doi:10.1111/j.1745-493X.1997.tb00026.x

Min, H., & Galle, W. P. (2001). Green purchasing practices of US firms. *International Journal of Operations & Production Management*, *21*(9), 1222–1238. doi:10.1108/EUM0000000005923

Min, H., & Galle, W. P. (2001). Green purchasing practices of US firms. *International Journal of Operations & Production Management*, *21*(9), 1222–1238. doi:10.1108/EUM0000000005923

Ninlawan, C., Seksan, P., Tossapol, K., & Pilada, W. (2010, March). The implementation of green supply chain management practices in electronics industry. *Proceedings of the international multiconference of engineers and computer scientists* (Vol. 3, pp. 17-19).

NSF. (2010). Report. Retrieved from http://www.nsf.gov/statistics/seind12/c6/c6s5.htm

Pfohl, H. C., Gallus, P., & Thomas, D. (2011). Interpretive structural modeling of supply chain risks. *International Journal of Physical Distribution & Logistics Management*, *41*(9), 839–859. doi:10.1108/09600031111175816

Sarkis, J. (2012). A boundaries and flows perspective of green supply chain management. *Supply Chain Management: An International Journal*, *17*(2), 202–216. doi:10.1108/13598541211212924

Sarkis, J., Zhu, Q., & Lai, K. (2011). An organizational theoretic review of green supply chain management literature. *International Journal of Production Economics*, *130*(1), 1–15. doi:10.1016/j.ijpe.2010.11.010

Seuring, S. A. (2008). Assessing the rigor of case study research in supply chain management. *Supply Chain Management: An International Journal*, *13*(2), 128–137. doi:10.1108/13598540810860967

Shahabadkar, P. (2012). Deployment of Interpretive Structural Modelling Methodology in Supply Chain Management–An overview. *International Journal of Industrial Engineering & Production Research*, *23*(3), 195–205.

Simpson, D. F., & Power, D. J. (2005). Use the supply relationship to develop lean and green suppliers. *Supply chain management*. *International Journal (Toronto, Ont.)*, *10*(1), 60–68.

Singh, M. D., Shankar, R., Narain, R., & Agarwal, A. (2003). An interpretive structural modeling of knowledge management in engineering industries. *Journal of Advances in Management Research*, *1*(1), 28–40. doi:10.1108/97279810380000356

Srivastava, S., & Dubey, R. (2014). Supply Chain Skill Gap Modelling using Interpretive Structural Modelling and MICMAC Analysis. *International Journal of Operations and Quantitative Management*, *20*(1), 33–47.

Stock, J. R., & Boyer, S. L. (2009). Developing a consensus definition of supply chain management: A qualitative study. *International Journal of Physical Distribution & Logistics Management*, *39*(8), 690–711. doi:10.1108/09600030910996323

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Sushil. (2012). Interpreting the interpretive structural model. *Global Journal of Flexible Systems Management*, 13(2), 87–106.

Thomson, A. M., & Perry, J. L. (2006). Collaboration processes: Inside the black box. *Public Administration Review*, *66*(s1), 20–32. doi:10.1111/j.1540-6210.2006.00663.x

Tjosvold, D. (1988). Cooperative and competitive interdependence collaboration between departments to serve customers. *Group & Organization Management*, *13*(3), 274–289. doi:10.1177/105960118801300303

Tranfield, Denyer, D., & Smart, P. (2013). Towards a methodology for developing evidence-Informed management knowledge by means of systematic review. *British Journal of Management*, *14*(3), 207–222. doi:10.1111/1467-8551.00375

Uttam, K., Faith-Ell, C., & Balfors, B. (2012). EIA and green procurement: Opportunities for strengthening their coordination. *Environmental Impact Assessment Review*, *33*(1), 73–79. doi:10.1016/j.eiar.2011.10.007

Verd, J. M. (2004). Qualitative research methods.

Wagner, S. M., & Bode, C. (2008). An empirical examination of supply chain performance along several dimensions of risk. *Journal of business logistics, 29*(1), 307.

Walker, H., Di Sisto, L., & McBain, D. (2008). Drivers and barriers to environmental supply chain management practices: Lessons from the public and private sectors. *Journal of Purchasing and Supply Management*, *14*(1), 69–85. doi:10.1016/j.pursup.2008.01.007

Whitelock, V. G. (2012). Alignment between green supply chain management strategy and business strategy. *International Journal of Procurement Management, 5*(4), 430-451.

Zhu, Q., & Sarkis, J. (2006). An inter-sectoral comparison of green supply chain management in China: Drivers and practices. *Journal of Cleaner Production*, *14*(5), 472–486. doi:10.1016/j.jclepro.2005.01.003

Zhu, Q., & Sarkis, J. (2007). The moderating effects of institutional pressures on emergent green supply chain practices and performance. *International Journal of Production Research*, *45*(18-19), 4333–4355. doi:10.1080/00207540701440345

Zhu, Q., Sarkis, J., & Geng, Y. (2005). Green supply chain management in China: Pressures, practices and performance. *International Journal of Operations & Production Management*, *25*(5), 449–468. doi:10.1108/01443570510593148

Zhu, Q., Sarkis, J., Lai, K. H., & Geng, Y. (2008). The role of organizational size in the adoption of green supply chain management practices in China. *Corporate Social Responsibility and Environmental Management*, *15*(6), 322–337. doi:10.1002/csr.173

This research was previously published in the International Journal of Applied Logistics (IJAL), 6(2); edited by Lincoln C. Wood, pages 33-50, copyright year 2016 by IGI Publishing (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 19
Development of a Research Framework for Green IT Enablers Using Interpretive Structural Modelling

Sania Khan
GITAM University, India

Abdul Razak Honnutagi
Indian Institute of Technology Bombay, India

Mohammed Shahid Ahamed Khan
CSH Co. LTD., Saudi Arabia

ABSTRACT

The purpose of this paper is to identify the key variables and develop the relationships among the green IT enabling factors which drive consumers towards green purchasing. In this paper Delphi technique and Interpretive structural modelling approach have been employed to model the identified factors. These variables are segregated as 'enablers' that facilitate corporate consumers' to purchase eco-friendly IT products. The major finding of this research is power consumption, e-wastage disposal, product performance and global warming are underlined as significantly important enablers which also drives other factors. The variables are interpreted for sustainable procurement in terms of their driving and dependence powers. For true sustainability the corporate organisations should focus on considering environmental consciousness, Kyoto protocol, corporate social responsibility and eco-label certified products as main interest for green purchasing. Developing the present strategic model and validating it scientifically are further suggested as directions for future research.

INTRODUCTION

The increased power consumption, carbon footprints and early disposal of electronic items containing toxic and non-biodegradable material in the regular IT operations are estimated to be responsible for 2% of global carbon emission from IT industry and also causing serious health problems to mankind (Simon

DOI: 10.4018/978-1-5225-7915-1.ch019

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Mingay, 2007). Consequently, unsustainability through global warming is becoming a major problem on the planet. So the green IT found to be an emerging area in the IT management emphasising on six dimensions namely raw material and resources, energy and climate, excess production, health and safety of mankind, management development and invention through IT. The first generation of green IT which was driven by reduced power consumption, eco-labeled products, recycling and reusing process of e-waste (Murugesan and Gangadharan, 2012) and the second generation was focused on sustainability through IT. Today the green IT studies are progressed far beyond these issues and delivering sustainable benefits in the business by being socially responsible, economically viable and environmental benefits which is considered to be the triple bottom line. Despite reducing 2% of global pollution, green IT initiatives also able to reduced remaining 98% of global emissions to some extent and attracting interest among IT vendors and corporate consumers. Green IT being a potential research area has exciting research opportunities in IT through business sustainability and low carbon economy (Molla, 2008). Hence this research is primarily conducted to provide an evidence of authenticated studies on consumer purchasing behaviour of green IT products which are found to be neglected so far.

This paper identifies and develops the conceptual relationships among the identified enabling factors that are driving the corporate IT consumers towards green IT products using Delphi technique and Interpretive Structural Modelling (ISM) approach. ISM is a popular strategic approach for identifying relationships among various elements in a complex system (Sage, 1977 and Warfield, 1974). The major consensus among experts in this field and a source from literature study are used in developing the relationship matrix using pairwise comparison and thereby developing the ISM model. The suggested variables are gathered as "enablers" from various green IT literature and experts responses as presented in Table 1. Further with the application of integrated approach of Delphi technique and ISM in developing the green IT consumer purchasing behaviour model are discussed in detail followed by conclusions and direction for future research studies.

LITERATURE REVIEW

Green IT being a new area of study since 2007 was primarily looked from the corporate perspective and the consumer perspective has widely been neglected (Mines and Davis, 2007; Velte et al., 2008; Molla, 2008). As green IT includes the attributes related to energy consumption, disposals and recycling will also show influence on the purchasing behaviour of IT products (BITKOM, 2009). Pertaining to the literature review fifteen enabling factors were gathered and are explained below.

The growing impact of IT on environment and awareness among business and consumers has brought significant realisation in their production and consumption pattern (Laroche et al., 2001; Chan T.S., 1996; Kerr, 1990; and Donaton & Fitzgerald, 1992; Noushin et al., 2009). Also most of the consumers understand that the majority of our environmental problems like excess garbage, pollution, waste of energy and material are the outcomes of their consumption behaviours (Christopher et al., 2008) While there is a very clear that the ecological concern is not only applicable to consumers but also appropriate for industrial goods and even services also (Stern, 2006). In reducing the industrial impact on the environment, government is also actively involving in alerting the firms by introducing new regulations from time to time to put down their carbon emissions. Hence towards the sustainable development the federal government and Intergovernmental Panel on Climate Change (IPCC) introduced carbon tax and trade scheme in line with Kyoto protocol established by European Union (Butner et al., 2008). With

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

the recognition of IT industry accountable for 2 percent of global warming approximately equal to 820 million ton emissions per year the ICT product manufacturers were also restricted by regulations in reducing waste and hazardous substances during the manufacturing process (Simon Mingay, 2007, Hugh Wareham, 2009; CGI, 2010). As green IT adoption addresses a broad range of business sustainability most of the firms are adhering to these policies by implementing CSR strategy in their business operations (Chandrasekhar, 2009) while 55% of European organisations provide evidence with these strategies in position (nlyte software, 2011).

IT equipment particularly in the data centers are major power consumers which use 123,000 GWH of electricity across the world on an average equal to the power consumption of a small country such as Poland (Koomey 2007; Schmidt et al. 2009). Power consumption by data centers have doubled from 2000 and 2005, and increased by 40% by 2010 found energy cost will be higher than equipment cost by 2015 (nlyte software, 2011). As electricity is a major cause of climate changes, it is therefore clear that increased energy consumption has positive impact on green IT product purchase. The computing devices like PCs and monitors accounted for nearly 62% of total ICT energy consumption followed by enterprise communications infrastructure with 25% (Gartner, 2008). As stated by U.S Environmental Protection Agency, out of 25 billion computers and other electronic equipment sold since 1980 has generated 2 million tons of e-waste while only 15-20% of them were recycled (Ruth, 2009; Vetter and Creech, 2008; Poniatowski, 2009). It was also found India has generating 3.3 lakh tons of e-waste in 2007 with the expectation of 4.7 lakh tons in 2011 (Anand, 2009; UNEP 2007; Pinto, 2008). All these are found to be due to the lack of awareness on green IT among the people and it can be improved by government's strict regulations (Velte et al., 2008; Noushin et al., 2009; Stephen, 2006, Sania Khan et al., 2011). Computers and office electronics account for 40% of lead and 70% of heavy metals, in landfills leading critical disruption of natural resources (Hobby et al., 2009; Hayes, 1990). The green IT products despite minimising these issues delivers much more financial benefit over the time by lowering operating and maintenance costs, reduced power consumption, space consumption (Clifford, 2009; Dubie, 2009; and Castro, 2009). TCS provides evidence by 12.5% reduction in electricity consumption, 76MWH of solar energy generation, 1.5 cubic meters of water reuse, 28% and 67% of reduction in paper and printer cartridge consumption, leading 2% of carbon footprint reduction in 2007 and 2008 compared to the prior year (Anand, 2009). In relation to this consumers found better choice of eco IT equipment without entering them into the waste stream prematurely (Robert and Nora, 2009; Hobby et al., 2009; Consumer Electronics Association, 2008). In the United States, the EPEAT product registry is a major force in green IT procurement relatively decreasing energy consumption providing superior energy efficiency standards (CGI, 2010; Nordin, 2008). Consumers and corporate buyers recognised eco-labeling or certification programs such as TCO, Energy Star and Blue Angel as one of easiest methods to accurately determine the eco feature of ICT products which can offer additional financial benefits such as operational efficiency and cost reduction (Christopher et al., 2008; Hobby et al, 2009). The driving factors like attitude, desire and intention are much more considered when comes to actual purchasing decision with a better understanding of consumers' behaviour (Tim Flannery, 2010; Roberts, 1996; Yam-Tang & Chan, 1998; Ricky Chan, 2001).

Developed countries being much advanced in green IT issues, and among all South Korea expected to be a world leader in green technology by strictly practicing government policies, strong executive leadership and commitment of CSR (Castro, 2009). The most common green criteria for electronic product purchasing are: environmental performance with greater energy efficiency, durability, and energy rating (William et al., 2010). So the new technologies are coming up with IT operative performance which can

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

reduce power usage up to 75%, carbon emissions by 56%, functional performance by 55%, office space saving by 47% (Hobby et al. 2009; Murugesan, 2008).

Consumers who look for environmental information on labels found to have a better understanding on green products and their green purchasing intention is improving the market visibility with efficient and effective performance products (D'Souza et al., 2006; Schmidt et al, 2010; Hugh Wareham, 2009; CGI, 2010). Especially for green electronic products the present demand found to be 47% and expecting a future growth to 88% where the vendors and manufacturers delivering products in line with customer demands (Grail Research, 2009; Hugh Wareham, 2009). Further these consumer's green purchasing behaviour are driving other market players to encourage green criteria in their products to gain market share (Aysel Boztepe, 2012). The potential market for PC with green IT attributes found to be 26.6% by attracting new customers and gain extra revenues (Schmidt et al, 2010). Hence it can be said there exist a competition among IT product manufacturers towards green initiatives and promote their products with eco-label which can reduce 25% of GHG emissions (CGI, 2010; Grail Research, 2009). Hence a clear driver of green purchasing can develop a sustainability strategy in the organisation with a good impact on their day-to-day operations (Hugh Wareham, 2009; nlyte software, 2011; Nathalie, 2010).

Specially for green electronic products it was found environmental awareness, environmental related factors, attitude and intention towards green purchases has a causal link towards green purchasing behaviour with the influence of regulatory actions majorly (Tim Flannery, 2010; Hugh Wareham, 2009, Ishaswini & Saroj, 2011; Ricky Chan, 2001). So companies implementing green initiatives and financial recession situation have changed two-third of consumers to consider green purchases (Grail research, 2009).

Overall 15 enablers of green IT with respect to socioeconomic and environmental criteria are identified from the literature as shown in Table 1 with the appropriate category they belong to.

Table 1. Enabling factors for the green IT product purchasing

S. No	Enablers	Category
1	Environmental Consciousness	Environment
2	Kyoto Protocol	Environment, Social
3	Global Warming	Environment
4	Corporate Social Responsibility	Social
5	Power Consumption	Environment, Economic
6	E-wastage Disposal	Environment, Economic
7	Financial Benefits	Economic
8	Eco-labelling & Certifications	Environmental, Social
9	Psychological Factors	Social
10	Corporate Perception	Social
11	Performance	Environment, Economic
12	Consumer Demand and Preferences	Social
13	Market Players	Social
14	Sustainable Strategy	Social, Economic, Environment
15	Green Purchasing Behaviour	Social, Economic, Environment

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

INTEGRATED APPROACH OF DELPHI TECHNIQUE AND INTERPRETIVE STRUCTURAL MODEL

Interpretive Structural Modelling was first proposed by J. Warfield in 1974 to analyse the complex socioeconomic systems for identifying the relationships among specific items in a system. The ISM approach starts with an identification of elements which are relevant to the problem or issue. Then a contextually relevant subordinate relation is chosen. Having decided the contextual relation, a structural self-interaction matrix (SSIM) is developed based on pair-wise comparison of elements. After this, SSIM is converted into a reachability matrix (RM) and its transitivity is checked. Once transitivity embedding is completed, a matrix model is obtained. Then the partitioning of the elements and an extraction of the structural model called ISM is derived. Thus it can be seen ISM involves establishing relationship among the elements which are subjected to a series of subsequent processes to categorise the elements suitably and also develop structural relationships among various sets of elements. ISM modelling apart from providing insights into relationships between the various enablers also helps in developing the multi-level hierarchical structure based on the importance of each enabler and provides a visual representation of the scenario in the form of digraph. Therefore this approach is considered prudent and appropriate for this research study in developing a hierarchical structural model by undergoing set of steps in the process. Firstly the major inputs to the methodology are the elements and the relationships among them. The elements were already gathered from literature and to understand their relationship, pairwise comparison of the variables is done by involving a group of green IT experts in a Delphi study from Riyadh, Saudi Arabia.

OVERVIEW OF DELPHI TECHNIQUE

This technique involved twelve industrial experts in the field of green IT from Riyadh, Saudi Arabia in three rounds with an aim to obtain the consensus among expert's opinion towards the development of contextual relationships of the variables. For this a well-developed questionnaire in an excel template was developed with self-explanatory instructions to help them filling questionnaire. A relationship code system for filling the questionnaire was used with V, A, O, X alphabets with the conditions shown in Table 2.

Some conflicts also arised between the expert's opinions which was resoluted by giving them a feedback form after each round on the group opinion along with a new set of questionnaire to be answered in the succeeding round. This procedure provides panelists' an opportunity to review his/her opinions between each rounds. The iteration of this procedure was stopped at the third round as there were reasonable consensus among majority of the experts. The final opinion consensus were summarised and segregated in the form of a structural self-interaction matrix (SSIM) as shown in Table 2 for the further use in the development of ISM model. These final opinions are therefore directly used in developing initial reachability matrix by transforming the codes into binary digits 1's and 0's.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 2. Structural self-interaction matrix

Enablers	Description	15	14	13	12	11	10	9	8	7	6	5	4	3	2
1	Environmental Consciousness	V	V	X	V	O	O	V	X	O	A	A	X	A	X
2	Kyoto Protocol	V	V	V	V	O	O	O	V	O	A	A	V	A	
3	Global warming	V	O	V	V	O	O	V	V	O	A	A	V		
4	Corporate Social Responsibility	V	V	X	V	O	O	V	V	O	A	A			
5	Power consumption	V	O	V	V	V	O	V	V	O	V				
6	E-waste Disposal	V	O	V	V	A	V	V	V	O					
7	Financial Benefits	A	V	X	V	A	V	V	X						
8	Eco labelling and Certifications	V	V	X	V	A	V	V							
9	Psychological Factors	V	V	X	V	O	O								
10	Corporate perception	V	A	X	V	A									
11	Performance	V	V	V	V										
12	Consumer Demand & Preferences	V	X	X											
13	Market Players	X	A												
14	Sustainable Strategy	X													
15	Green Purchasing Behaviour														

V = element (i) leads to element (j) but element (j) is not leading to element (i). This is one-way relationship.
A = element (j) leads to element (i) but element (i) is not leading to element (j). This is one-way relationship.
X = both element (i) and element (j) lead to each other. This is two-way relationship.
O = both element (i) and element (j) does not lead to each other. This has no relationship.

INITIAL REACHABILITY MATRIX

The SSIM is converted into the Initial Reachability Matrix as in Table 3, which is a binary matrix with 1's and 0's. The rules for substitution of 1's and 0's are:

- If the (i, j) entry in the SSIM is V, then (i.j) entry in the Reachability matrix becomes 1 and (j, i) entry becomes 0;
- If the (i, j) entry in the SSIM is A, then (i.j) entry in the Reachability matrix becomes 0 and the (j, i) enry becomes 1;
- If the (i.j) entry in the SSIM is X, then (i, j) entry in the Reachability matrix becomes 1 and the (j, i) entry becomes 1;
- If the (i, j) entry in the SSIM is O, then (i, j) entry in the Reachability matrix becomes 0 and the (j, i) entry becomes 0.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 3. Initial reachability matrix

Enabler	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Driving Power
1	1	1	0	1	0	0	0	1	1	0	0	1	0	1	1	**8**
2	1	1	0	1	0	0	0	1	0	0	0	1	1	1	1	**8**
3	1	1	1	1	0	0	0	1	1	0	0	1	1	0	1	**9**
4	1	0	0	1	0	0	0	1	1	0	0	1	1	1	1	**8**
5	1	1	1	1	1	1	0	1	1	0	1	1	1	0	1	**12**
6	1	1	1	1	0	1	0	1	1	1	0	1	1	0	1	**11**
7	0	0	0	0	0	0	1	1	1	1	0	1	1	1	0	**7**
8	1	0	0	0	0	0	1	1	1	1	0	1	1	1	1	**9**
9	0	0	0	0	0	0	0	0	1	0	0	1	1	1	1	**5**
10	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	**4**
11	0	0	0	0	0	1	1	1	0	1	1	1	1	1	1	**9**
12	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	**4**
13	1	0	0	1	0	0	1	1	1	1	0	1	1	0	1	**9**
14	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	**5**
15	0	0	0	0	0	0	1	0	0	0	0	0	1	1	1	**4**
Dependency Power	**8**	**5**	**3**	**7**	**1**	**3**	**5**	**10**	**9**	**7**	**2**	**14**	**14**	**10**	**14**	

FINAL REACHABILITY MATRIX

The initial reachability matrix which is multiplied by itself till it achieve the state of transitivity is called final reachability matrix. The concept of transitivity is introduced so that some of the cells of the initial reachability matrix are filled by inference. The transitivity concept is used to fill the gap if any in the opinions collected during the development of the SSIM. In this case the entries are included to incorporate transitivity. One method of testing for transitivity is by multiplying initial reachability matrix by itself successively i.e., by raising the power of initial reachability matrix successively till two consecutive matrices become identical. After getting the final reachability matrix, the next step is to find the driving power (DRP) and dependence power (DEP) of each element as shown in Table 4. This is done by considering the sum of all 1's in the row to get DRP and in the column to get DEP.

LEVEL PARTITIONING OF THE REACHABILITY MATRIX

From the final Reachability matrix, the reachability and antecedent sets for each enabler are found. The reachability set consists of the element itself and the other elements in its row having digit-1, whereas the antecedent set consists of the element itself and the other elements in its column having digit-1. Thereafter, the intersection of these sets is derived for all the enablers. The enablers for whom the reachability and the intersection sets are the same occupy the top level in the ISM hierarchy. The top-level element in the hierarchy would not help achieve any other element above its own level. Once the top

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 4. Final reachability matrix

Enablers	ENVC	KYPL	GW	CSR	PCON	EWD	FB	ECOLC	PSYF	CPER	PER	CDP	MKTP	SSTG	GPB	Driving Power (DRP)
ENVC	1	1	0	1	0	0	1	1	1	1	0	1	1	1	1	**11**
KYPL	1	1	0	1	0	0	1	1	1	1	0	1	1	1	1	**11**
GW	1	1	1	1	0	0	1	1	1	1	0	1	1	1	1	**12**
CSR	1	1	0	1	0	0	1	1	1	1	0	1	1	1	1	**11**
PCON	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**15**
EWD	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	**13**
FB	1	1	0	1	0	0	1	1	1	1	0	1	1	1	1	**11**
ECOLC	1	1	0	1	0	0	1	1	1	1	0	1	1	1	1	**11**
PSYF	1	1	0	1	0	0	1	1	1	1	0	1	1	1	1	**11**
CPER	1	1	0	1	0	0	1	1	1	1	0	1	1	1	1	**11**
PER	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	**14**
CDP	1	1	0	1	0	0	1	1	1	1	0	1	1	1	1	**11**
MKTP	1	1	0	1	0	0	1	1	1	1	0	1	1	1	1	**11**
SSTG	1	1	0	1	0	0	1	1	1	1	0	1	1	1	1	**11**
GPB	1	1	0	1	0	0	1	1	1	1	0	1	1	1	1	**11**
Dependency Power (DEP)	**15**	**15**	**4**	**15**	**1**	**3**	**15**	**15**	**15**	**15**	**2**	**15**	**15**	**15**	**15**	**175**

level element is identified as shown in Table 5, it is separated out from the other elements. Then the same process is repeated to find out the elements in the next level. This process is continued until the level of each element is found as shown in Table 5. These levels help in building the digraph (directed graph) and the final model.

CLASSIFICATION OF ENABLERS USING MIC MAC ANALYSIS

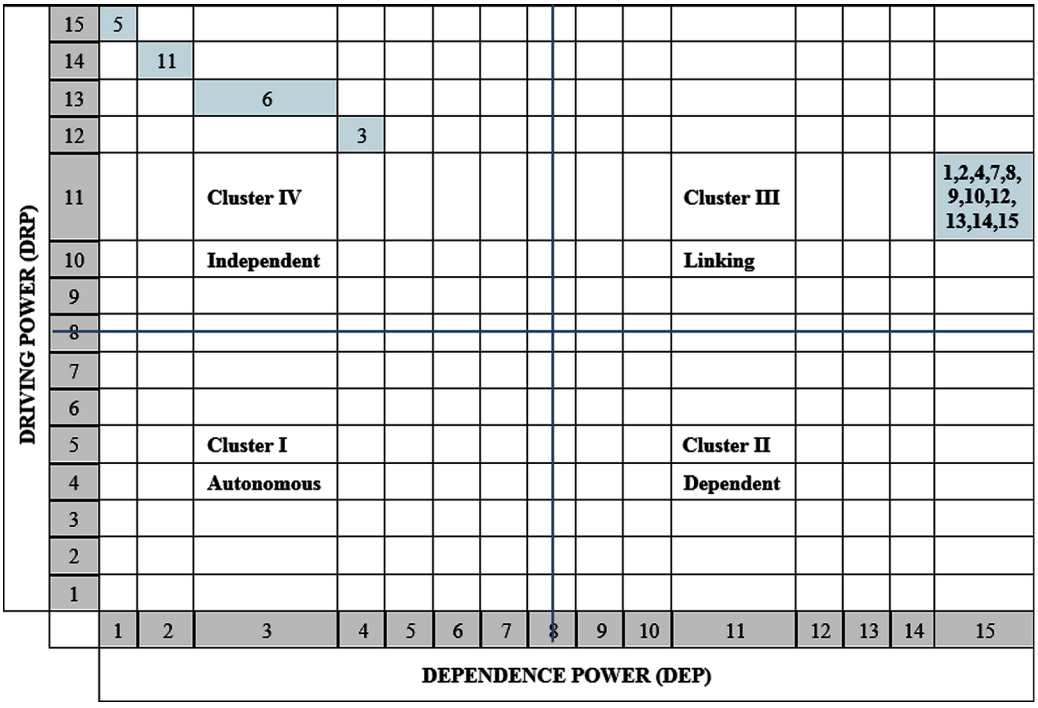
The purpose of classifying enablers is to analyse the driving power and dependence power of enablers (Mandal and Deshmukh, 1994). MIC MAC principle is based on multiplication properties of matrices (Sharma et al., 1995). Based on this the enablers are separated into four categories as autonomous enablers, dependent enablers, linkage enablers and independent enablers. The driving power and dependency power for each enablers is shown in Figure 1. In this classification of enablers, the first cluster is of autonomous enablers that have a weak driving power and weak dependency power. The autonomous enablers are relatively disconnected from the system. In this case there are no autonomous enablers. The second cluster consists of dependent enablers that have weak driving power and strong dependency power. In the present case there are no dependent enablers. The third group consists of linkage enablers that have strong driving and dependency power. Any action on these enablers will have an effect on the other enablers and also a feedback effect on themselves. In this case, enablers 1, 2, 4, 7, 8, 9, 10, 12, 13, 14 and15 are in this category of linkage enablers. The fourth cluster includes independent enablers that have strong driving power and weak dependence power. In this case enablers 3, 5, 6 and 11 are in the category of independent enablers.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 5. Partition of reachability matrix

Enabler	Reachability Set	Antecedent Set	Intersection	Level
1	1,2,4,7,8,9,10,12,13,14,15	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15	1,2,4,7,8,9,10,12,13,14,15	I
2	1,2,4,7,8,9,10,12,13,14,15	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15	1,2,4,7,8,9,10,12,13,14,15	I
3	1,2,3,4,7,8,9,10,12,13,14,15	3,5,6,11	3	II
4	1,2,4,7,8,9,10,12,13,14,15	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15	1,2,4,7,8,9,10,12,13,14,15	I
5	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15	5	5	V
6	1,2,3,4,6,7,8,9,10,12,13,14,15	5,6,11	6	III
7	1,2,4,7,8,9,10,12,13,14,15	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15	1,2,4,7,8,9,10,12,13,14,15	I
8	1,2,4,7,8,9,10,12,13,14,15	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15	1,2,4,7,8,9,10,12,13,14,15	I
9	1,2,4,7,8,9,10,12,13,14,15	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15	1,2,4,7,8,9,10,12,13,14,15	I
10	1,2,4,7,8,9,10,12,13,14,15	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15	1,2,4,7,8,9,10,12,13,14,15	I
11	1,2,3,4,6,7,8,9,10,11,12,13,14,15	5,11	11	IV
12	1,2,4,7,8,9,10,12,13,14,15	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15	1,2,4,7,8,9,10,12,13,14,15	I
13	1,2,4,7,8,9,10,12,13,14,15	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15	1,2,4,7,8,9,10,12,13,14,15	I
14	1,2,4,7,8,9,10,12,13,14,15	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15	1,2,4,7,8,9,10,12,13,14,15	I
15	1,2,4,7,8,9,10,12,13,14,15	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15	1,2,4,7,8,9,10,12,13,14,15	I

Figure 1. Cluster of green IT product purchasing enablers



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

ISM BASED DIGRAPH AND MODEL

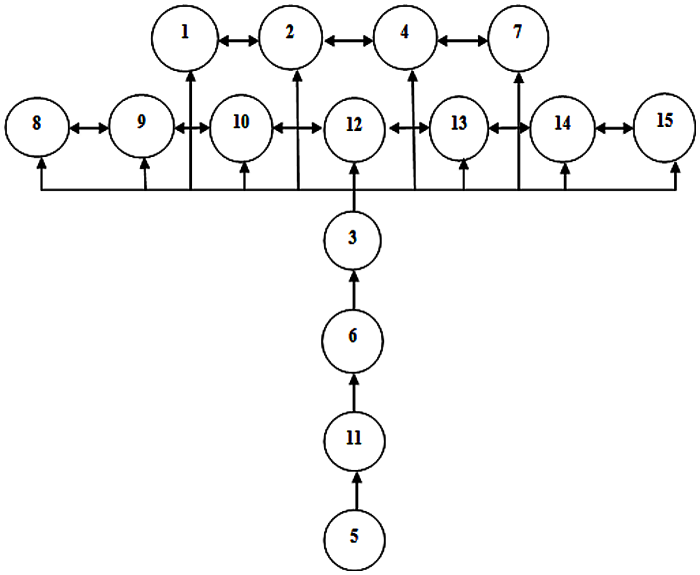
The structural model is generated by means of vertices and lines based on the relationship between the variables 'i' and 'j' as in Figure 2. Then the transitivities are removed to develop the digraph or directed graph. This graph is called as an initial directed graph or initial digraph. Directed arrows are used in digraph to depict the relationship. This process is carried out till the last level is reached and transitivity's are removed. The final digraph is converted into an ISM based model by replacing with the respective enablers as shown in Figure 3 illustrating the relation among each element.

It is necessary to understand the levels of green IT enablers for consumers' purchasing as presented in Figure 1. Enabler "power consumption" with high driving power and low dependence among other identified enablers is positioned at lowest level in the hierarchy of ISM based models. This is most important and independent enabler. Next comes the enablers' global warming, e-wastage disposal and performance in second, third and fourth levels in the hierarchy respectively. Eleven enablers as shown in digraph are with high dependence and low driving power hence they are placed on the top level in the hierarchy which is depending on the rest of all the enablers. The enablers in middle layers with high driving power are called "strategic enablers", which need greater consideration from the corporate IT sector. As autonomous variables have low driving power and low dependence power which does not exist in this case. They play less role in driving the green IT product purchasing. Other enablers have a vital role in green IT product purchasing and hence need to concentrate on all the suggested enablers.

CONCLUSION AND FUTURE IMPLICATIONS

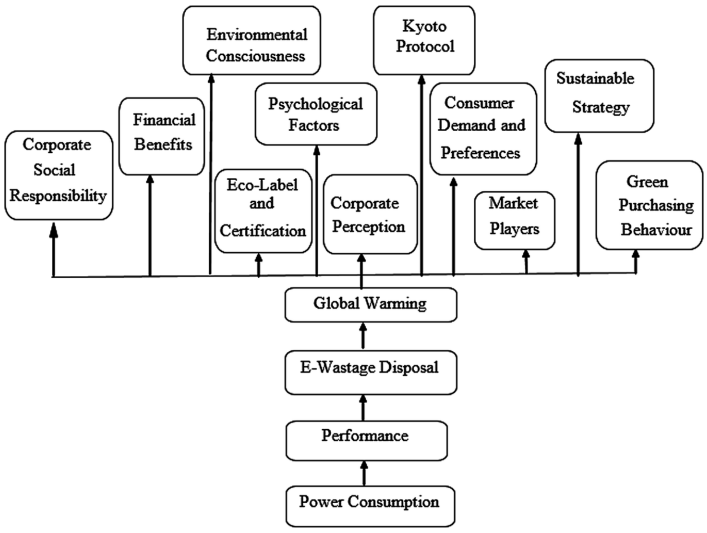
Although all the fifteen enablers in the ISM based model have their own importance towards green IT product purchasing after the enabler power consumption, e-wastage disposal, IT product performance and global warming have the highest driving power and less dependency power. So the other eleven factors

Figure 2. Final digraph depicting relationship between green IT enablers



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 3. Proposed model of green IT enablers for consumer purchasing



with moderate driving power and high dependency power in the model are highly dependent on these four enablers. In this study, only the key variables as enablers are identified and their interrelationships were developed and as the proposed model lacks scientific validation it is presented as the limitation of the study. Therefore further research studies may identify any other related underlying enablers in developing the present model of green IT enablers for consumer purchasing behaviour using ISM and test the validity of model empirically. Structural Equation Model (SEM) which sometimes referred as linear structural relationship approach can be used as a statistical tool.

REFERENCES

Anand S.S. (2009). Making IT Green – The TCS Way (White Paper). *TCS*.

Ansari, N.L., Ashraf, M., Malik, B.T., & Grunfeld, H. (2009). Green IT awareness and Practices: result from a field study on mobile phone related e-waste in Bangladesh. *Proceedings of the IEEE International Symposium on Technology and Society*.

Bachour, N., & Chasteen, L. (2010). *Optimizing the Value of Green IT Projects within Organizations*. IEEE.

BITKOM. (2009). Verbraucherachtenzunehmend auf Energie-und Umwelteigenschaften. Retrieved from http://www.bitkom.org/51996_51978.aspx

Boztepe, A. (2012). Green Marketing and its impact on Consumer Buying Behaviour. *European Journal of Economic and Political Studies*, *5*(1), 5–21.

Butner, K., Geuder, D., & Hittner, J. (2008). Mastering Carbon Management: Balancing Trade-Offs to Optimize Supply Chain Efficiencies. *IBM Institute for Business Value*.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Castro, D. (2009). Learning from the Korean Green IT Strategy, The Information Technology & Innovation Foundation Web Memo. Retrieved from http://www.greenbiz.com/research/report/2009/08/11/learning-korean-green-it-stratey

CGI group INC. (2010). Emerging trends in Green IT. Retrieved from http://www.cgi.com/files/pdf/cgi_whpr_84_emerging_trends_green_it_e.pdf

Chan, T.S. (1996). Concerns for environmental issues and consumer purchase preferences: A two-country study. *Journal of International Consumer Marketing*, 9(1), 43.

Clifford, A. (2009), Sustainable IT. it.toolbox.com. Retrieved from http://it.toolbox.com/blogs/minimalit/sustainable-it-30157

Consumer Electronics Association. (2008). Environmental Sustainability and Innovation in the Consumer Electronics Industry. Retrieved from www.ce.org

D'Souza, C., & Mehdi, P. (2006). An empirical study on the influence of environmental labels on consumers. *International Journal*, *11*(2), 162–173.

Donaton, S., & Fitzgerald, K. (1992). Polls Show Ecological Concerns is Strong. *Advertising Age*, *63*, 49.

Dubie, D. (2009, January 26). How to Cut IT Costs with Less Pain. In *Network world* (pp. 11- 40).

Flannery, T. (2010, October). The gap between consumer attitude and purchase behavior of eco-friendly products. Macquarie University, Sydney, Australia. Retrieved from http://blogs.panasonic.com.au/consumer/wp-content/uploads/2011/03/Panasonic-booklet.pdf

Gan, C., Han Yen Wee, Ozanne, L., Tzu Hui Kao. (2008). Consumers' purchasing behavior towards green products in New Zealand. *Journal of Innovative Marketing*, *4*(1), 93–102.

Gartner. (2008). *Sustainable IT, A Gartner Briefing*. Dublin: Gartner.

Grail Research. (2009, September). The Green Revolution. Retrieved from http://grailresearch.com/pdf/ContenPodsPdf/The_Green_Revolution.pdf

Harmon, R.R., & Auseklis, N. (2009). Sustainable IT Services: Assessing the Impact of Green Computing Practices. *Proceedings of PICMET*.

Hayes, D. (1990). The green decade. *The Amicus Journal*, *12*, 24–29.

Hobby, C., Rydel, N., Sjogren, E., & Williams, W. (2009). IT products – Going Beyond Green – Can High performance and Sustainability Co-exist, Sustainable Systems and Technology. *Proceedings of the ISST IEEE International symposium.*

Ishaswini, S. K. (2011). Pro-environmental concern influencing Green Buying: A study on Indian consumers. *International Journal of Business and Management*, *6*(6), 124–133.

Kerr, K. (1990). Thinking Green is No Longer a Hippie Dream. *Marketing week*, 31, 18-19.

Khan, Sania, & Razak, Abdul, H., and Krishna Kumar, V. (2011). Prioritization of Green IT Parameters for Indian IT Industry: Using Analytical Hierarchy Process, World. *Journal of Social Sciences*, *1*(4), 179–194.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Koomey, J.G. (2007). Estimating total power consumption by servers in the U.S. and the world (Final report). Stanford University.

Laroche, M., Bergeron, J., & Barbaro-Forleo, G. (2001). Targeting consumers who are willing to pay more for environmentally friendly products. *Journal of Consumer Marketing*, *18*(6), 503–520. doi:10.1108/EUM0000000006155

Mandal, A., & Deshmukh, S. (1994). Vendor selection using interpretive structural modeling (ism). *International Journal of Operations & Production Management*, *14*(6), 52–59. doi:10.1108/01443579410062086

Mines, C., & Davis, E. (2007, November 26). Topic Overview: Green IT. Forrester Research. Retrieved from http://www.forrester.com/Research/Document/Excerpt/0,7211,43494,00.html

Mingay, S. (2007, December 7). Green IT: The New Industry Shock Wave. Gartner Research. Retrieved from http://www.gartner.com/newsroom/id/503867

Molla, A. (2008). GITAM: A Model for the Adoption of Green IT. *Proceedings of the 19th Australasian Conference on Information System (ACIS)*.

Murugesan, S. (2008). Harnessing Green IT: Principles and Practices, IT Professional, IEEE. *Computers & Society*, 2008, 24–33.

Murugesan, S., & Gangadharan, G. R. (2012). Green IT: An Overview. In S. Murugesan & G. R. Gangadharan (Eds.), *Harnessing Green It: Principles and Practices*. Chichester, UK: John Wiley & Sons, Ltd; doi:10.1002/9781118305393.ch1

Nlyte software. (2011). Enabling the Green Data Center: Drivers, Benefits and Technology Enablers (White Paper 102).

Nordin, H. (2008). *Your Computer and the Climate*. Stockholm: TCO Development.

Pinto, V. N. (2008, May). E-waste hazard: The impending challenge. *Journal of Occupational and Environmental Medicine*, *12*(2), 65–70. doi:10.4103/0019-5278.43263 PMID:20040981

Poniatowski, M. (2009). *Foundations of Green IT: Consolidation, Virtualization, and ROI in the data center*. United States: Prentice Hall.

Ramasastry, C. (2009). *Green IT Matters at Wipro LTD*. Asia Case Research Centre, The University of Hong Kong.

Ricky Chan, Y.K. (2001). Determinants of Chinese Consumers Green Purchase Behavior. *Journal of psychology Marketing*, 18(4), 389-413.

Roberts, J. A. (1996). Green Consumers in the 1990s: Profile and implications for advertising. *Journal of Business Research*, *36*(3), 217–231. doi:10.1016/0148-2963(95)00150-6

Ruth, S. (2009, July). Green IT-More than a Three Percent Solution? *IEEE Internet Computing*, *13*(4), 74–78. doi:10.1109/MIC.2009.82

Sage, A. P. (1977). *Interpretive structural modeling: Methodology for large scale systems*. New York, NY: McGraw-Hill.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Schmidt, N.-H., Erek, K., Kolbe, L. M., & Zarnekow, R. (2009), Towards a Procedural Model for Sustainable Information Systems Management. *Proceedings of the 42th Hawaii International Conference on System Sciences 2009*, Hawaii, USA.

Sharma, H. D., Gupta, A. D., & Sushil. (1995). The objectives of waste management in India: A future inquiry. *Technological Forecasting and Social Change*, *48*(3), 285–309. doi:10.1016/0040-1625(94)00066-6

Sinnappan, P., & Rahman, A. A. (2011). Anteced of Green Purchasing Behavior Among Malaysian Consumers. *International Business Management*, *5*(3), 129–139. doi:10.3923/ibm.2011.129.139

Stern, N. (2006). Review on the Economics of Climate Change. HM Treasury and Cabinet Office: London. Retrieved from http:/www.sternreview.org.uk

Swoyer, S. (2006, November 14). The Greening of IT: Cutting Power Consumption is Just the Beginning, Enterprise Systems.

UNEP (United Nations Environment Programme). (2007). Global Environment Outlook – GEO4. Retrieved from http://www.unep.org/geo/geo4/report/GEO-4_Report_Full_en.pdf

Velte, T. J., Velte, A. T., & Elsenpeter, R. (2008). *Green IT: Reduce your Information System's Environmental Impact While Adding to Bottom Line*. New York: McGraw Hill Companies.

Vetter, T., & Creech, H. (2008), The ICT Sector and the Global Connectivity System: A sustainable development overview. The International Institute for Sustainable Development, IISD, Winnipeg. Retrieved from http://www.iisd.org/pdf/2008/ict_global_con_sd.pdf

Wareham, H. (2009, August). CEO – ECO Buy, Green Purchasing in Australia. Retrieved from http://www.ecobuy.org.au/uploads/documents/Green%20Purchasing%20Australia%20Report%20Summary%20Document.pdf

Warfield, J. W. (1974). Developing interconnected matrices in structural modeling, IEEE transcript on systems. *Men and Cybernetics*, *4*(1), 51–81.

Yam-Tang, E. P. Y., & Chan, R. Y. K. (1998). Purchasing behaviors and perceptions of environmentally harmful products. *Marketing Intelligence & Planning*, *16*(6), 356–362. doi:10.1108/02634509810237532

Young, W., Hwang, K., McDonald, S., & Oates, C. J. (2010). Sustainable Consumption: Green Consumer Behaviour When Purchasing Products. *Journal of Sustainable Development*, *18*, 20–31.

This research was previously published in the International Journal of Green Computing (IJGC), 6(1); edited by Vicente Gonzalez-Prida, pages 1-13, copyright year 2015 by IGI Publishing (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 20
Eco-Innovation Enablers and Typology in Green Furniture Manufacturing

Yudi Fernando
Universiti Sains Malaysia, Malaysia

Muhammad Shabir Shaharudin
Universiti Sains Malaysia, Malaysia

Wah Wen Xin
Universiti Sains Malaysia, Malaysia

ABSTRACT

Fierce competition has forced firms to be more creative and innovative to increase market share. Differentiating between green products or services with conventional products or services is one of the ways for firms to improve their business sustainability. The objective of this chapter is to explore the eco-innovation enablers and design its typology to measure the current green business practices in industry. Although there are many well-documented enablers or practices of eco-innovation that have been researched, this chapter focuses on practices that contribute towards the successful adoption of eco-innovation by one SME in green furniture manufacturing. This chapter uses the case study method as a source of data collection. Eco-innovation typology has been found in this study to define the effort of green company by looking at the target of eco-innovation versus the mechanism of eco-innovation.

The furniture industry will grow and prosper through constant innovation and improvements in the manufacturing process. (H. Mardiyanto, Central Java Governor, 2013)

INTRODUCTION

Firms today face a number of environmental challenges such as pollution, scarcity of natural resources, global warming, and a growing demand for environmentally-friendly goods. It is not a secret that environmental management, also known as eco-innovation (Kemp & Pearson, 2008), plays an important

DOI: 10.4018/978-1-5225-7915-1.ch020

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

role due to increasing climate change and uncontrollable business activities. Some many major business disasters include the 2011 earthquake and resulting tsunami in Japan, various earthquakes in Indonesia, flooding in Thailand, and pollution in China. It is no longer one nation's problem but rather a global concern in which such catastrophes mostly affect poor and developing countries. As such, it has an impact on the policymaking and rules in the business industry. However, considering social, economic, and environmental benefits alone is not sufficient as policies and businesses are also subject to political factors. Businesses are very concerned about expansion and profitability, and for any business to achieve this it has to ensure continuity in improvement and innovation (Schumpeter, 1934; Baumol, 2002).

This chapter has two objectives: 1) to explore the eco-innovation enablers in green furniture; 2) to design eco-innovation typology to measure the current green business practices in industry. Some of the drivers of eco-innovation from previous studies are discussed from past studies to guide the authors in identifying enablers. This chapter is organized by first explaining various types of eco-innovation definitions and concepts that would be useful to know when comparing the results of this chapter with previous research, as well as eco-innovation practices that are useful to SMEs. In this study we first reviewed the furniture industry in Indonesia and then selected a sample from a company that managed eco-innovation activities successfully. This company is also as a premier supplier of green furniture to overseas markets. As this is a case study, brief information concerning the firm is presented. Then, the chapter discusses the methodology used and several tools that helped in the analysis of the findings. Last, this chapter provides the discussion, limitations, recommendations for future studies and the conclusion. It is hoped our work concerning the eco-innovation practices in this SME will contribute to the existing eco-innovation concepts and practices, especially in understanding how SMEs in emerging markets can compete by undertaking eco-innovation.

LITERATURE REVIEW

Innovation

In extant management literature, innovation is perceived as a relatively new concept (Türker, 2012). However, innovation is no longer a new concept and phenomenon to popular belief. Türker (2012) argued that innovation is as old as humankind itself. According to Fagerberg, Mowery, and Nelson (2006), innovation seems to be something integrally "human" about the tendency to deliberate about better ways of doing things and practice in reality. This deep-rooted and well-established concept had been worked by scientists during the history of the social sciences.

According to Schumpeter (1934), innovation is defined as "to produce means to combine materials and forces within our reach. To produce other things, or the same things by a different method, means to combine these materials and forces differently". To explain the statement above, Schumpeter (1934) used the concept named "new combinations" for his explanation. It is a strong connection between the definition of innovation that commonly being adopted today and Schumpeter's "new combinations". The "new combinations" can be any new product with which customers are not familiar; a new technique of production that not yet being practised in the branch of manufacture concerned; a new supply source of raw materials and resources; a new target marketplace; or a new organization of any industry (Schumpeter, 1934). Therefore, "new goods" do not fully reflect the meaning of innovation.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Green Technology in Globalization

So-called "Green Technology" is an advance which includes various kinds of methodologies and materials enhancement ranging from techniques for generating energy to non-toxic cleaning products (Kamrudin Bakar et al., 2011). It is increasing the societal push for environmental friendly mechanisms to help reduce the impact resulting from fossil fuel consumption, landfill and industrial sector wastages since there are many studies discussing climate changes and global warming (Cheng & Shiu, 2012; Rennings, 2000).

According to Barlett and Trifilova (2010), the goals underlying the eco-innovation are defined as follows:

- "New or improved use of environmental resources" shows the alternatives which people can reduce waste and pollution by improved use of environmental resources or through the discovery of new uses of such resources;
- "Removing harmful environmental toxins" is concerned with how people can remove environmental pollutants which are potentially harmful to human health and;
- "Recycling" is concerned with how people can re-use the manufacture products and the creation of products from recycled materials.

Eco-Innovation

There seems to be various research conducted on eco-innovation linking business with environmental issues throughout the year. Initially, the eco-innovation definitions from empirical research are similar to the definitions of innovation but with the addition of environmental, economic and social value as its aspiration. The eco-innovation research paper of Kemp and Pearson (2008), which was supported by the European Commission, defined eco-innovation as the production, assimilation, or exploitation of a product, production process, service or management, or business method that is novel to the organization (developing or adopting it) and which results, throughout its life cycle, in a reduction of environmental risk, pollution and other negative impacts of the resources used (including energy use) compared to relevant alternatives (OECD, 2009).

Additionally, Oltra and Saint Jean (2009) also defined eco-innovation similar to the innovation definition of Schumpeter (1934) but with the goal of being to contribute to environmental sustainability. As the line between eco-innovation and innovation becomes thinner, more researchers have attempted to further distinguish the two. Foxon and Pearson (2008) defined sustainable innovation as innovation towards more sustainable technological and institutional systems, and processes broadly understood as systems for which the resources used and waste production remain within appropriate environmental limits through which socially acceptable levels of economic prosperity and social justice are achieved. Although most researchers and policy makers are well-acquainted with the concept of innovation, eco-innovation is a new concept for which a standardized definition does not yet exist (Kesidou & Demirel, 2010).

Kemp and Pearson (2008) provided an eco-innovation typology following diverse objectives. Eco-innovation is categorized in four different categories. Table 1 shows a comparison of four different typologies. The first category is the environmental technologies which are divided into eight subcategories. Environmental technologies are only a part of eco-innovation, and are not limited to it. The second category corresponds to organisational innovation with methods and management systems for dealing with environmental issues in production and products. The third category is product and service

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 1. Typology of eco-innovation

1. Environmental Technologies:
a. Pollution control technologies including waste water treatment technologies.
b. Cleaning technologies that treat pollution released into the environment.
c. Cleaner process technologies: new manufacturing processes that are less polluting and/or more resource efficient than relevant alternatives.
d. Waste management equipment.
e. Environmental monitoring and instrumentation.
f. Green energy technologies.
g. Water supply.
h. Noise and vibration control.
2. Organisational Innovation for the Environment:
a. Pollution prevention schemes: aimed at prevention of pollution through input substitution, more efficient operation of processes and small changes to production plants (avoiding or stopping leakages and the like).
b. Environmental management and auditing systems: formal systems of environmental management involving measurement, reporting and responsibilities for dealing with issues of material use, energy, water and waste such as EMAS and ISO 14001.
c. Chain management: cooperation between companies so as to close material loops and to avoid environmental damage across the value chain (from cradle to grave).
3. Product and Service Innovation Offering Environmental Benefits:
a. New or environmentally improved material products (goods) including eco-houses and buildings.
b. Green financial products such as eco-leases or climate mortgages.
c. Environmental services: solid and hazardous waste management, water and waste water management, environmental consulting, testing and engineering, other testing and analytical services.
d. Services that are less pollution and resource intensive.
4. Green System Innovations: Alternative systems of production and consumption that are more environmentally benign than existing systems: biological agriculture and a renewables-based energy system are examples.

Source: Kemp & Pearson (2008)

innovation which is offering environmental benefits such as new or environmentally improved products and environmentally beneficial services, whereas the last category includes green system innovation.

Drivers of Eco-Innovation

Traditional scholars believed regulation is an additional cost to firms which impacts the ability of firms to gain profit and reduces the competitiveness of the firm (Jaffe et al., 1995). However, this view has been challenged by authors such as Porter and van der Linde (1995), who stated that, in a static world, firms make the decision whether to seek social responsibility (not polluting the environment) or business growth (profit maximization). Furthermore, real world competition is more vigorous and innovation is important because it can offset the cost incurred by the firm. There are five major drivers found to be main determinants of eco-innovation in the extant literature. Table 2 shows the distribution over the time period and it provides the reader with essential information about the literature sample. From the following tables, this study found that the five drivers (regulation, technology, cross-functional coordination, supplier involvement, and market focus) are important for eco-innovation.

- **Regulation:** It is acknowledged that strict regulations and policies enhance the decision of firms to engage in eco-innovation and increase firm performance (Doran & Ryan, 2012). However, there are two views regarding the impact of regulation on firm performance. Since the main concern of businesses is about profit maximization and increasing shareholder's wealth, a traditional view, also known as the cost-based view, argues that if managing the environment is profitability, then firms would long seek to pursue eco-innovation (Jaffe et al., 1995). Porter and van der Linde

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 2. Descriptive analysis of article review

Reviewed Papers	Aim/Main Topic
Sub-field 1: General reviews eco-innovation • OECD (2008) • Horbach (2008) • OECD (2009) • Santolaria et al. (2011) • Boons et al. (2012)	Linking economy, society, environment Determinants of eco-innovations by type of environmental impact Sustainable Manufacturing and Eco-Innovation Eco-design in innovation driven companies Sustainable innovation, business models and economic performance
Sub-field 2: Regulation • Brunnermeier and Cohen (2003) • Beise and Rennings (2005) • Horbach (2008) • Khanna et al. (2009) • Kammerer (2009)	Determinants of environmental innovation in US Lead markets and regulation Determinants of environmental innovation The role of management systems and regulatory pressures The effects of customer benefit and regulation on environmental product innovation
Sub-field 3: Technology • Rennings (1998) • Baumol (2002) • Horbach (2008) • Khanna et al. (2009) • Doran and Ryan (2012)	Towards a theory and policy of eco-innovation The free-market innovation Machine Determinants of environmental innovation The role of management systems and regulatory pressures Regulation and firm perception, eco-innovation and firm performance
Sub-field 4: Supplier involvement • Hult and Swan (2003) • Rao and Holt (2005) • Georgiadis and Besiou (2008) • Arundel and Kemp (2009)	Research on product development and supply chain management Green supply chain lead to competitiveness and economic performance Sustainability closed-loop supply chains Measuring eco-innovation
Sub-field 5: Market focus • Day and Wensley (1988) • Kohli and Jaworski (1990) • Pujari (2006) • Piercy (2009) • Hermosilla et al. (2010)	A framework of diagnosing competitive superiority Construct, proposition and implications of market orientation Eco-innovation and new product development Change of market-led strategic Diversity of eco-innovations with selected case studies
Sub-field 6: Firm specific • Love and Roper (1999)	The determinants of innovation

(1995) believed that firms are able to gain a competitive advantage over non-eco-innovation adoption firms once they have become more expert at reducing or removing pollution, while complying with regulation and improving their products or services that can affect the environment. Eco-innovation regulation drives firms to reduce the cost to firms in the future as well as gain a competitive advantage over other firms.

- **Technology:** The technology driver is essential in the initial development phase of eco-innovation (Horbach, 2008). This statement refers to the capability of firms to gain core competencies or increase their profitability through new products or services that are derived from the adoption of new technology. Technology comes from investment in knowledge, which, ultimately, will introduce more innovation (Baumol, 2002). That is why many Multinational Corporations (MNCs) allocate budgets for the Research and Development (R&D) department to acquire more knowledge.
- **Supplier:** By learning from consumers (forward linkages), suppliers (backward linkages), competitors (horizontal linkages) and universities (private linkages) (Roper et al., 2008), firms can develop the knowledge and skills necessary for innovation. On the supplier side, eco-innovation practice is possible if firms and suppliers together adopt a greener perspective (Doran & Ryan, 2012).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- **Market:** Horbach (2008) discovered there is great demand for eco-innovation products, processes and management systems, while Jansson et al. (2011) stated that customer perception is an important indicator for innovation adoption. Such research shows that a firm's innovation is greatly linked to the marketing of its green products or services to customers. Thus, marketing is one of the reasons why firms adopt eco-innovation practices, and is one of the earliest and strongest reasons why firms adopt eco-innovation in the first place.
- **Firm Specific:** Factors such as the size of the firm and industry to which the firm belongs have a different impact on the performance and innovation of the firm (Love & Roper, 1999). Therefore, SMEs with flexible decision making, a lean organizational structure, and less bureaucratic communication are able to respond to changes or develop innovative products or higher quality services. However, industries such as the automobile and pharmaceutical industries where resources such as financial capital play an important role would be disadvantageous for SMEs to operate and become competitive.

Since all eco-innovation practices that are deemed important to the firm have been identified, this chapter will discuss the Indonesia furniture industry, the firm involved for this chapter and the methodology used.

Indonesia Furniture Market Overview

Indonesia is renowned for its traditional culture. Indonesians are very fond of their culture and beliefs, and one of the characteristics of Indonesian furniture or handicraft is that it resembles their culture and heritage. Interestingly, there are different styles or designs for furniture and handicraft across Indonesia due to the many ethnic groups in Indonesia of which the majority is Javanese. According to the Indonesia Furniture Industry and Handicraft Association (Tjahyono, 2007), there are clusters of solid wood and furniture production in the Java and Bali regions. The solid wood industry in Indonesia is not well-developed and the Java region has trouble obtaining a solid wood supply. Accordingly, Tjahyono (2007) also mentioned that wood processing industries are scattered in Sumatera, Kalimantan, Sulawesi, and Papua. This explained why two out of three KWaS (this study's example firm located in Yogyakarta, Indonesia) suppliers for Forest Stewardship Council (FSC)-certified wood are from Kalimantan. Additionally, the majority of furniture manufacturers are SMEs, while ASEAN reported there are approximately 4,000 furniture firms in Indonesia (Global Indonesia Guide, 2013).

The furniture industry in Indonesia is a labour-intensive and segmented with SMEs. In central Java alone, KWaS comprised a total of 26.5% of furniture production while over half of the rattan furniture production is based in Cirebon, a port city north of Java (IFMAC, 2012). As timber is one of the commodities exported to other countries, it is understandable that ASMINDO, the International Furniture & Craft Fair Indonesia (IFFINA), the National Handicraft Council (DEKRANAS), and the ASEAN Furniture Industries Council (AFIC) were created to develop the furniture and handicraft industries.

In Indonesia, furniture manufacturers are segmented in Java Island where wood furniture, rattan furniture, and panes furniture are manufactured. However, the other regions in Indonesia are rich in wood supply. Indonesia is the world's largest rattan producer and has abundant supply of teak wood. Moreover, Indonesia exports reached US$2.2 billion in 2011 and are expected to reach US$2.7 billion in 2012. Previously, the furniture industry has only been an export-driven business until lately when consumer purchasing power increases and rises of middle class people in Indonesia enabled them to increase

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

consumption and home ownership (Global Business Indonesia, 2013). According to Tjahyono (2007), domestic sales of furniture and housewares are worth over US$700 million annually. This explained how SME furniture manufacturers could sustain themselves in the furniture industry.

Since China can produce furniture at low cost, the Indonesian furniture industry faces stiff competition. Nevertheless, Indonesia furniture is still produced at a lower cost because the supply of wood is circulated in Indonesia alone and this advantage has helped Indonesian SMEs furniture manufacturers to produce furniture at a competitive price. Furthermore, Indonesian furniture is also unique in terms of design rather than competing on cost. Nonetheless, in 2014, the large Swedish firm IKEA will open its first franchise in Indonesia due to demand by local consumers (The Jakarta Post, 2012). International market remains the profitable market with a total of 58.1% of Indonesia total export from furniture exports (Global Indonesia Guide, 2013).

Many furniture manufacturing firms seek to open business in Indonesia because some 85% of all rattan is made there and Indonesia is rich with timber such as teak, bamboo, and plywood in addition to natural materials such as water hyacinth. An interesting fact regarding furniture demand is that it is seasonal in the local market, especially during festive seasons such as Eid Fitri (Global Indonesia Guide, 2013).

In order to do improvements and innovates in the production process, there is a need to implement green practices, especially in furniture manufacturing. This is because competition in the furniture industry is very stiff. As more international firms can penetrate into the Indonesia market, local firms such as our example firm (KWaS) needed to go to another level. As green practices in furniture manufacturing are still in the infant stage, local firms need to adopt eco-practices earlier to sustain long-term competitive advantage. Malaysia, Indonesia, Philippines, Thailand, and Vietnam are five strong emerging economies which manufacture furniture not only for export, they also import from other countries.

Green Industry Indonesia

Green industry can be in the shape of various criteria such as clean production, energy conservation, resource efficiency, and adopt eco-design and low carbon technology. The Indonesian government has contrived to introduce more incentives such as tax allowance to develop its green industry in Indonesia (The Jakarta Globe, 2013). Nonetheless, the incentives for "going green" are still feeble (POS Kota, 2013). Furthermore, the Chamber of Commerce and Industry (Kadin) has confirmed that only several SMEs are benefitting from the green incentives provided by the government (Suara Merdeka, 2013). The government is attempting to boast green incentive in Indonesia by giving discounts for equipment and machines to prosper green business (Embassy of Indonesia, 2013).

WWF-Indonesia Conservation Director Nazir Foead said in Indonesia there are only 1.1 million Hectares (Ha) of FSC-certified forest, or 2% of the total Indonesian production forest. However, since 2009 the Borneo Initiative has facilitated 26 companies with a total of 2.6 million Ha for FSC-certification (Lang, 2007). FSC is the only green incentive for furniture industry, even though it is expensive. The Indonesian government has made it mandatory for local firms to implement a Timber Legality Verification System (TLAS) by the end of 2013 as this regulation has a unique capability to meet European Union (EU) Timber regulations. Nonetheless, both certifications are more of a guideline rather than for incentives.

Applying FSC and TLAS can ensure sustainable business in the long-term and regulation is one of the most important factors for green practices. This indicates that environmental awareness is still lacking in Indonesia because most firms still seek to maintain their business financially. Eco-innovation has been addressed to better manage resources for the environment, society, and economy. Realistically, the

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Indonesian government should focus on green incentives in term of green economics more so that firms can achieve its objective. The Global Green Growth Institute (2014) stated that the green economic development strategy should refer to the four pillars of growth; namely: pro-growth, pro- business, pro-poor, and pro-environment. After satisfying these pillars, then more local firms will be more incline towards eco-innovation.

Outlook of Indonesia Furniture Industry

The Indonesian government predicts the nation's economy will grow 7% in year 2012 and ASMINDO Chairman, Mr. Ambar Tjahyono, states the furniture industry in Indonesia will grow due to demand by the USA, Japan, and 27 EU nations have increased their demand for furniture following the recovery of the global economy (IFMAC, 2012). However, a study by Zainuri, Waridin, Santoso, and Susilowati (2012) on the performance and the prospect of SME of furniture industry in Jepara, Central Java found that the furniture industry structure has a monopolistic competition. This is due to many SMEs competing in a segmented market on Java Island while most firms practice product differentiation. Firms engage in differentiation due to many competitors in an industry; thus, every firm must produce a unique or quality product to attract customers.

Nevertheless, the marketplace is changing after the global economic recovery. International consumers are more demanding as a survey also found that consumers now request product specification, meaning the barrier to entry will be much higher in the future. More firms need to invest in technology and meeting customer specification to sustain the business, so green certificates such as FSC and TLAS will make Indonesian furniture manufacturers more competitive.

METHODOLOGY

The Organization for Economic Co-Operation and Development (OECD) is a forum where governments from 30 countries collaborate to address economic, social, and environmental issues. As such, attention has been drawn towards eco-innovation, and the OECD has developed its own definition, framework, practices, and measurement of eco-innovation to expand the study. The typology tool is a framework to study eco-innovation targets and mechanisms by identifying products and processes, organizations and marketing methods, and institutions as eco-innovation targets with modification, re-design alternatives, and creation as standard mechanisms for eco-innovation.

This chapter uses the case study method as a source of data collection. Karya Wahana Sentosa (KWaS) is a pioneer in furniture manufacturing, and is currently active in promoting green practices. KWaS, a firm located in Yogyakarta, Indonesia with over 80 employees, produces four containers of furniture monthly. Data was obtained from company reports and interviews with key informants in the company such as the managing director, production managers, logistics managers, and sales and marketing managers. The data was collected and analyzed by the authors. The literature review was used as a guideline for the interpretation of data. A framework developed by OECD (2009) called Eco-innovation Typology was used to position KWaS based on its understanding and practices at the firm. The typology tool is a framework to paper the eco-innovation target and mechanism. This tool identified 'products and processes', 'organizations and marketing' 'methods and institutions' as eco-innovation targets while 'modification', 're-design alternatives' and 'creation' are standard mechanisms for eco-innovation. By

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

classifying the firm's position according to the target and mechanism, this chapter is able to determine the level of eco-innovation and on what improvements the firm needs to focus.

Results

Based on the interviews with key informants and document reviews, we found that the several steps of eco-innovation adoption related to the eco-innovation enablers in the company. Some of the results include the following:

1. **Regulation:** This is a key factor for eco-innovation practices. We found that regulation is the key factor for eco-innovation enabler in the company. This relates and to meets the demand from the market to be served. To meet the criteria set by the international market, companies must change the business strategy and production processes.
2. **Technology:** The use of environmentally-friendly technology is also the basis for the creation of furniture products which are manufactured without causing negative effects to the environment. The company stopped using any toxic chemicals in the production of its products and reduced usage of synthetic materials. The company is now using equipment approved by local authorities and has passed international certification. Machineries used have met standards for environmentally-responsible equipment and materials.
3. **Supplier Involvement:** The company learned from suppliers to improve knowledge of the eco-innovation. Supplier informs about the latest technologies and international regulation on green products. Suppliers also contribute to the quality of product. The company is working with the University to share knowledge and find new method to improve the quality of products produced and environmentally friendly production.
4. **Firm Specific:** The company has changed the company's vision and mission as a producer of green furniture which produce product quality. The company is also changing production methods which are more efficient and lower cost.
5. **Market Orientation and Focus:** The company also frequently gets consumer feedback on specification of product they want and continuously improve the production process. The concept of built to order and online ordering system are introduced to responses the market demand.
6. **Green Network:** The company actively establishes and develops cooperation with external parties such as government agencies, Non-Governmental Organizations (NGOs), and international trade agencies to expand green furniture markets, especially in developed countries.

KWaS Steps/Stages of Eco-Innovation Adoption

KWaS adopted eco-innovation and began when the firm was in financial difficulty and required something "special" to survive. The KWaS eco-innovation implementation timeline is as below:

2004: On the day of restructuring the business by Robertus Agung, KWaS changed its vision and mission to reflect more of an image of green furniture manufacturer to attract more international consumers.

2004: After KWaS changed its organizational structure, Robertus Agung placed put more effort in creating KWaS network of customers and suppliers. This is the start of "Green Networking" practice at KWaS.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

2005: Collaboration with IFC-PENSA, part of the International Finance Corporation for sustainable wood program, brings KWaS closer to eco-innovation. This program was introduced to increase the supply of sustainable legal wood in the market as well as to use alternative material in furniture manufacturing.

2006: KWaS joined WWF-Indonesia to expand its knowledge and network in using sustainable legal wood. This program however, focuses on supporting producers to use Acacia Mangium wood.

2007: As the firm actively participating in international fairs, KWaS accumulated enough experience to understand customer's preference for sustainable furniture. KWaS won the "Sustainable Home Furnishing Design" competition this year, providing the company with more confidence and motivation to fully implement eco-innovation.

2009: KWaS yet again received aid from international organization, this time from the USA in capital and knowledge transfer to support a creation of sustainable business in developing country through New Venture Indonesia.

2009: KWaS earned the FSC-COC (Chain of Command) certificate, thus requiring the firm to comply with tough and substantial requirements to separate between sustainable and normal wood. This is the year in which KWaS fully adopted eco-friendly practices.

2012: FSC influences in green industry seem to trigger Indonesian government to start its own regulation on sustainable legal wood regulation. This is a starting point for Indonesia to strengthening the infrastructure and promotes green policy.

Based on the findings, it is understood that the understanding of eco-innovation from the perspective of KWaS is quite similar to previous research that has been conducted (Fussler & James, 1996; Little, 2005; Charter & Clark, 2007; Kemp & Pearson, 2008; OECD, 2009). Our research found all of these components to be the same except one new factor that can contribute to the existing knowledge of eco-innovation. During the data collection, the Managing Director of KWaS explained the current activities of eco-innovation which provided us with an understanding of eco-innovation. Our findings define eco-innovation as follows:

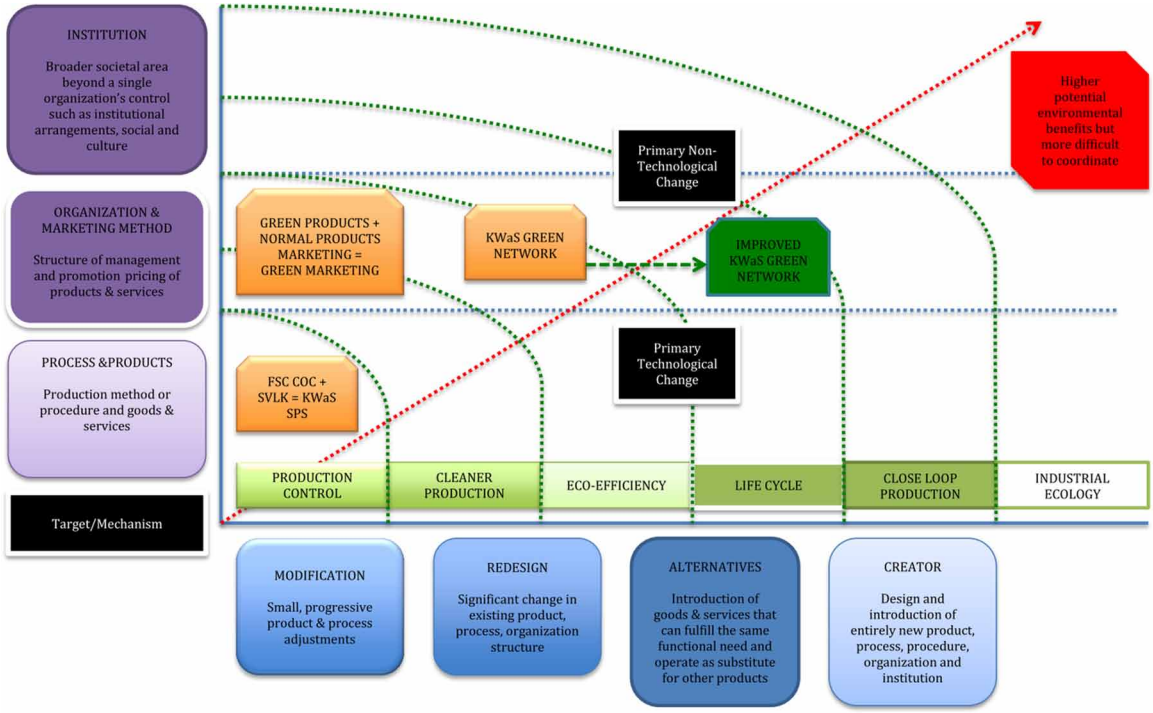
Eco-innovation is mostly about producing raw materials from legal natural resources (supply of sustainable legal wood), which are transformed to become a green product (producing green furniture) utilizing certain technology and procedures. Eco-innovation shall consider the concepts of cost management and recycling without any negative effect on the environment (market push-for cost effective and efficiency in production that does not harm the environment). The final product also needs to obtain approval and certificates from the respective agency (regulations for environment, social and economic benefits) and target the local and international markets that need the product (market pull).

Hence, managing this element can help KWaS sustain its business, as it was also part of the KWaS customer network. Furthermore, there is a need to determine the strength of the position of KWaS in green innovation ecology and how the firm can improve its business and position. Using the OECD eco-innovation typology enables us to show the position of KWaS according to the eco-innovation practices at the company with an internationally recognized eco-innovation acceptable tool. This is useful for future comparison and improvements as shown in Figure 1.

Eco-innovation typology can be used to define the effort of KWaS in eco-innovation by viewing the target of eco-innovation versus the mechanism of eco-innovation. As shown in Figure 1, the company's efforts in green marketing are classified as the organization and marketing method and modification mechanism. This means the manner in which KWaS quotes for both green furniture and normal furniture

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 1. Eco-innovation typology



at an agreeable customer price is seen as a part of small and progressive product or process adjustment. The connotation of this marketing method is regarded as a minor eco-innovation practice that contributes towards the sustainability of the firm in the furniture industry.

The ability of KWaS to work well with its network consisting of green suppliers and customers has proven to be substantial according to the typology. If KWaS is able to integrate more suppliers or customers, it will be more challenging and difficult to coordinate but it could put KWaS in a better position, enabling the firm to prolong the production lifecycle of the products and create alternative products or services in innovative ways. Our research also found that the synergy between the suppliers and business partners will lower the production cost and meet the expectations of the customers' green consciousness.

Discussion

SMEs still lack an understanding of the concept of eco-innovation and sometimes do not have a clear standard how best to apply the techniques of eco-innovation. In this chapter, we have outlined some of the enablers that can help SMEs apply the concept of eco-innovation. These include five eco-innovation enablers such as regulation, technology, supplier involvement, firm specific, market orientation and focus, and a green network. In this chapter, we also have discussed eco-innovation typology to measure the attainments of the company in applying eco-innovation.

Previous findings postulated that the network is a mediating factor to foster eco-innovation while our research shows that the green network is one of the main drivers of eco-innovation practices, and, hence, should be put into practice from the beginning of the business or production process. As the firm continues to reap the benefits through its green network, this driver is an inseparable part of the

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

eco-innovation drivers to sustain in the green industry, especially in an emerging market. SMEs will find it difficult to sustain in the green business without fully utilizing the green network to market their products, as this mechanism helps to make the production cost cheaper and reach a wider target market.

The argument is that green products are perceived as a luxury lifestyle product rather than a part of social responsibility to promote environmental sustainability, especially in emerging markets such as Indonesia and Malaysia. In contrast, green-conscious consumers in developed countries such as Canada, France, Germany, Italy, Japan, Spain, the UK, and the USA are willing to pay 5-10 percent more for green products (Manget et al., 2009) because of their high quality perception concerning green products and as part of their responsibility to support environmental care causes. Today, not only are businesses required to take care of the environment, but consumers are also required to support green initiatives.

KWaS furniture is built to order only when the firm's representative (usually the owner) meets potential customers then the customer can customize the furniture according to their needs. Implementing online ordering systems such as that found in the Texas-based Dell Computer Company enables customers to choose the material, components, design, measurement, and additional items for furniture almost everywhere via Internet connection. This system also permits customers to know the price of their custom-made furniture and the desired delivery method. Online ordering systems should be able to capture customer demand or innovation and record of type of materials, components and additional information for KWaS to forecast demand.

While it can be argued that the definition of the green network falls between networking and the green supply chain, it must not be mistaken for a green supply chain as the green network is about sharing knowledge, contacts and fostering a relationship between the supplier and customer with the firm to sustain in the green industry. Although Hermosilla et al. (2010) argued that the diverse contexts of different connotations of eco-innovation may eventually reduce its practical value, as more research regarding green network as a driver of eco-innovation surface in the future, it is expected that the concept will be much clearer, especially in the SME environment.

Future Work and Conclusion

In the future, more research should be done to identify and strengthen knowledge of green networking. In addition, green networking should be associated more with eco-innovation to enhance its relationship. After all, contributes towards business sustainability. Furthermore, more research should occur in emerging markets where technology and huge investments on R&D and innovation are expensive and limited. As a result, firms seek other alternatives to reduce cost. One way to reduce cost while being innovative and considering the environment is to practice lean management (reducing waste) while continuing to improve and innovate by considering customer demands. Such activity is also more practical and affordable for small firms. Additionally, more research should focus on the contribution of SMEs towards eco-innovation and its impact on society as a whole because SMEs with their limited resources are responsible for improving society's quality of life and are regarded as an engine for the economic growth of a country. A country such as Indonesia has the potential to be one of the top producers of green furniture since it is blessed with rich natural resources and a large number of SMEs. Hence, there is a high demand to conduct further studies in this area.

Firms must also continuously add value to their products or services by considering current and future consumer trends. This case study shows that a firm, especially an SME, needs strong support from the government in terms of regulation and policies to encourage them to be innovative. The lack

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

of proper infrastructure and support led to KWaS implementing eco-innovation practices on their own initiative and paying for an expensive FSC certificate which remains limited in its function. The success of the green network that KWaS and its suppliers and customers formed has helped all parties involved to remain in the green business.

By practicing eco-innovation, it is expected that society will benefit from increasing the quality of life and future generations will not suffer from the scarcity of natural resources and pollution. It is understood that in a static world, as explained by Porter and van der Linde (1995), firms will try to balance between profitability and environmental care. However, in the real world it is difficult to find the right balance. As such, both researchers and practitioners have shown that by committing to eco-innovation, firms can create a "win-win" situation as the end results of adopting eco-innovation are profitability and less pollution to the environment.

REFERENCES

Arundel, A., & Kemp, R. (2009). *Measuring eco-innovation*. Netherlands: United Nations University.

Barlett, D., & Trifilova, A. (2010). Green technology and eco-innovation: Seven case studies from a Russian manufacturing context. *Journal of Manufacturing Technology Management*, *21*(8), 910–929. doi:10.1108/17410381011086757

Baumol, W. (2002). *The Free-Market Innovation Machine – Analysing the Growth Miracle of Capitalism*. Princeton, NJ: Princeton University Press.

Beise, M., & Rennings, K. (2005). Lead markets and regulation: A framework for analyzing the international diffusion of environmental innovations. *Ecological Economics*, *52*(1), 5–17. doi:10.1016/j.ecolecon.2004.06.007

Boons, F., Montalvo, C., Quist, J., & Wagner, M. (2012). Sustainable innovation, business models and economic performance: An overview. *Journal of Cleaner Production*, 1–8.

Brunnermeier, S. B., & Cohen, M. A. (2003). Determinants of environmental innovation in US manufacturing industries. *Journal of Environmental Economics and Management*, *45*(2), 278–293. doi:10.1016/S0095-0696(02)00058-X

Charter, M., & Clark, T. (2007). *Sustainable Innovation. Sustainable Design*. Retrieved June 13, 2012, from: http://cfsd.org.uk/Sustainable%20Innovation/Sustainable_Innovation_report.pdf

Cheng, C. C., & Shiu, E. C. (2012). Validation of a proposed instrument for measuring eco-innovation: An implementation perspective. *Technovation*, *32*(6), 329–344. doi:10.1016/j.technovation.2012.02.001

Day, G. S., & Wensley, R. (1988). Assessing advantage: A framework of diagnosing competitive superiority. *Journal of Marketing*, *52*(2), 1–20. doi:10.2307/1251261

Doran, J., & Ryan, G. (2012). Regulation and firm perception, eco-innovation and firm performance. *European Journal of Innovation Management*, *15*(4), 421–441. doi:10.1108/14601061211272367

Fagerberg, J., Mowery, D. C., & Nelson, R. R. (2006). *The Oxford Handbook of Innovation*. London: Oxford University Press. doi:10.1093/oxfordhb/9780199286805.001.0001

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Foxon, T., & Pearson, P. (2007). Overcoming barriers to innovation and diffusion of cleaner technologies: Some features of a sustainable innovation policy regime. *Journal of Cleaner Production*, *16*(1), 148–161. doi:10.1016/j.jclepro.2007.10.011

Fussler, C., & James, P. (1996). *Eco-innovation: A Breakthrough Discipline for Innovation and Sustainability*. London: Pitman Publishing.

Georgiadis, P., & Besiou, M. (2008). Sustainability in electrical and electronic equipment closed-loop supply chains: A System Dynamics approach. *Journal of Cleaner Production*, *16*(15), 1665–1678. doi:10.1016/j.jclepro.2008.04.019

Global Green Growth Institute. (2014). *Indonesia's Green Growth Program to include Private Sector and Civil Society in new Steering Committee*. Retrieved January 23, 2013, from: http://gggi.org/indonesias-green-growth-program-to-include-private-sector-and-civil-society-in-new-steering-committee/

Global Indonesia Guide. (2013). *Indonesia's Furniture & Homeware Sector*. Retrieved July 19, 2013, from: http://www.gbgindonesia.com/en/manufacturing/article/2012/indonesia_s_furniture_and_homeware_sector.php

Hermosilla, J., Rio, P., & Konnola, T. (2010). Diversity of eco-innovations: Reflections from selected case studies. *Journal of Cleaner Production*, *18*(10-11), 1073–1083. doi:10.1016/j.jclepro.2010.02.014

Horbach, J. (2008). Determinants of environmental innovation - New evidence from German panel data sources. *Research Policy*, *37*(1), 163–173. doi:10.1016/j.respol.2007.08.006

Hult, G. T., & Swan, S. K. (2003). A research agenda for the nexus of product development and supply chain management processes. *Journal of Product Innovation Management*, *20*(6), 333–336. doi:10.1111/1540-5885.00039

IFMAC. (2012).*Overview of Indonesia.* Furniture Manufacturing Components Show. Retrieved September 4, 2013, from: www.ifmac.net/images-en/Overview%20of%20Indonesia.pdf

Jaffe, A., Peterson, S., Portney, P., & Stavins, R. (1995). Environmental regulation and the competitiveness of US manufacturing: What does the evidence tell us? *Journal of Economic Literature*, *33*(1), 132–163.

Jansson, J., Marell, A., & Nordlund, A. (2011). Exploring consumer adoption of a high involvement eco-innovation using value-belief-norm theory. *Journal of Consumer Behaviour*, *10*(1), 51–60. doi:10.1002/cb.346

Kamarudin Bakar, M., Tahir, H., Rajiani, I., & Muslan, N. (2011). Green Technology Compliance in Malaysia for Sustainable Business Development. *Journal of Global Management, 2*(1).

Kammerer, D. (2009). The effects of customer benefit and regulation on environmental product innovation. empirical evidence from appliance manufacturers in Germany. *Ecological Economics*, *68*(9), 2285–2295. doi:10.1016/j.ecolecon.2009.02.016

Kemp, R., & Pearson, P. (2008). *Final Report MEI Project about Measuring Eco-innovation: Deliverable 15 of MEI project (D15)*. Retrieved March 26, 2013, from: http://www.merit.unu.edu/MEIS

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Kesidou, E., & Demirel, P. (2010). On the drivers of eco-innovations: Empirical evidence from the UK. *Research Policy*, *41*(5), 862–870. doi:10.1016/j.respol.2012.01.005

Khanna, M., Deltas, G., & Harrington, D. R. (2009). Adoption of pollution prevention techniques: The role of management systems and regulatory pressures. *Environmental and Resource Economics*, *44*(1), 85–106. doi:10.100710640-009-9263-y

Kohli, A. K., & Jaworski, B. J. (1990). Market orientation: The construct, research propositions and managerial implications. *Journal of Marketing*, *54*(2), 1–18. doi:10.2307/1251866

Lang, C. (2007). *Banks, Pulp and People A Primer on Upcoming International Pulp Projects*. Retrieved June 21, 2012 from: http://www.greenpressinitiative.org/documents/bankspulppeople.pdf

Little, A. D. (2005). How leading companies are using sustainability-driven innovation to win tomorrow's customers. *Innovation High Ground Report.*

Love, J., & Roper, S. (1999). The determinants of innovation: R&D, technology transfer and networking effects. *Review of Industrial Organization*, *15*(1), 43–64. doi:10.1023/A:1007757110963

Manget, J., Roche, C., & Munnich, F. (2009). *Capturing the green advantage for consumer companies*. Retrieved June 16, 2013, from: http://www.bcg.com/documents/file15407.pdf

OECD. (2008). *Linking economy, society, environment*. New York: McGraw-Hill.

OECD. (2009). *Sustainable Manufacturing and Eco-Innovation: Framework, Practices and Measurement*. Paris: OECD.

Oltra, V., & Saint Jean, M. (2009). Sectoral systems of environmental innovation: An application to the French automotive industry. *Technological Forecasting and Social Change*, *76*(4), 567–583. doi:10.1016/j.techfore.2008.03.025

Piercy, N. (2009). *Market-Led Strategic Change: Transforming the Process of Going to Market* (4th ed.). Oxford, UK: Butterworth-Heinemann.

Porter, M., & van der Linde, C. (1995). Toward a new conception of the environment competitiveness relationship. *The Journal of Economic Perspectives*, *9*(4), 97–118. doi:10.1257/jep.9.4.97

Pujari, D. (2006). Eco-innovation and new product development: Understanding the influences on market performance. *Technovation*, *26*(1), 76–85. doi:10.1016/j.technovation.2004.07.006

Rao, P., & Holt, D. (2005). Do green supply chains lead to competitiveness and economic performance? *International Journal of Operations & Production Management*, *25*(9), 898–916. doi:10.1108/01443570510613956

Rennings, K. (1998). Towards a theory and policy of eco-innovation: Neoclassical and (Co-) Evolutionary Perspectives. *ZEW Discussion Paper*, 98-124.

Rennings, K. (2000). Redefining innovation - eco-innovation research and the contribution from ecological economics. *Ecological Economics*, *32*(2), 319–332. doi:10.1016/S0921-8009(99)00112-3

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Roper, S., Du, J., & Love, J. (2008). Modeling the innovation value chain. *Research Policy*, *37*(7), 961–977. doi:10.1016/j.respol.2008.04.005

Santolaria, M., Sola, J. O., Gasol, C. M., Pinzon, T. M., & Rieradevall, J. (2011). Eco design in innovation driven companies: Perception, predictions and the main drivers of integration. The Spanish example. *Journal of Cleaner Production*, *19*(12), 1315–1323. doi:10.1016/j.jclepro.2011.03.009

Schumpeter, J. A. (1934). *The Theory of Economic Development*. Cambridge, MA: Harvard University Press.

Suara Merdeka. (2013). *Kadin: Pemerintah Harus Fokus Turunkan Defisit.* Retrieved from December 19, 2013 from: http://m.suaramerdeka.com/index.php/read/news/2013/12/19/183937

The Jakarta Globe. (2013). *Government Considers Incentives to Turn the Economy Green*. Retrieved on December 25, 2013 from: http://www.thejakartaglobe.com/news/government-considers-incentives-to-turn-the-economy-green/

Tjahyono, A. (2007). *The Readiness of Asmindo Member for SVLK Implementation*. Retrieved December 18, 2013, from: http://www.illegal-logging.info/sites/default/files/Ambar%20Tjahyono.pdf

Türker, C. (2012). Patent trolls and technology diffusion. *TILEC Discussion Paper No. 2012-030.*

Zainuri, M. W., Santoso, P. B., & Susilowait, I. (2012). The Performance and Prospect of Small Medium Enterprises of Furniture Industry in Jepara Regency, Central Java, Indonesia. In *Proceedings of 2012 2nd International Conference on Business and Economics Research.* Academic Press.

KEY TERMS AND DEFINITIONS

Built to Order: The furniture produces when customer ordered and paid. This system is able to let customers know the price of their custom made furniture and the delivery method they want.

Eco-Innovation: Innovative in production process which consent to a reduction of environmental risk and benefited to society and stakeholders.

Green Industry: Can be in the shape of various criteria such as clean production, energy conservation, resource efficiency, and adopt eco-design and low carbon technology.

Green Network: Falls between networking and the green supply chain, it must not be mistaken for a green supply chain as the green network is about sharing knowledge, contacts and fostering a relationship between the supplier and customer with the firm to sustain in the green industry.

Online Ordering System: Is system to capture customer demand and record of type of materials, components and additional information for company to forecast the demand.

Typology: Is a framework to study eco-innovation target and mechanism. This tool identified 'products and processes', 'organizations and marketing' 'methods and institutions' as eco-innovation targets while 'modification', 're-design alternatives' and 'creation' are standard mechanisms for eco-innovation.

This research was previously published in the Handbook of Research on Global Business Opportunities edited by Bryan Christiansen, pages 416-431, copyright year 2015 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 21
Cloud Computing Technologies for Green Enterprises:
Fundamentals of Cloud Computing for Green Enterprises

Parkavi Ravi
Thiagarajar College of Engineering, India

Priyanka Chinnaiah
Thiagarajar College of Engineering, India

Sheik Adullah Abbas
Thiagarajar College of Engineering, India

ABSTRACT

Green computing, also called green equipment, is the environmentally sustainable to use of computers and related resources like - monitors, printer, storage devices, networking and communication systems - effectively with minimal or no impact on the environment. Green cloud is a catchphrase that refers to the potential environmental benefits that information technology (IT) services delivered over the Internet will present society. The word combines the words green meaning environmentally gracious and cloud, the traditional image for online and the shortened name for a type of service delivery model known as cloud processing.

INTRODUCTION

Green Enterprise Computing refers to how business or corporate sectors can deal with the vision of Green computing to manage power utilization and boost energy efficiency. Green Computing or Green IT is the study and practice of using computing resources in an ecological manner to tone down the environmental impacts of computing. All these, in turn, bring up the issue of reducing immoral use of resource and power Green computing whose goals are to reduce the use of perilous materials, maximize

DOI: 10.4018/978-1-5225-7915-1.ch021

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

energy efficiency during the product's lifetime, and promote the recoverability or biodegradability of redundant products and factory waste. Computers today not only used in offices but also at homes. This can be called as Green Computing. We use Green Computing because it reduced energy usage from green computing techniques translates into lower carbon dioxide emissions, stemming from a decline in the fossil fuel used in power plants and transportation, Conserving resources means less energy is required to produce, use, and order of products, saving energy and resources saves money. Green computing even includes changing government policy to promote recycling and lowering energy use by individuals and businesses.

Green Cloud computing can be used to manage efficient processing and utilization of computing infrastructure and reduce energy consumption. It is needed for ensuring that the future development of Cloud computing is supportable else, cloud computing with growing front-end client devices interacting with back-end data centers will begin a huge escalation of energy usage. Green Computing is also defined as designing, manufacturing/engineering, using and disposing of computing devices in a way that reduces their environmental impact. IT department is usually always the one department that uses the majority amount of power which in turn is an unnecessary amount of "Green computing" represents environmentally responsible way to reduce power and ecological e-waste. Virtualization, Green Data Centre, Cloud computing, grid computing, Power optimization are the technologies of green computing. Main goals of green computing are to condense the use of poisonous and hazards materials and progress the energy efficiency, recycling of factory waste. Cloud Computing is a model for delivering services in which resources are retrieved from the internet through web-based tools and applications, rather than a shortest connection to a server. Data is stored in servers. Cloud computing structure allows access to information as long as an electronic device has access to the web. This type of system allows human resources to work distantly. It enables hosting of applications from consumer, scientific and business domains. But data centers hosting cloud computing applications consume enormous amounts of energy, causal to high operational costs and carbon footprints to the environment. With energy shortages and global climate modify leading our concerns these days; the power consumption of data center has become a key issue. Therefore, green cloud computing solutions saves energy as well as reduces operational costs. The vision for power resourceful management of cloud computing environments. Such practice expert implementation of server and peripherals as well as decrease the power consumption. It shows how to use resources proficiently and how to reduce the waste Green computing is the requirement to save the energy with the operating cost.

GREEN COMPUTING

Green computing is the ecological use of computers and correlated resources. Such practices include the execution of energy-efficient central processing units, servers, peripherals as well as reduced resource expenditure and proper disposal of electronic waste. Green computing is a study and practice of designing, industrialized, using, and disposing of computers, servers, and associated subsystems such as monitors, printers, storage devices, and networking and interactions systems resourcefully and efficiently with minimal or no impact on the environment." The goals of green computing are similar to green chemistry; reduce the use of hazardous materials, make the most of energy efficiency during the product's lifetime, and promote the recyclability or bidegradability of defunct products and factory waste.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Research continues into key areas such as making the use of computers as energy-efficient as possible, and designing algorithms and systems for efficiency-related computer technologies.

There are several approaches to green computing namely

- Algorithmic efficiency
- Resource allocation
- Virtualization
- Power management

NEED OF GREEN COMPUTING IN CLOUDS

Modern data centers, in service under the Cloud computing model are hosting a multiplicity of applications ranging from those that run for a few seconds to those that run for longer periods of time on collective hardware platforms. The need to manage multiple applications in a data center creates the challenge of on-demand reserve provisioning and allocation in response to time-varying workloads. Normally, data center capitals are statically allocated to applications, based on peak load characteristics, in order to maintain isolation and provide performance guarantees. Recently, high performance has been the individual concern in data center deployments and this require has been fulfilled without paying much deliberation to energy consumption. The average data center exhaust as much energy as 25,000 households. As energy costs are increasing while availability dwindles, there is a need to shift focus from optimizing data center resource management for sterilized performance to optimizing for energy efficiency while maintaining high service level performance.

Data centers are not only luxurious to maintain, but also unsociable to the environment. Data centers now drive more in carbon emissions than both Argentina and the Netherlands. High energy costs and huge carbon footprints are incurred due to huge amounts of electricity needed to power and cool numerous servers hosted in these data centers. Cloud service providers need to adopt measures to ensure that their profit margin is not considerably reduced due to high energy costs. For instance, Google, Microsoft, and Yahoo are building large data centers in unproductive desert land s the Columbia River, USA to exploit cheap and reliable hydroelectric power.

Lowering the energy convention of data centers is a demanding and composite issue because computing applications and data are increasing so quickly that progressively larger servers and disks are desirable to process them fast enough within the essential time period. Green Cloud computing is envisioned to achieve not only well-organized processing and utilization of computing infrastructure, but also minimize energy utilization. This is essential for ensuring that the future growth of Cloud computing is sustainable. Otherwise, Cloud computing with increasingly persistent front-end client devices interacting with back-end data centers will cause an huge acceleration of energy usage.

To address this problem, data center resources need to be managed in an energy well-organized manner to drive Green Cloud computing. In particular, Cloud resources need to be allocated not only to satisfy QoS requirements specific by users via Service Level Agreements (SLA), but also to decrease energy usage.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

GREEN CLOUD SERVICES

- **Infrastructure as a Service (IaaS):** "Infrastructure as a Service (IaaS)", delivers computer infrastructure – A platform virtualization environment - as a service. Rather than purchasing servers, software, data-center space or network tackle, clients instead as a fully outsourced service.
- **Desktop as a Service (DaaS):** With DaaS, deployment and management of the desktop environment is beginner's. Data and applications are accessed from beginning to end a virtual environment, allowing businesses and providers to support, patch and maintain one environment rather than managing personage desktops during an organization. And, with one central environment, data is more secure while still allowing users the elasticity to choose between working on desktop or mobile devices.
- **Software as a Service (SaaS):** "Software as a Service (SaaS), sometimes referred to as "software on demand," is software that is deployed over the internet and/or is deployed to run behind a firewall on a local area network or personal computer.
- **Disaster Recovery as a Service (DRaaS):** Serve Restore, our cloud disaster recovery solution for on-premise physical servers, is often called our better than backup solution. With Serve Restore, our engineers prebuilt a fully designed virtual environment for your data. When disaster strikes, we fully manage the recovery of your servers, construct them to run within our cloud environment in just a combine of hours.
- **Backup as a Service (BaaS):** Green Clouds backup solution powered provides a remote, secure, cloud based storage destination for obtainable server infrastructures.

ENERGY SAVINGS IN THE CLOUD

Here are some of the ways that the cloud can help a corporation cut its carbon footprint down to size:

- **Fewer Machines:** With the cloud, server deployment rates are typically 60-70%, while in many small business and industry environments, exploitation rates hover around 5 or 10%. As a result, shared data centers can employ small number machines to get the same capacity.
- **Equipment Efficiency:** Larger data centers frequently have the resources to allow them to improve to energy-saving equipment and building systems. Usually, this is not an option in smaller organizations where this good organization is not the focus.
- **Consolidated Climate Control Costs:** In order for a server to run at its the highest point performance, its temperature and humidity level must be suspiciously controlled, and cloud providers can use high density efficient layouts that are unbreakable for in-house centers to reproduce.
- **Dynamically Allocated Resources:** In-house data centers need extra servers to handle peak data loads, and cloud providers can enthusiastically allocate resources where fundamental in order for fewer machines to sit idle. Cloud computing has massive potential to transform the world of IT: reducing costs, improving efficiency and business agility, and s to a more sustainable world.

There are basically four main entities involved in the Green Cloud Computing Environment:

1. **Consumers:** Cloud consumers suggest service requirements from anywhere in the world to the Cloud. It is main to notice that there can be a difference between Cloud consumers and users of

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

deployed services. For occurrence, a consumer can be a company deploying a Web application, which presents unreliable workload according to the number of users accessing it.

2. **Green Resource Allocator:** Acts as the interface between the Cloud infrastructure and consumers. It requires the communication of the following components to support energy-well-organized resource management:
    a. **Green Negotiator:** Negotiates with the consumers/brokers to complete the SLA with specified prices and penalties (for violations of SLA) between the Cloud provider and consumer depending on the consumer's QoS requirements and energy reduction schemes. In case of Web applications, for illustration, QoS metric can be 95% of requirements being served in less than 3 seconds.
    b. **Service Analyzer:** Interprets and analyses the service requirements of a submitted request before deciding whether to accept or reject it. Hence, it needs the most modern load and energy information from VM Manager and Energy Monitor respectively.
    c. **Consumer Profiler:** Gathers specific characteristics of customers so that important clients can be granted particular privileges and prioritized over other clients.
    d. **Pricing:** Decides how service requests are charged to manage the supply and demand of computing resources and facilitate in prioritizing service allocations effectively.
    e. **Energy Monitor:** Study and resolve which physical machines to power on/off.
    f. **Service Scheduler:** Assigns requests to VMs and determines resource privilege for allocated VMs. It also decides when VMs are to be added or uninvolved to meet demand.
    g. **VM Manager:** Keeps track of the availability of VMs and their resource privilege. It is also in charge of migrating VMs across physical machines.
    h. **6. Accounting:** Maintains the actual usage of resources by requests to compute usage costs. Historical usage information can also be used to improve service allocation decisions.
3. **VMs:** Multiple VMs can be enthusiastically started and stopped on a single physical machine to meet accepted requests, hence providing maximum flexibility to construct various partitions of resources on the same physical machine to different explicit requirements of service requests. Multiple VMs can also parallel run applications based on different operating system environments on a single physical machine. In addition, by dynamically migrating VMs crosswise physical machines, workloads can be consolidated and unexploited resources can be put on a low-power state, turned off or construct to operate at low-performance levels (e.g., using DVFS) in order to save energy.
4. **Physical Machines:** The underlying physical computing servers present hardware infrastructure for creating virtualized resources to meet service demands.

CLOUD COMPUTING MORE GREEN ENTERPRISES

Three approaches have been tried out to build cloud computing environments more environmental friendly. These approaches have been tried out in the data centers under experimental conditions. The methods are:

- **Dynamic Voltage Frequency Scaling Technique (DVFS):** Each electronic circuitry will have an operating clock related with it. The operating frequency of this clock is familiar so that the supply voltage is synchronized. Thus, this method heavily depends on the hardware and is not convenient

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

according to the unreliable needs. The power savings are also low compared to other approaches. The power savings to cost acquire ratio is also low.

- **Resource Allocation or Virtual Machine Migration Techniques:** In a cloud computing environment, each physical machine hosts a number of virtual machines engaging which the applications are run. These virtual machines can be transferred across the hosts according to the varying needs and accessible resources. The VM migration method focuses on transferring VMs in such a way that the power increase is least. The most power well-organized nodes are selected and the VMs are transformed across to them. This method is dealt in detail later.
- **Algorithmic Approaches:** It has been experimentally resolute that an ideal server consumes about 70% of the power utilized by a fully utilized server.

Using a neural network interpreter, the green scheduling algorithms first estimates required dynamic workload on the servers. Then preventable servers are turned off in order to minimize the number of running servers, thus minimizing the energy use at the points of utilization to present benefits to all other levels. Also, several servers are added to help reassure service-level agreement. The bottom line is to protect the environment and to condense the total cost of ownership while ensuring quality of service.

VM Migration

The problem of VM distribution can be divided in two: the first part is admission of new requests for VM provisioning and placing the VMs on hosts, whereas the second part is optimization of current allocation of VMs.

Optimization of present allocation of VMs is carried out in two steps: at the first step, we select VMs that need to be migrated, at the second step chosen VMs are located on hosts using MBFD algorithm. We propose four analytical methods for choosing VMs to migrate. The first methodical, Single Threshold (ST), is based on the idea of setting upper utilization threshold for hosts and placing VMs while maintenance the total utilization of CPU below this threshold. The aim is to preserve free resources to prevent SLA violation due to consolidation in cases when exploitation by VMs increases. At each time frame all VMs are reallocated using MBFD algorithm with further condition of keeping the upper utilization threshold not violated. The new placement is achieved by live migration of VMs.

The other three analytical are based on the idea of setting upper and lower utilization thresholds for hosts and maintenance total utilization of CPU by all VMs between these thresholds. If the utilization of CPU for a host goes less than the lower threshold, all VMs have to be migrated from this host and the host has to be switched off in order to remove the idle power consumption. If the utilization goes over the upper threshold, some VMs have to be migrated from the host to reduce exploitation in order to prevent probable SLA violation. We propose three policies for choosing VMs that have to be migrated from the host.

- **Minimization of Migrations (MM):** Migrating the smallest number of VMs to minimize migration in the clouds.
- **Highest Potential Growth (HPG):** Migrating VMs that have the lowest usage of CPU reasonable to the requested in order to minimize total potential increase of the utilization and SLA violation.
- **Random Choice (RC):** Choosing the essential number of VMs by alternative them according to a uniformly distributed random variable.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

FEATURES OF CLOUDS ENABLING GREEN COMPUTING

Cloud Infrastructure has developed to a key environmental disquiet keeping in view of energy consumption and carbon production. The key technology for power efficient Clouds is "Virtualization", development of presenting a logical grouping or subset of computing resources so that they can be accessed in ways that give benefits over the unusual configuration.

The following are the four key factors that have enabled the Cloud Computing to lower power usage and carbon radiation from ICT. In this way, organizations can reduce carbon radiation at last 30% per user by moving their applications to the cloud.

1. **Dynamic Provisioning:** In long-established settings, IT companies end up deploying far more infrastructure than desired. It is very difficult to forecast the demand at a time and to warranty availability of services and to maintain confident level of service quality to end users. The virtual machines in a Cloud infrastructure can be live migrated to another host in case user application requires more property. Cloud providers observe and expect the demand and thus allocate resources according to demand. Those applications that require less number of resources can be consolidated on the same server. Thus, datacenters always continue the active servers according to current demand, which results in low energy consumption than the traditional approach of over-provisioning.
2. **Multi-Tenancy:** Cloud computing infrastructure reduces on the whole energy usage and associated carbon emissions. The SaaS providers serve multiple companies on same infrastructure and software. This approach is obviously more energy efficient than multiple copies of software installed on different infrastructure, which can minimize the need for extra infrastructure. The smaller variation in demand results in better prediction and results in greater energy savings.
3. **Server Utilization:** Using virtualization technologies, several applications can be hosted and executed on the same server in separation, thus lead to utilization levels up to 70%. Even though high exploitation of servers results in more power consumption, server running at higher operation can process more workload with similar power usage.
4. **Datacenter Efficiency:** The power efficiency of datacenters has main impact on the total energy usage of Cloud computing. By using the most energy well-organized technologies, Cloud providers can considerably improve the Power Usage Effectiveness (PUE) of their datacenters. Cloud computing grant services to be moved involving multiple datacenter which are running with better PUE values. This is achieved by using high speed network, virtualized services and dimension, and monitoring and accounting of datacenter.

APPROACHES TO GREEN COMPUTING

Green Data Center

Practical requirement of data centers are as follows:

- Provide a physical secure position for server.
- Should provide all-time network connectivity in data center.
- Should provide essential power to operate all equipment.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Characteristics:

- Design must be simple.
- Design must be scalable.

The design should be scalable because once it is finalized it must work for any size of computer center:

- Design must be modular.
- Design must be flexible.

Virtualization

Virtualization, a term that used a variety of techniques, methods or approaches to create a virtual environment, such as a virtual hardware platform, virtual operating system (OS), storage device, or network resources.

Challenges

Complexities of licensing are the issue with virtualization. For instance, a Linux based server offers a virtualized windows server must satisfy licensing requirements. Because of this licensing issue flexibility of virtualization and benefits of on demand virtualization is in a weak position. Some venders of proprietary software have attempted to update licensing scheme to address the virtualization but flexibility and cost issues are opposing requirements. Virtualized desktop results in trust on centralized servers (for computing and SAN storage) and the network (and higher-bandwidth requirements). Dependency on centralized server and network leaves the end users vulnerable to server. The user able to operating locally through an outage, but when user logs off or reboots the machine it become dead This is in contrast with thick clients where the user locally operates continually until the connectivity can be restored:

1. **Product Longevity:** Gartner maintains that the PC developed process accounts for 70% of the natural resources used in the life cycle of a PC. Therefore, the biggest involvement to green computing usually is to broaden the equipment's lifetime. Another report from Gartner recommends to "Looking for product longevity, including upgradability and modularity. "For instance, manufacturing a new PC makes a far bigger environmental footprint than manufacturing a new RAM module to improve an existing one.
2. **Data Center Design:** Data center services are heavy consumers of energy. The U.S. Department of Energy estimates that data center services consume up to 100 to 200 times more energy than standard office buildings. According to the U.S. Department of Energy, Information technology (IT) systems, Environmental settings, Air management, Cooling systems and Electrical systems are the primary areas on which to focus energy proficient data center design best practices.
3. **Software and Deployment Optimization:** It includes algorithmic effectiveness, resource allocation, workstation servers and virtualization. The efficiency of algorithms has an impact on the amount of computer resources essential for any known computing function and there are many efficiency trade-offs in writing programs. Allocating resources according to the energy can be saved. With virtualization, a system administrator could merge a number of physical systems into virtual ma-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

chines on one single, powerful system, by this means unplugging the original hardware and dropping power and cooling disbursement. Virtualization should be able to support distributing work so that servers are either busy or put in a low-power sleep state. Terminal servers have also been used in green computing. When using the system, users at a terminal connect to a central server; all of the authentic computing is done on the server, but the end user experiences the operating system on the terminal. These can be combined with thin clients, who use up to 1/8 the amount of energy of a common workstation, resulting in a decrease of energy costs and consumption.

4. **Power Management:** The Advanced design and Power Interface (ACPI), an open industry standard, allows an operating system to straight control the power-saving aspects of its fundamental hardware. This allows a system to automatically revolve off components such as monitors and hard drives after set periods of inactivity. In addition, a system may hibernate, when most components (including the CPU and the system RAM) are turned off. ACPI is a successor to an previous Intel-Microsoft standard called Advanced Power Management, which allows a computer's BIOS to control power management functions. Some programs allow the user to physically adjust the voltages complete to the CPU, which reduces both the amount of heat produced and electricity consumed. This process is called under volt. Some CPUs can automatically under volt the processor, depending on the workload; this technology is called "SpeedStep" on Intel processors.
5. **Materials Recycling:** Recycling computing tools can keep destructive materials such as lead, mercury, and hexavalent chromium out of landfills, and can also replace equipment that otherwise would need to be pretend, saving further energy and emissions.
6. **Telecommuting:** Teleconferencing and telepresence technologies are often implemented in green computing resources. The advantages are many; improved worker satisfaction, decrease of greenhouse gas emissions related to travel, and increased income margins, resulting from lower overhead costs for office space, heat, lighting, etc.
7. **Telecommunication Network Devices Energy Indices:** The energy expenditure of information and communication technologies (ICTs) is today important even when compared with other industries. Recently some study tried to identify the key energy index that allows a relevant comparison between different devices (network elements). This analysis was focus on how to optimize device and network consumption for carrier telecommunication by itself. The target was to allow an immediate observation of the relationship between the arrangement technology and the environmental impact.

Need of Virtualization for Green Computing

Cloud computing cannot be always appropriate for ecology. The recent studies confirmed that rely on a server is in the main more environmentally friendly, although care must be taken to a entire sequence of parameters to compute the best real efficiency of the cloud. In other words, the data centers force on real environment by producing heat. It is also important to keep in mind that a data center has a more environmental collision than a system. The research was based on setups those include virtualization and without virtualization. It is found that on-site server with no virtualization will emit about 46kg of CO2 per year. If data is stored on the public cloud whose servers are not that well-organized, those servers are not well used and use electricity from higher carbon-emitting sources. Thus, there will be some practices by which servers can be run with greener solutions. Also, studies also proved that cloud systems are more energy capable and carbon efficient than that of an ordinary system. It consists of a

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

concept of use of virtualization. And thus, virtualization is critical to cloud computing. It simplifies the delivery of services by provided that a platform for optimizing complex IT resources in a scalable manner. That makes cloud computing so cost effective. In cloud computing it needs to support many different service environments, to manage the various aspects of virtualization in cloud computing most companies use hypervisors. A hypervisor, also called a virtual machine manager (VMM), is a program that allows multiple operating systems to share a on its own hardware host. Each operating system appears to have the host's processor, memory, and other property all to itself. However, the hypervisor is scheming the host processor and resources, allocating what is needed to each operating system in turn and making sure that the guest operating systems (called virtual machines) cannot disrupt each other. The hypervisors can support different operating system environment hence, the hypervisor becomes a perfect delivery mechanism by allowing you to show the similar application on lots of different systems. Because hypervisors can load multiple operating systems, they are a very practical way of getting things virtualized rapidly and efficiently.

Discussion on How Virtualization Works as in the Green Cloud Computing

Let's discuss about how virtualization makes cloud green or eco-friendly. We know, the data center consumes the power as enormous as that can be used to power thousands of homes. The environmentalists and computer scientists are working on reducing the huge amount of power used and make data centers additional energy-efficient than they currently are. The virtualization can be the solution for it. It can be used to decrease power consumption by data centers. The main purpose of the virtualization is that to make the most efficient use of available system possessions, including energy. A data center, installing virtual infrastructure allows several operating systems and applications to run on a lesser number of servers, it can help to reduce the in the main energy used for the data center and the energy consumed for its cooling. Once the number of servers is reduced, it also means that data center can decrease the building size as well. Some of the advantages of Virtualization which directly brunt efficiency and contributes to the environment include: Workload balancing across servers, Resource allocation and distribution are better monitored and managed and the Server utilization rates can be increased up to 80% as compared to initial 10-15%. The energy saved per server would be near about 7000 KWH per year. It means that there would be large saving of energy.

Green Computing Techniques to Manage Power in Computing System

These techniques can be classified at different levels:

1. Hardware and Firmware Level
2. Operating System Level
3. Virtualization Level
4. Data Center Level

Hardware and Firmware level techniques are applied at the developed time of a machine. These techniques control all the optimization methods that are applied at the time of scheming at the logic, circuit, architectural and organization levels. Operating System level techniques include methods which take care with reference to programs at operator level. Virtualization level techniques used the perception of

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Virtual Machines (VMs) to manage power. In this number of VM are created on a physical server, so that reduce the amount of hardware in use and improve the utilization of resources. Data Center level techniques are practical at data centers and embrace methods which are used to manage workload across physical nodes in data centers.

Adoption of Green Computing Practices

With the digital development, the IT industry has focused on the increase and use of IT products and services to satisfy the raising demands of business consumers. Due to this the following factors are impacting the IT industry and coercing the acceptance of Green Computing practices:

1. Rapid growth in the size and scale of data centers
2. Advancement in CPUs
3. Energy Cost
4. Server utilization
5. Impact on the environment.

Framework for Green Cloud Computing

Green cloud computing frameworks to supply energy capable services to the cloud users. There are mainly four components as described below:

1. **Users/Brokers:** At topmost layer the cloud users/brokers demand for services from anywhere around the world. APIs provides the capacity to store VM images and source files for web server mechanism.
2. **Green Service Request Manager:** It provides a crossing point between the cloud users and cloud infrastructure. It handles all the requests generated by the cloud users and supports the energy efficient resources. It also uses various scheduling schemes for distribution of virtual machines.
3. **Virtual Machines:** Commonly known as Virtual appliances it includes software to create and deploy the applications. VMs are used to handle the service requests at the virtual machine layer.
4. **Physical Machines:** The lowest layer exhibits the physical objects or resource instances to map the services to particular machine so that the calculation of the particular task can be performed.

GREEN CLOUD COMPUTING BENCHMARKS

With the advancement of technology, where the cloud computing resources are being remotely controlled by the service providers It is necessary to provide the energy efficient services while maintaining the cost. To keep such performance tradeoffs various benchmarks were introduced previously to measure the rate of power consumption, energy efficiency, resource utilization etc. at the level of system, data centre and server. These benchmarks are listed with their brief formulation, level of usage and application discipline in Table.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

VM MIGRATION

The problem of VM allocation can be divided in two: the first part is access of new requests for VM provisioning and insertion the VMs on hosts, whereas the second part is optimization of present allocation of VMs.

Optimization of current allocation of VMs is carried out in two steps: at the first step, we select VMs that require to be migrated, at the second step chosen VMs are located on hosts using MBFD algorithm. We propose four heuristics for choosing VMs to migrate. The first heuristic, Single Threshold (ST), is based on the idea of location upper consumption threshold for hosts and placing VMs while maintenance the total exploitation of CPU below this threshold. The aim is to protect free resources to prevent SLA destruction due to consolidation in cases when utilization by VMs increases. At each instance frame all VMs are reallocated using MBFD algorithm with extra condition of keeping the upper exploitation threshold not violated. The new assignment is realized by live migration of VMs.

The other three heuristics are based on the idea of setting upper and lower consumption thresholds for hosts and maintain total utilization of CPU by all VMs connecting these thresholds. If the utilization of CPU for a host goes under the lower threshold, all VMs have to be migrated starting this host and the host has to be switched off in order to remove the idle power consumption. If the utilization goes over the upper threshold, some VMs contain to be migrated from the host to reduce exploitation in order to check potential SLA violation. We propose three policies for choosing VMs that have to be migrated from the host.

- **Minimization of Migrations (MM):** Migrating the smallest amount of number of VMs to minimize migration overhead.
- **Highest Potential Growth (HPG):** Migrating VMs that have the lowest usage of CPU moderately to the requested in order to minimize total potential increase of the exploitation and SLA violation.
- **Random Choice (RC):** Choosing the required number of VMs by selection them according to a uniformly distributed random variable.

RECENT IMPLEMENTATIONS OF GREE COMPUTING

Blackle

Is a search-engine site motorized by Google Search. Blackle came into individual based on the concept that when a computer screen is white home, your computer exhausts 74W. When the screen is black it consumes only 59W.Based on this theory if each person switched from Google to Blackle, mother earth would save750MW each year was a really good implementation of Green Computing. The principle behind Blackle is based on the information that the display of different colors consumes different amounts of energy on computer monitors.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Fit-PC

A tiny PC that draws only 5w: Fit-PC is the size of a book and extremely silent, yet fit sufficient to run Windows XP or Linux.fit-PC is projected to fit where a standard PC is too bulky, noisy and power hungry. you ever wished for a PC to be compact, quiet and green then fit- PC is the perfect fit for you. Fit-PC draws only5 Watts, consuming in a day less power than a conventional PC expend sin 1 hour. You can leave fit-PC to work 24/7 without making a dent in your electric.

Zonbu Computer

The Zonbu is a new, very energy well-organized PC. The Zonbu consumes just one third of the power of a distinctive light bulb. The tool runs the Linux operating system using a 1.2 gigahertz processor and 512 megs of RAM. It also contains no moving parts, and does even surround a fan. You can get one for as little as US$99, but it does involve to sign up for a two-year subscription

Sunray Thin Client

Sun Microsystems is exposure increased customer attention in its Sun Ray, a thin desktop client, as electricity prices scale, according to Subodh Bapat, vice president and chief engineer in the Eco liability office at Sun. Thin clients like the Sun Ray consume far less electricity than predictable desktops, he said. A Sun Ray on a desktop consumes 4 to 8 watts of power, because most of the important computation is performed by a server. Sun says Sunrays are mainly well suited for cost-sensitive environments such as call centers, education, healthcare, service providers, and finance. PCs have more controlling processors as well as hard drives, something thin clients don't have. Thus, expected PCs always consume a significantly larger amount of power. In the United States, desktops need to consume 50 watts or less in idle mode to succeed for new rigorous Energy Star certification

The Asus Eee PC and Other Ultra Portables

The "ultra-portable" class of personal computers is characterized by a small size, practically low power CPU, compact screen, low cost and innovations such as using flash memory for storage rather than hard drives with revolving platters. These factors combine to enable them to run more professionally and use less power than a standard form factor laptop. The Asus Eee PC is one example of an ultraportable. It is the size of a book, weighs less than a kilogram, has built-in Wi-Fi and uses flash memory as a substitute of a hard drive. It runs Linux too.

RESOURCE ALLOCATION STRATEGY

There are various Strategies which are related to Resource Allocation:

1. **Resource Allocation Strategy in Cloud Computing:** In cloud computing, Resource Allocation (RA)is the procedure of allocating accessible resources to the demanded cloud requirements above the internet. Resource allocation starves services if the allocation is not grasped accurately. Resource

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

provisioning solves that impede by permitting the ability providers to grasp the resources for every single individual module. Resource Allocation Strategy (RAS) is all relating to incorporating cloud provider hobbies for employing and allocating manipulated resources inside the check of cloud nature so as to encounter the needs of the cloud application. It needs the kind and number of resources demanded by every single request in order to finish a user job. The order and period of allocation of resources are furthermore an input for an optimal RAS.

2. **Task Scheduling Algorithms in Cloud Environment:** Cloud users join virtualization, computerized multimedia, and internet connectivity to furnish their services. A frank agent of the cloud nature is client, server, and web connectivity. A hybrid computing ideal permits client to impact both area and private computing services to expertise a extra flexible and cost-effective computing utility. The area cloud nature involves Web established request, Data as a ability (DaaS), Groundwork as a Service (IaaS), Multimedia as a ability (SaaS), and Email as a ability (EaaS). A confidential cloud accesses the resources from the area cloud association to furnish services to its clients.
3. **Policy and Job Scheduling Algorithms of Cloud Computing:** Job arranging of cloud computing mentions to the procedure of adjusting resources amid unrelated resource users according to specific laws of resource use below a given cloud environment. Resource organization and job arranging are the key technologies of cloud computing. At present, there is not a uniform standard for job arranging in cloud. Most algorithms focus on job correspondent that is nearly accountable for all the task allocations, replies and retransmissions.
4. **Resource Allocation Policies in Cloud Computing Environment:** Resource allocation is a subject that has been dispatch in many computing areas, such as operating systems, grid computing and datacenter management. A Resource Allocation System (RAS) in Cloud Computing can be seen as any device that aims to guarantee that the applications' requirements are attended to correctly by the provider's infrastructure. Along with this guarantee to the developer, resource allocation mechanisms should also consider the current status of each reserve in the Cloud environment, in order to apply algorithms to better distribute physical and/or virtual assets to developers' applications, thus minimizing the operational cost of the cloud location.
5. **Ant Colony Optimization Algorithm for Resource Allocation:** Cloud computing dispersed cluster uses a Master/Slaves structure. There is a Chief node responsible for manipulating and supervision all the Slave nodes. As the specific condition of resource is strange below cloud circumstance, and the webs do not have a fixed topology, the construction and the resource allocation of the complete cloud nature is unpredictable.
6. **Dynamic Resource Allocation Strategy in Cloud Computing Environment:** Cloud data centers can be a distributed web in construction that is composed of countless compute nodes, storage nodes, and web node. Every single node is industrialized by a sequence of resources such as CPU, recollection, web bandwidth and countless more. These resources are shouted multidimensional resources. The number of contiguous mechanisms (VMs) used in a huge cloud data center every single date can be extremely colossal, and their placement familiarize a momentous burden on the data center web.
7. **Dynamic Resource Allocation using Migration in Cloud:** The cloud computing period guarantees subscribes that it sticks to the ability level concurrence by bestowing resources as ability and by needs. Though, date by date subscribers' needs are rising for computing resources and their needs have animated heterogeneity and period irrelevance. But in cloud computing nature, resources are public and if they are not accurately distributed next it will result into resource wastage.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Reducing Use of Paper

Much of our communication and documentation is still conducted via a paper shadow. Not only does this leave loads of paper to manage, there is the economic cost of all the ink and paper and, more importantly, there is also an environmental cost concerned with printing that we all bear as

"a society. The environmental impact of printing is significant and wide ranging. The printing business is one of the most polluting industries in the world for the following reasons:

- The printing industry uses important amounts of energy from heating and lighting to powering tools and final delivery.
- Large quantities of water are used in most printing processes. In most of the cases, infected water is liable without cleaning.
- Comparatively high levels of waste are generated in the print development. From printing plates and ink tins to pallets and packaging there is plenty of waste formed by the printing industry.
- Many volatile organic compounds (VOCs) are said to branch from the printing industry. As the ink dries, the isopropyl alcohol used as a damping solution, evaporates at room temperature, releasing VOCs. These are colorless, odorless gases that are dangerous to the surroundings; contribute to global warming and the making of ozone, as well as being harmful to pressroom workers.
- To make paper, pulpwood trees are cut down in large numbers and are then transported to document mills where pulpwood fibers are strong and dried into sheets. This process is particularly energy consuming and the polluted waste water produced pose a major environmental hazard. Further, the impact of deforestation on the environment is a greater reason for concern.

The following policies can be adopted to reduce paper wastes in the enterprise:

- Memos and newsletters that workers should see, but need not keep can be posted online.
- Document editing and formatting features of ubiquitous word processing software can be broken instead of making drafts on document.
- Information can be exchanged electronically via e-mails and formal online forums instead of fax or mailed letters when probable.
- An electronic filing system can be put in place for easy and well-organized storage and recovery of all electronic documents.

DESKTOPS VS. LAPTOPS

Laptop computers may require the absolute power of their desktop counterparts, but they are more feasible from a green computing perception.

The following points highlight some of the s of using laptops over desktops:

- **Energy Efficiency:** Laptops consume on average 20-50 watts of electricity (which can be further trimmed in power saving modes) whereas desktops consume about 60-200 watts. The conventional Cathode Ray Tube (CRT) monitors of desktops also use more power than the Liquid Crystal Display (LCD) monitors of current laptops.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- A laptop is always better to use than a desktop computer as it uses 1/3 of the energy and is portable thus taking up less room. The fundamental issue with present desktops is that they consume significant energy even in idle mode, but by their design, laptops use much less active power.
- **Battery Power:** Laptops benefit from energy efficiency as a necessary importance of their battery-powered design so much so that manufacturers often tout how long laptop computers can run on battery power as a selling position.

The prospect of extending the battery life of laptops can be approached from two perspectives:

- Adding a larger, higher-capacity battery to the laptop
- Designing the laptop hardware to use less energy.
- **Less Potential, Less Consumption:** Laptops contain a lower possible for maximum power consumption because they attribute smaller power supply units (PSUs). A piece desktop computer has the potential to draw 400Wh energy at complete load with a larger PSU, whereas a performance laptop may be limited to 90Wh because of its smaller PSU. Laptops often include considerably slower performing but more energy well-organized processors and other components, compared to correspondingly-named desktop parts, so processes may take longer to complete. However, many firms such as Intel have already inhabited greener desktop computing in a big way with highly energy-efficient processors like Atom Businesses are more and more switching to or substituting on premise solutions with cloud-based models for resource and processing power constraint to tap benefits like faster scale up/scale-down of capacity, pay-per-use pricing, and access to various cloud-based applications. Cloud computing solutions also allow enterprises to ——virtual cloud servers. It eliminates the need to install and preserve bulky, energy consuming physical servers by relocating them on the Internet. In many small business and commercial environments, server utilization rates are around 5 or 10 percent, but with the cloud, consumption rates are typically 60-70 percent due to shared data centers that employ fewer machines to get an equivalent capacity. The cloud-based alternative can be used in areas such as data storage, networking, software applications and operating systems. As a result, business or business sectors can save a lot of money, time and resources on maintenance and support.

The cloud infrastructure addresses two significant elements of a green IT approach: resource efficiency and energy efficiency:

- **Resource Virtualization:** Virtualization is a initial technology for deploying cloud-based infrastructure that allows a particular physical server to run multiple operating system images concurrently. As an enabler of consolidation, server virtualization reduces the whole physical server footprint, which has intrinsic green benefits.
- From a resource-efficiency perception, less equipment is needed to run workloads, which proactively reduces data center space and the ultimate e-waste footprint. From an energy-efficiency perspective, with less physical tackle plugged in, a data center will use less electricity. It is attraction noting that server virtualization is the most extensively adopted green IT project implemented or planned, with 90 percent of all IT organizations worldwide adopting it by
- **Automation Software:** The presence of virtualization unaccompanied does not maximize energy and reserve efficiencies. To rapidly provision, move, and scale workloads, cloud-based infrastruc-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

ture relies on computerization software. Combined with the right skills and prepared and architectural standards, computerization allows IT professionals to make the most of their cloud-based infrastructure asset by approaching the limits of traditional consolidation and exploitation ratios. The higher these ratios are, the less physical infrastructure is needed, which in turn maximizes the energy and resource efficiencies from server virtualization.

- **Pay-Per-Use Self-Service:** The pay-per-use nature of cloud based communications encourages users to only consume what they need and not more. Shared with self-service, lifecycle management will improve, as users will ——turn off or transfer resources and infrastructure after use. The pay per-use self-service capability of the cloud thus drives resource and energy efficiencies simultaneously.
- **Multi-Tenancy:** Multi-tenancy allows lots of different organizations (public cloud) or many different business units inside the same organization (private cloud) to benefit from an ordinary cloud-based infrastructure.
- **Reduce Costs:** Consolidation means fewer servers, which in turn means lower cooling and space requirements, which means lower energy costs.
- **Fulfill Regulations:** By tapping more efficient and therefore lower-emitting resources, cloud customers can reduce their carbon emission and be better-positioned to meet regulatory standards.
- **Improve Resiliency:** Consolidation and improved exploitation create more space, more command, and more cooling capacity within the same facility. Tapping into the cloud offloads the management of those resources to the cloud provider.

THE SECURITY IMPLICATIONS OF GREEN ENTERPRISES

Virtualization

There is also anxiety that predictable information security controls cannot mark malevolent traffic passing between virtual machines (VMs). “In a virtual environment, if you contaminate one virtual server or one operating system, you peril infecting all the other systems and server management in that environment,” says Doug Cooke, manager, system engineers at anti-virus firm McAfee’s Canadian office. “There’s no documentary confirmation that actual threats have got through all the operating systems in a virtual environment, but ‘white-hat’ groups have proved it’s possible.”

“A few firewall products have been ported to the VMware environment and they organize taps, so they are preliminary to see traffic between the VMs, but they can’t block it”, O’Higgins says. “So these controls are not for the most part effective. After all, you want firewalls to block assured traffic, not just look at it. The approach Third Brigade uses is host security, so that each individual VM is confined, and malicious traffic connecting VMs can be detected and blocked.”

Simple Measures

Consolidation isn’t restricted just too broad operating systems, however. Information security vendors have been squeezing more functions into a single box though driving down power consumption. “As UTM appliances can perform multiple security functions such as firewall, spam / web filtering, IPS/IDS, and gateway anti-virus, firms can reduce the number of dissimilar security systems on their networks”,

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Forti Green allows clients to approximation the potential annual energy savings of a UTM-based network security topology compared to a traditional architecture with multiple info security devices at each site. "You tell Forti Green the number of UTM boxes in the branch offices, and the totals at the head office and the regional offices," James says. "The branch devices can have fewer security functions than the regional office devices, which will in turn have less than the head office boxes."

Routers

Cisco has started putting numerous virtual security functions onto its routers, says Fred Kost, director of advertising, Cisco Virtual Office (CVO). "We offer content program on our ASR edge routers and contented filtering, firewalls and intrusion prevention on our ISR boxes", he says. "Cisco's Adaptive Security Appliances include firewall, IPSec and SSL VPN security, and email screening. The ASR can also run multiple virtual firewalls for divide partitioned networks."

Power Management

The effort made to decrease the power expenditure of servers and information security appliances doesn't eliminate the need to monitor and manage that energy use. Several initiatives are underway to measure and manage IT devices' influence consumption, although information security appliances cannot yet be mechanically powered down while their traffic flow is dormant.

Cloud Computing

Global service line lead for security move toward and hazard management at Accenture, says some cloud providers such a state in their SLA (service level agreement) where they store clients' data, but others don't do so. "I predict cloud providers that are not apparent being locked out of markets likes the European Union, where there are clear laws about how data is stored and transmitted. What's incident in the EU is that firms are looking for intra-European cloud solutions to avoid contravention EU data privacy laws."

Ashdown adds that firms using a cloud provider must insist in their SLA that the provider go through third-party security audits.

"If you store data on a third-party cloud, you could fall victim to a man-in-the-middle attack", says IDC's Senf. "It's vital to encrypt data sent to a cloud, and the provider must have an SLA specifying that they use good authentication."

The answer to man-in-the-middle is to use two-factor authentication in the form of hardware or software tokens, and to prove the IP address of PCs logging on to the cloud, There are clearly benefits for both the information security occupation and the broader IT department when it comes to using green technology. But apply it with care, and guarantee that your power saving efforts doesn't compromise your data.

Advantages of Green Computing:

- Reduced energy method from green computing techniques translates into lower carbon dioxide Emissions, stemming from a reduction in the vestige fuel used in power plants and transportation.
- Conserving resources means less energy is essential to produce, use, and arrange of products.
- Saving energy and possessions saves money.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- Green computing even includes changing government policy to promote recycling and Lowering energy use by individuals and businesses.
- Reduce the risk existing in the laptops such as chemical known to source cancer, nerve damage and immune reactions in humans.

Benefits of Cloud Computing for Green Enterprises

Reduce Paper Consumptions

The world uses over 300 million tons of documents every year. Businesses account for a very large split of the paper that is inspired. Smart businesses will look for ways to reduce paper expenditure to become promote sustainability. Cloud computing considerably reduces the need for paper, because it enables businesses to use digital technology for projects that may not have been a practicable otherwise. One example is sharing critical documents with organizational counterparts in other regions.

Reduce Server Dependence

While data storage is distant greener than retaining records on paper, it's still not 100% environmentally friendly. Servers involve a decent amount of energy to operate. If you are storing terabytes of data, then you'll likely need a superior server. However, it's much more reasonable to store data on a single large server than frequent hard drives. Since cloud computing allows you to store your data in a central database, you'll significantly decrease the number of servers that you rely on.

Cut Transportation Costs

Transportation and distribution are two other actions that leave a large carbon footprint. Cloud computing is significantly reduced, because your organization will not need to mail nearly as many documents.

Take Your Green Business to the Cloud

There is a diversity of reasons that smart companies are going green. The two most understandable benefits for their bottom line are that they can save on waste and progress their branding with customers that are disturbed about sustainability. They also get to see that they are doing their part to support a better world.

CONCLUSION

Cloud computing is prevailing as a considerable shift as today's organizations which are in front of extreme data overload and skyrocketing energy costs. Green Cloud architecture, which can help combine workload and attain significant energy saving for cloud computing environment, at the same time, guarantees the real-time recital for many performance-sensitive applications.

In the future, there are still a number of research behavior that we plan to carry out, which could improve the performance of Green Cloud and bring solid value to users to attain their business goals and their social dependability in Green IT Applying green technologies is highly fundamental for the

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

sustainable development of cloud computing. Of the various green methodologies enquired, the DVFS technology is a highly hardware oriented approach and hence less supple. Green scheduling algorithms based on neural predictors can lead to a 70% power savings. These policies also enable us to cut down data Centre energy costs, thus leading to a strong, aggressive cloud computing industry. End users will also benefit from the decreased energy bills. As a conclusion, Green Cloud effectively saves energy by dynamically support to workload leveraging live VM migrations, at the same time convention system SLAs.

REFERENCES

Agarwal, S., Ghosh, A., & Nath, A. (2016). Green Enterprise Computing- Approaches Towards a Greener IT. *Presented at the International Journal of Innovative Research in Advanced Engineering (IJIRAE).*

Blue and Green Tomorrow. (n. d.). Benefits of green cloud computing. Retrieved Dec 12, 2016 from http://blueandgreentomorrow.com/environment/benefits-of-cloud-computing-for-green enterprises/S

Bobby, S. (2015). A greener approach to computing and save energy. *International Journal of Advance Research in Science and Engineering.*

Computer Weekly. (n. d.). Security implications of green IT. Retrieved Dec 12, 2016 from http://www.computerweekly.com/feature/The-security-implications-of-green-IT

Jayanthi, S., & Babu, S. (2015). Green Cloud Computing - Resource Utilization with Respect to SLA and Power Consumption. *International Journal of Computer Science and Mobile Applications.*

Kamiya, S.N. (2013). Green Cloud Computing Resource Managing Policies a Survey.

Liu, L., Wang, H., Liu, X., Jin, X., He, W. B., Wang, Q. B., & Chen, Y. (2009) *GreenCloud: A New Architecture for Green Data Center.*

Nimje, A. R. V. T. Gaikwad, H. N. Datir (2013). Green Cloud Computing: A Virtualized Security Framework for Green Cloud Computing. *Presented at the International Journal of Advanced Research in Computer Science and Software Engineering*.

Pandya, S. S. (2014). Green Cloud computing.

Patel, Y. S., Jain, K., & Shukla, S. K. (2016). A Brief Survey on Benchmarks and Research Challenges for Green Cloud Computing. *Presented at the National Conference on Advancements in Computer & Information Technology.*

Patil, P. S., & Kharade, J. (2016). A Study on Green Cloud Computing Technologies. *Presented at the International Journal of Innovative Research in Computer Communication Engineering*.

Pragya, M. G. (2015). A Review on Energy Efficient Techniques in Green Cloud Computing. *International Journal of Advanced Research in Computer Science and Software Engineering*.

Prashant, D. (2014). Greening the Cloud Computing.

This research was previously published in Cloud Computing Technologies for Green Enterprises edited by Kashif Munir, pages 1-27, copyright year 2018 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 22
Collective Green Creativity and Eco-Innovation as Key Drivers of Sustainable Business Solutions in Organizations

Ziska Fields
University of KwaZulu-Natal, South Africa

Sulaiman Olusegun Atiku
University of KwaZulu-Natal, South Africa

ABSTRACT

The main objective of this chapter was to explore if collective green creativity and eco-innovation can create novel and sustainable business and management practices. A literature review approach was conducted on the link between collective creativity, innovation, and sustainable business practices. It was found that collective green creativity and eco-innovation can create sustainable business practices. The process starts with the creative individual which needs creative thinking skills, creative motivation, green mindfulness and green self-efficacy. A creative collective is then created using their creative intelligence and creative exchange to create a shared green vision. The creative collective requires green transformational leadership with access to green dynamic capabilities and resources to be effective in the business environment. This creative collective follows the six-step creative problem-solving process which enables the collective to create eco-innovation using an additional four steps. The end result is novel and sustainable business practices and solutions.

INTRODUCTION

King (2012) stated that the world has changed and that the planet is in crisis. Holthaus (2015, p.1) wrote that "we have reached the point of no return: climate change nightmares are already here". The climate has visibly changed and more species are dying out at disastrous rates. Dell'Amore (2014) reports that mankind is busy causing the rapid loss of species estimated by experts to be between 1,000 and 10,000

DOI: 10.4018/978-1-5225-7915-1.ch022

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

times higher than the natural extinction rate. For example, *because scientists do not know how many different species there are on the planet yet*, if there are around 2 million different species on the planet, then between 200 and 2,000 extinctions occur every year. If there are 100 million different species, then between 10,000 and 100,000 species are becoming extinct each year.

Mankind are faced with serious challenges due to human overexploitation of resources and unsustainable living. If this habit and mind-set are not changed very quickly by everyone on the planet, the unsustainable living and destruction of the incredible biodiversity on this planet, which is essential for mankind's survival, can lead to the so-called sixth extinction as identified by Kolberg (2014).

Traditional business and management practices have been blamed for the crises of the planet specifically. Issues like ecological overshoot, population growth, water and food shortages, financial crises, greed and corruption, as well as greater expectations of shareholders are however causing the rethink and transformation of business practices and other unsustainable human activity. An ever-increasing number of businesses are realizing that their long-term profitability is now dependent on social justice and protecting the environment (Global Sustainability Standards Board (GSSB), 2015). These expectations will intensify as businesses, financiers, customers and other stakeholders become more aware of the critical need for a sustainable economy (GSSB, 2015). This book and chapter, aims to play a role in creating more awareness to enable people and business to change and transform to protect the planet and life on it, because mankind have not been and still are not sustainable.

The main objective of this chapter was to explore whether collective creativity and eco-innovation in organizations can create novel and sustainable business and management practices. The secondary objectives were to

1. Explain the concept of collective creativity, green creativity and eco-innovation in business,
2. Identify the barriers to collaborative creativity and eco-innovation,
3. Discuss the determinants for successful organizational, collective creativity and eco-innovation with a view to enhance collaboration, and
4. Show how collaborative green creativity and eco-innovation can be used to solve 'wicked problems' and to create sustainable business practices.

The chapter starts off by providing the background to the chapter. This will be followed by a discussion on collaborative creativity and eco-innovation in organizations and how it can be used to create sustainable solutions, practices and strategies in an effort to minimize damage caused to the planet. Recommendations will also be made to enhance collaborative creativity and eco-innovation at organizational level in contemporary and future organizations.

BACKGROUND

The planet experienced five extinction events. The next extinction, the Holocene extinction, also called the sixth extinction, started at the end of the last Ice Age. Vince (2012) predicts that in the next 300 years, a total of 75% mammal species will disappear due to a human-caused extinction. Mankind's attributes and intelligence are responsible for the biological success and advancement as a specie, however mankind's successes also altered the climate and reduced animal species. Kolbert (2014) chronicles

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

that man's indifference (cruelty) to other life on the planet and unmindful living makes every human a partner in these die-offs.

Unheeded warnings and mankind's reactive mindset are evident throughout history. There will always be people that disagree, those that prefer to ignore warning signs and then action will only be taken after a disastrous event occurred that could have been prevented if proactive action was taken. This is called the Cassandra syndrome or complex.

In Greek mythology, as cited in Greek Myths and Greek Mythology (2016), Cassandra was one of the princesses of Troy, daughter of Priam and Hecuba, who had a gift and a curse of foreseeing the future. There are several different versions explaining the gift and curse of Cassandra. The most popular one is that Apollo fell in love with her and gave her the gift of prophecy as a token of his love. When Cassandra rejected his advances, he placed a curse on her that no one will believe her predictions – even though her premonitions were always accurate. Based on the myth of Cassandra, the French Philosopher Gaston Bachelard, identified the Cassandra syndrome or complex in 1949, which is applied in cases where people would have valid alarms, visions, or dreams about upcoming events, which are disbelieved (Elgueta, 2014), often with disastrous consequences.

In 2000, a small group of leaders from the United Nations (UN) and business created the United Nations Global Impact. The aim of the UN is to build a sustainable, inclusive global community that can thrive within the environmental limits of the planet by creating an inclusive global economy that delivers lasting benefits to all people, communities and markets. The UN tries to inspire, guide and support companies to do business responsibly and take action for a more sustainable future by using the ten principles: Human rights (principles 1-2); Labour (principles 3-6); Environment (principles 7-9) and Anti-corruption (principle 10). However, deep-seated business paradigms and the expectations of societies caused high profile clashes between various organizations and societies (United Nations Global Compact Report, 2015). The Cassandra syndrome became evident from criticism against the UN Global Compact and the future it is trying to prevent, if nothing is done. For example, to name a few, some people view it as a superficial contribution to development; a PR tool; not in line with the traditional position of the UN on issues of economic policy. The UN seems like a less reliable partner for NGOs and other partners particularly in developing countries; and the initiative is seen as "global corporatism" (Bandi, 2007). Despite the criticism and Cassandra syndrome being evident, the goal of the UN is to make sure that mankind does not reap benefits at the expense of the environment and future generations (United Nations Global Compact Report, 2015), which remains a noble and very important one.

A documentary film in 2006, *An Inconvenient Truth*, was an effort by former US vice-president Al Gore to educate citizens about global warming and to reenergize the environmental movement. Gore discussed the present, future effects and consequences of global warming if human-generated greenhouse gases are not significantly reduced. The theme song "I need to wake up" by Melissa Etheridge encouraged viewers and listeners to realize the impact and effect of global warming. In the music video, some alarming facts are highlighted, for example that 70 million tons of CO_2 is released into the atmosphere every single day and that there is more CO_2 in the atmosphere now than in 650 000 years. Al Gore ended the film with the words:

Each one of us is a cause of global warming, but each one of us can make choices to change that with the things we buy, the electricity we use, the cars we drive; we can make choices to bring our individual carbon emissions to zero. The solutions are in our hands, we just have to have the determination to make

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

it happen. We have everything that we need to reduce carbon emissions, everything but political will. But in America, the will to act is a renewable resource.

As with Cassandra, Al Gore's message was criticized by the President of the United States and certain Senators. There was also global criticism. The Prime Minister John Howard for example refused to meet with Al Gore or agree to Kyoto, because he said that he does not take policy advice from films. Even today, the Cassandra syndrome is evident across the world regarding climate change. Current president candidate for the Republican Party in 2016 Donald Trump said that he would "cancel the Paris Climate Agreement and stop all payments of U.S. tax dollars to UN global warming programs" because "the concept of global warming was created by and for the Chinese in order to make U.S. manufacturing non-competitive" (Jacobson, 2016, p. 1). There is a website called the GlobalClimateScam.com and here Beauregard (2015, p.1) reported on the site that climate change is a hoax; 31,000 scientists have signed a petition saying they do not believe in 'Catastrophic Man-Made Global Warming'; and that NASA found that most of the CO2 in the atmosphere was not coming from the industrialized northern hemisphere, but from the rainforests in South America, Africa and China. However, on 'NASA's Global Climate Change – vital signs of the planet' website, it is reported that the "current warming trend is of particular significance because most of it is very likely human-induced and proceeding at a rate that is unprecedented in the past 1,300 years" and that "evidence for rapid climate change is compelling" (NASA Global Climate Change, 2016, p.1). Even with criticism, there were positive responses to the film and the film became a memorable effort to create sustainable solutions for the planet

Vaidyanathan (2016) indicated what happened 10 years after An Inconvenient Truth and stated that scientists that the planet is now in the Anthropocene time, meaning that humans have surpassed nature and that humans are the primary shapers and directors of the planet story. Elizabeth Kolbert wrote a book called, 'The Sixth Extinction: An Unnatural History' which was published in 2014. This is seen as an important book about the future of the world as it predicts the most devastating extinction event since the asteroid impact that wiped out the dinosaurs and confirms Vaidyanathan's statement. Kolbert's book is based on the work of researchers in half a dozen disciplines (for example geologists, botanists, marine biologists) and she accompanied many of them into the field. Kolberg cited in Gore (2014) explains that extinction is a relatively new idea in the scientific community, because most scientists could not imagine a planetary force powerful enough to wipe out forms of life. People in general also find it unthinkable that mankind can destroy the planet's ecology (Gore 2014). Kolberg (2014) however predicts that the sixth extinction is likely to be mankind's most lasting legacy. Kolbert (2014) wrote that:

the qualities that made us human to begin with: our restlessness, our creativity, our ability to cooperate, to solve problems and complete complicated tasks are leading us to change the world so rapidly and profoundly that other species cannot keep up.

Muhammad (2015, p.1) indicates that Kolberg however discusses *"why humanity is wreaking such havoc, with no consideration of the crucial role that capitalism's relentless search for growth and accumulation has played."* This is an important aspect to consider in addition to the issues that are now grouped under the heading of 'sustainability'. These issues are ranging from stopping global warming to saving ecosystems, changing economics and ending global poverty. These issues can be referred to as 'wicked problems'. The concept of a 'wicked problem' was identified by Rittel and Webber (1973) cited in Jackson (2013, p.5) as "a problem that is essentially unique, the search for solutions will never

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

stop, it can be seen as a symptom of another problem and is often intertwined with other problems; it involves many stakeholders, and it generates unexpected consequences over time". It is evident that issues around the sixth extinction, climate change, unsustainable living, to name a few, are complex and not easy to resolve due to the intertwined nature of it and the involvement of a lot of different stakeholders. Another challenge, adding to the wicked problem, is that history has demonstrated that humans often do not listen to warnings about the future, even when warnings were justified. There is still time to listen and to do something about it.

It is important that organizations realize that no business can be prosperous in an environment faced with catastrophic climate change, rampant unemployment and social conflict. The only way to create a prosperous business environment, stable societies and a healthy planet, is for organizations to ensure that the benefits and profits that they reap today, are not at the expense of the environment or future generations. This chapter therefore focuses on organizations specifically as we search for ways to create sustainability.

The question is, what can organizations do to transform themselves to become more responsible and sustainable and can eco-creativity and eco-innovation, as a collaborative effort, help to create novel and sustainable business practices?

COLLECTIVE GREEN CREATIVITY AND ECO-INNOVATION

Organizations can no longer continue on the same path and repeat the old and unsustainable business practices of the past. An overhaul of the traditional and dominant worldviews about resource management and the negative impact of business practices on societies and the environment are necessary and imperative. Creative and innovative thinking and problem-solving can offer sustainable ways to conduct business now and in the future, even if Kolberg (2014) explained that our creativity, our ability to co-operate and to solve problems is changing the world rapidly and profoundly. This ability can be used to improve the world and find ways to assist species to keep up with changes made by mankind.

It is important however to first explain what creativity and innovation mean before it can be explored from an ecological perspective as a possible way to create and enhance sustainable business practices.

Creativity

Cropley (2016) supports the view of Plucker, Beghetto and Dow (2004) when he explains that creativity is like a system with four interacting elements namely the person (which refers to the interaction among aptitude), press (which refers to the process and environment), product (which refers to a novel and useful product) and the social context. Cropley (2016, p. 63) further explains that

Creativity is about solving problems and satisfying needs by developing novel and useful solutions—in other words, creativity is all about the aptitudes, processes, and environmental factors that help us to generate new and useful products.

Vygotsky (2004) states that a creative act is any human act that leads to either a new physical object or some mental or emotional construct that lives within the person who created it. Creativity is also explained as a mental and social process which involves the discovery of novel ideas by combining

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

ideas or seeing new relationships among ideas and discarding preconceived assumptions, in an attempt to come up with a new approach (Afolabi, Dionne & Lewis, 2009, p. 2). Creativity, according to Boden (2004), is the ability to generate ideas that are new, surprising, and valuable. Creativity occurs on the right side of the brain when ideas are sparked. To make creativity useful requires both divergent thinking (generating many unique ideas) (Runco, 2007) and convergent thinking (combining those ideas into the best result). Creativity, according to Groenewald (2013) involves lateral thinking, decision-making and problem-solving.

Cropley and Cropley (2010) explain that creativity is the generation of effective novelty and the National Advisory Committee on Creative and Cultural Education (NACCCE) (1999) agrees and adds that novelty can be identified in three possible ways: individual creativity (also referred to as personal creativity); relative creativity (refers to originality in relation to a person's peer group); and historic creativity (refers to an original previous output). Boden (2004, p. 2) identifies it a bit differently by stating that "psychological" creativity (P-creativity) "involves coming up with a surprising, valuable idea that is new to the person who comes up with it, no matter how many people have had that idea before"; and historical" creativity (H-creativity), "involves an idea that no-one else has had before and seems to appear for the first time in human history".

Parjanen (2012) indicates that there are two different types of creativity namely individual creativity and collaborative creativity. This links to NACCCE's personal and relative creativity as ways to add novelty. According to Parjanen (2012), p. 2)

A collective creativity system becomes a co-creation between the founders of the system and the crowd members, who both design the products and contribute to the design of the system. Out of this comes a kind of system that benefits society through its creative outputs and benefits participants through the mastery they attain.

For this book and chapter, the focus is on collective creativity, because the idea of a lone creative genius will not be useful in the search for the higher potential source of creativity to create novel and sustainable business practices. A collective of creative people working as a team can create better ideas and solutions for unsustainable business practices and living than one individual. In sustainability, the nature of the output of collective creativity can be aggregated which refers to the collection of each participant's work or emergent which refers to something new and novel. Emergent outputs are developed through discovery where the participants find something never seen before or through combination where the participants' work are combined and integrated to produce something novel (Yu et al., 2012).

This is also a valuable view of creativity, which will also be valuable for this chapter, because it shows that creativity can be seen as a concept of growth or development where the human will is the central cause of action, is the view of Rank (cited in De Sousa, Pellissier & Monteiro, 2012), that

Each individual is unique and carries within him or her the potentiality of creating something new, different and unexpected out of past experience (via the human capacity to internalize experiences of the outer environment and making it a part of the self).

From the above explanation, creativity and specifically, collective creativity, seems to be an important phenomenon to consider in the search for sustainable business practices because it creates novel solutions, it can enhance human development and is linked to the human will to make a difference.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Sherwin (2011) wrote in an article that the missing link in sustainable ideas is creativity and agree that creativity needs to play a bigger role in finding better sustainable solutions and business practices. This type of creativity can possibly be linked to eco-creativity and green creativity. Eco-creativity is described as the combination of creativity and art; the marriage of reusing, recycling and creativity (Lapia & Knight, 2011), as well as eco-design where creativity, brainstorming, imagination and trash materials are used. Green creativity was highlighted by Chen and Chang (2013) as part of green product development. They stated that for green creativity and green product development to be successful, green dynamic capabilities and green transformational leadership are required. Chen, Chang, Yeh and Cheng (2015) added that a green shared vision, green mindfulness and green self-efficacy are needed to enhance green creativity. The concept of green creativity therefore can be seen as the most suitable concept that can be used to link creativity to sustainable ideas presently. Green creativity is valuable because it involves a whole-brain activity, linking divergent and convergent thinking, as well as leadership, capabilities, vision, mindfulness and self-efficacy to create novel green solutions to "wicked" unsustainable practices and environmental problems. There are, however, barriers to creativity and bad habits that should be identified and overcome to ensure that any creative endeavor can succeed.

Barriers to Creativity

There are various barriers that can prevent individuals and teams from using creativity and these are, for example, not believing you are creative; acceptance of the status quo; having no creative role-models; narrow-mindedness; feeling silly; red tape, procedure and group-process constraints; conformance pressure; and being too busy.

Hiam (2003) identified nine bad habits that can prevent creativity which are still relevant today and these are:

1. **Failure to Ask Questions:** Creativity requires a lot of why questions to be asked to create creative insight. Not asking questions cannot lead to creative ideas.
2. **Failure to Record Ideas:** If ideas are not recorded, similar ideas can be generated over and over again without having more efficient and productive ideations sessions, where previous ideas can be built upon on linked together to find better ideas.
3. **Failure to Revisit Ideas:** If this is done, old ideas are not given a second chance and old assumptions are not identified.
4. **Failure to Express Ideas:** This is normally done through self-censorship and trying to have an orderly mind which prevents one from figuring out if an idea is worthwhile and novel.
5. **Failure to Think in New Ways:** If a person or team cannot focus on thinking differently and use a variety of structured creative thinking techniques, new and novel ideas cannot be generated.
6. **Failure to Wish for More:** Creativity is about making the impossible seem possible and finding a better way to improve the current status quo. If one does not wish for more and better things, the creative process cannot be successful as only "possible" ideas will be generated.
7. **Failure to Try Being Creative:** Many people still think that creativity is a special and rare gift and that they can never be creative, which prevents them from being willing to be part of the creative process and participate in creative thinking.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

8. **Failure to Keep Trying:** Creativity requires continuous effort, because brilliant novel ideas are not usually created with the first try and it is very easy to abandon a possible idea prematurely and then missing out on a creative discovery.
9. **Failure to Tolerate Creative Behaviour:** When people are being creative, their behaviour might seem weird to others and this should be tolerated to ensure that the creative thinking process leads to useable and novel ideas.

From the discussion in this section it seems that there are a great deal of different barriers and behaviours that can hamper creativity. It is therefore important to be aware of it and to find ways to overcome these barriers and behaviours to be able to solve "wicked" problems and to profit from creative thinking. Some ways to overcome the barriers and bad behaviours for example are to behave in ways that you are creative, behave in ways to generate many fresh ideas, offering ideas to others, applying ideas in the specific context, using divergent and convergent thinking (the whole-brain approach), experimenting with creative thinking processes and techniques as well as breaking boundaries to become an independent thinker/team. It is also helpful to use the five stages of the creative process and creative problem-solving.

The Creative Process and Creative Problem-Solving (CPS)

The creative process consists of five stages and is not a linear process according to Von Oech (cited in Groenewald 2013). The five stage are:

1. Preparation when the problem is defined, information is gathered and creative questions about the problem is formulated;
2. Frustration where the creative questions does not guarantee immediate or effective solutions;
3. Incubation where one steps away from the problem to allow the subconscious to come up with new insights;
4. Illumination where the answer is identified which might need further refinement to create a novel idea and solution; and
5. Elaboration where the idea is refined to develop further through innovation.

Creative problem-solving (CPS) aims to solve specific problems and the process was developed by Alex Osborn and Sydney Parnes (Groenewald, 2013). The process consists of five steps where the problem is defined and the objective is determined, followed by fact finding, idea finding, evaluating and prioritizing ideas and developing and implementing the plan to solve the problem. Various creative techniques can also be used in each of the five steps, for example in step one, the 5Ws/H method can be used when one is uncertain about what the problem really is; in step two, the bug list technique can be used to focus on finding fault with things around us that can lead to corrective action being taken; in step three, brainstorming can be used; in step four, the advantage-disadvantage technique or the reverse brainstorming technique can be used; and in step five, CPS techniques can be used and an action plan developed.

The process of green creativity and green creative problem-solving need to include specific focus areas to make it successful as identified by Chen and Chang (2013) and Chen et al. (2015). The collective (can be an organization/s or team/s for example) gathered to generate novel ideas, need to share a green vision created by green transformational leadership, which are supported by green dynamic capabilities.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The collective, as individuals, should also possess green mindfulness and green self-efficacy. Collective green creativity will follow the same steps as discussed in this section and the focus will be on achieving new and novel environmentally friendly and sustainable business ideas.

Innovation

Innovation is crucial to the economy and the performance of organizations (Groenewald, 2013). It also involves a variety of approaches like technological innovation, product-market innovation, innovative marketing strategies and management innovation like new organizational systems and techniques according to Groenewald (2013).

The processes of innovation and creativity overlap although these processes are different. Creativity is seen as the cognitive process of development of ideas, which normally takes place first, while innovation occurs when these ideas are applied and turned into something of value, for example, a new product or a new process. Florida (2002) expresses that creativity drives the innovation process which basically means that creativity is the key in generating new business opportunities – the start of any innovative idea. Innovation is the ability to apply creative solutions to enhance or enrich the lives of people according to Scarborough and Cornwall (2015).

Jones and George (2014, p. 23) defines innovation as "the process of creating new or improved goods and services that customers want or developing better ways to produce or provide goods and services". The authors identify two kinds of innovation:

1. Quantum product innovation, and
2. Incremental innovation.

Quantum product innovation is the development of new or radically different kinds of goods and services due to technology and the possibilities of pioneering discoveries. Incremental product innovation takes place when gradual improvements to existing products are made due to existing technologies being perfected. Groenewald (2013) explains that innovation can be divided into radical (similar to quantum production innovation), incremental (similar to incremental product innovation) and modular innovation. Modular innovation which involves the change of some of the components to new or significantly adapted components as per Groenewald (2013).

Hamel and Breen (2007) cited in Groenewald (2013) created a hierarchy of innovation which consists of five different levels. The lowest level, operational innovation, involves innovations to make organizations faster and better by focusing, for example, on the manufacturing processes and the development of online transactions. The second level, product and service innovation, is the most visible one as it involves for example completely new products, line extensions or product repositioning. The third level, business model innovation, focusses on value creation and value capture to enhance the profitability of the organization. The fourth level, architectural innovation, which implies a redesign or reconfigured system and industry. Level five, management innovation, which refers to strategic planning, project management, knowledge management and performance management, for example. Management innovation ensures the long-term success and competitive advantage of organizations (Hamel and Breen, 2007).

Martins (2002) explains that innovation is the implementation of a new and problem-solving idea, practice or artifact through which change is brought about. In addition, Puccio and Cabra (2010, p. 149) stress that *"innovation comes about as the result of the interaction among people, the processes they*

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

engage in, and the environment in which they work". Rothwell and Zegveld in Conway and Steward (2009, p. 9 & 10) define innovation as *"the commercialization of technological change"*. Innovation concerns "novelty" (as with creativity), and is a process that embraces various activities to ensure that the actual discovery is commercialized.

These different views are important for this chapter as it explains that innovation is the result of interaction among people and it creates something new that enhances or enriches lives and leads to change.

Eco-Innovation

Innovation is therefore important for sustainable business practices and can be referred to as eco-innovation, which requires collaboration to make it successful. Eco-innovation is explained as

the production, assimilation or exploitation of a novelty in products, production processes, services or in management and business methods, which aims, throughout its lifecycle, to prevent or substantially reduce environmental risk, pollution and other negative impacts of resource use (including energy) (OECD, 2009, p. 6).

Three aspects are important in eco-innovation as per OECD (2009) namely:

1. The target which refers to products, processes which tend to rely on technology, marketing, organizations and institutions. The target can be technological or non-technological.
2. The mechanism which refers to the method by which the target is changed and can either be possible through modification, redesign, alternatives or creation.
3. The impact which refers to the potential environmental impact due to the target, mechanism and their interaction with the socio-technical surroundings.

Part of eco-innovation is to look at the environmental effects across value chains and product lifecycles. Biomimicry specifically can be very helpful to create eco-innovation. Here innovation comes from nature's best ideas in terms of natural systems and its success in nature. Nature's ideas are then imitated to provide innovative and sustainable solutions (Benyus, 2006). The nine basic laws of biomimicry are also important for eco-innovation because it identifies the key working principles needed for ideas, namely:

1. *Nature runs on sunlight;*
2. *Nature uses only the energy it needs;*
3. *Nature fits form to function;*
4. *Nature recycles everything;*
5. *Nature rewards cooperation;*
6. *Nature banks on diversity;*
7. *Nature demands local expertise;*
8. *Nature curbs excesses from within; and*
9. *Nature taps the power of limits (Benysus, 2006, p. 129).*

The Biomimicry Guild, for example, aims to help businesses to become more sustainable by focusing on the transfer and application of biological knowledge, developing business model innovation as it

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

integrates this biological knowledge into the business focus and strategy, and ensuring that progress are monitored (The Biomimicry Institute, 2015). However, as with creativity, there are barriers to innovation that need to be addressed to make the innovation process successful.

Barriers to Innovation

Innovation is viewed form a number of perspectives which can make the innovation process challenging. As a management process, the focus is on the organization and management; as a social process, the focus is on the importance of social interaction during the innovation process; as political process, the focus is on the use of resources and between alternative solutions; and as emotional process, the focus is on psychological safety in allowing people to challenge the status quo according to Conway and Steward (2009, p. 12). If leadership cannot drive innovation and if the business culture does not support innovation, employees will not be innovative. Barriers are created when leaders, managers and employees do not have the required skills, are not aware of the latest trends and technology, do not have the passion to be innovative, or are afraid of risk taking and the cost involved in failure. The different activities that are necessary for innovation can cause tension and barriers as well. Dougherty (1996, p. 431) cited in Conway and Steward (2009) identifies four tensions due to contradictory practices which are identified in Table 1.

The Innovation Process

The innovation process consists of three phases according to Smith (2010). Phase one is the invention stage where a new idea, product, service, method or process is created. This phase is not yet innovation and can be linked to the creative process discussed earlier in the chapter. The viability of the invention should first be determined by ensuring that it can create a competitive advantage (unique selling proposition), it is aligned with the business strategy and objectives, it creates business value, customer needs are taken into consideration and the invention is successfully executed. This will then lead to phase two, commercialization of the invention, due to value creation and value capture to create demand and profits. Phase three is the final phase and is referred to as diffusion which refers to the adoption rate of consumers

Table 1. The tensions between contradictory practices and capacities to restore the balance

Activity	Tension	Problem of Normal Functioning that Disrupts Tension	Capacities to Restore Balance in the Tension
Market-technology	Outside versus inside	Keeping operations efficient	Generate and maintain an identity based on the value provided to customers
Organizing for creative problem solving	New versus old	Managing complexity	See work of organization in terms of process, focusing on relationships among parts, and changes
Evaluating and monitoring innovation	Determined versus emergent	Controlling multiple activities	Situated judgement, collective ability to be engaged in details of work but also appreciate unstructured problems
Developing commitment to innovation	Freedom versus responsibility	Accounting for work, results	Collective accountability, accept and share responsibility, legitimize innovation and inclusion

Source: Dougherty (1996, p. 431) cited in Conway and Steward (2009)

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

which can be fast or slow. Consumers need to familiarize themselves with the innovation first, so diffusion is normally slow. Figure 1 shows the link between collective green creativity and eco-innovation.

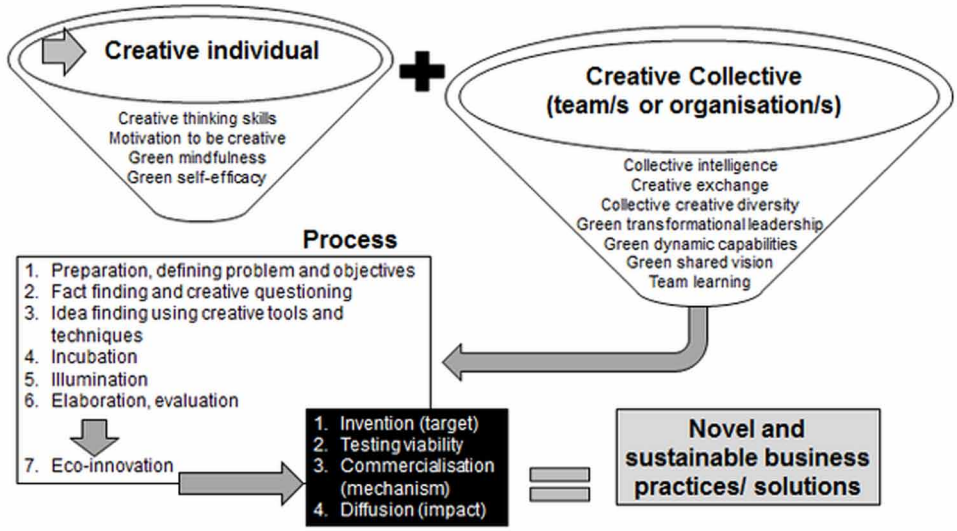
The process starts with the creative individual which needs creative thinking skills, creative motivation, green mindfulness and green self-efficacy. A creative collective (team or organization for example) is then created consisting of a diverse mix of these creative individuals who will use their creative intelligence and creative exchange to create a shared green vision. The creative collective will need green transformational leadership with access to green dynamic capabilities and resources to be effective in the business environment as well as the other determinants to make the process successful. This creative collective will then follow the six step creative problem-solving process which will enable the creative collective to create eco-innovation using an additional four steps. The end result will be novel and sustainable business practices and solutions.

Managing the Creative Collective and Creative Intelligence in Organizations

Collective green creativity and eco-innovation can be seen as creative exchange as identified by Flieschmann and Hutchinson (2012) although the practice of creative exchange was developed for the tertiary education environment. This method however fits into the development of sustainable business practices as well, because it is important to get multi-disciplinary and multi-industry perspectives to generate green creative and eco-innovative ideas. Creative exchange is helpful due to the fact that it fosters debate and dialogue amongst stakeholders, support expertise from various disciplines, acknowledges the differences in culture, communities and industries. In addition, creative exchange supports and develops individual and team development and examines debates and contemporary issues. It seems therefore that creative exchange can play a key role in collective green creativity and eco-innovation.

Parjanen (2012) defines collective creativity as social interactions between individuals due to new interpretations and new discoveries that the individuals involved could not have generated by themselves.

Figure 1. Fields's collective green creativity and eco-innovation process framework
Source: Own compilation



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Collective creativity is not simply the sum of individual creativities (Parjanen, 2012), but is greater than the sum of individual creativities, because it intensifies and multiplies due to the level of the problem and common concerns experienced about the problem. Creativity and innovation is a collaborative process and teams and people from various fields contribute to implementing new ideas. Therefore, managing collective green creativity and eco-innovation is critical for sustainable business practices in business organizations.

According to Parjanen (2012), four key elements are fundamental in managing collective creativity and innovation in business organizations. The first element is strategy. Collective creativity flourishes in an organization where policies are in support of team learning and free flow of productive ideas leading to new products or services (Anderson, Potočnik & Zhou, 2014; Marquardt, 2011; Parjanen, 2012). The second element is the usefulness in enhancing cognitive ideas and innovation is leadership (Parjanen, 2012). The leadership structure that supports collective creativity in developing new products or services will embraces comment from all stakeholders irrespective of their status in the organization (Zhang, Tsui & Wang, 2011). Thirdly, the methods or approaches adopted in collecting and distribution of information within the system will determine the success or failure of creative ideas at the implementation stage (Bissola & Imperatori, 2011; Parjanen, 2012). For example, superior ideas can be generated through informal interactions or interpersonal relationships with the subordinates. This example shows that collective creativity and innovation in organizations are not limited to formal discussions/interactions, or team learning (Parjanen, 2012). The last but not the least element according to Parjanen (2012), is organizational culture. The fourth element relates to a set of core values or management principles that supports continuous learning and knowledge sharing at all levels within the organization (Anderson, Potočnik & Zhou, 2014). Superiors and subordinates are open minded, but thorough in their habits of challenging the status quo. A proper alignment of strategic goals, leadership structures, approaches to interactions and shared values within an organization is necessary for collective green creativity in developing eco-friendly products or services (Chen & Chang, 2013; Parjanen, 2012).

Management support for team learning and knowledge sharing through brainstorming are efforts toward collective creativity. Collective creativity could be enhanced through task experiences, personal and team development. Gino, Argote, Miron-Spektor, and Todorova, (2010) found that teams who acquired direct task experiences are more creative compared to teams who acquired experience through feelings or actions of another person. Empirically, the study found that task experience has a direct positive influence on collective creativity. Therefore, eco-innovation can be enhanced through direct or indirect task experiences either acquired or shared within a group. Statistically, Sung and Choi (2012) found that team experience management and transfer are positively associated with collective creativity and sustainable business outcomes. Through horizontal and vertical communication individual creativity can easily be transformed into collective creativity, provided that policies and programmes are in support of the exchange process (Bissola & Imperatori, 2011; Gong, Kim, Lee & Zhu, 2013). For instance, team activity, storage and retrieval (Decuyper, Dochy & Van den Bossche, 2010) are some of the important elements in building team creativity and innovation. Findings from Bissola and Imperatori, (2011), informed that collective creativity and innovation is a function of individual innovative ideas, group dynamics and managerial resolutions. That is, developing sustainable business practices requires well harnessed individuals, teams and managerial creative capabilities. A learning culture that supports knowledge exchange through interactions within or between work groups is crucial in generating collective ideas and building sustainable business outcomes in the knowledge economy (Martins & Terblanche, 2003; Yoon, Song, Lim & Joo, 2010). Also, corporate entrepreneurial orientations such as creativity, innova-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

tion, and competitive aggressiveness of individuals and teams could be regarded as collective efforts in building sustainable business outcomes.

The concept eco-innovation for business organizations is an add-on to Corporate Social Responsibility (CSR), which also stands against profit maximization from the classical point of view (Carroll & Shabana, 2010). This chapter submits that collective green creativity and eco-innovation are essential in developing sustainable business models for the interest of all stakeholders in the 21st century. The reason is that, global warming, for instance, is a global issue confronting all stakeholders.

Another interesting emphasis for sustainable business practices in this chapter is the role of technology in collective creativity and team learning. Kirkman, Rosen, Tesluk and Gibson (2004) put it that improvements in information technology (IT) played a significant role in sharing knowledge situated in distance locations across the global with teams. Team members can be linked up using IT, which points to the importance of technology in generating collaborative intelligence. Also, distance is no longer a barrier in the global environment. Collaborative ideas could be easily generated, shared and improved on using online platforms, especially among work groups that are geographically dispersed (Faraj, Jarvenpaa & Majchrzak, 2011). Contemporary work organizations may find the IT based learning platforms valuable in advancing collaborative ideas and developing sustainable business models. Studies conducted by Hill, Brandeau, Truelove and Lineback (2014), reveal that *collaborative problem solving*, *discovery-driven learning* and *integrated decision-making* were instrumental in attaining *collective genius* at selected world leading IT firms. Collaborative problem solving starts with the documentation of interchange content and objectives; by verifying customers' current/future needs, and developing sustainable models in line with the global requirements (Aarikka-Stenroos & Jaakkola, 2012; Kirschner, Buckingham-Shum & Carr, 2012). Collective problem solving sets the pace for teams' discovery-driven learning in the act of creating collective intelligence (Hill, Brandeau, Truelove & Lineback, 2014), which is key to new products or services development. A discovery-driven learning is an action plan to arrive at more efficient, but sustainable business models through continuous update of skills and experiences at team levels (Chesbrough, 2010; McGrath, 2010). A discovery-driven learning in this context, could be enhanced using information and communication technologies in disseminating information among members. An integrated decision-making process in the knowledge economy is more advanced with the use of IT in consultation with all stakeholders or based on green IT balanced scorecard (Bhattacharya et al., 2014; Wati & Koo, 2011). Collaborative intelligence drawn from integrated decision-making process in advancing eco-innovation through green IT balanced scorecard could be regarded as efforts in the right direction toward sustainable business practices of the 21st century. The next section provides explanations regarding the merits of collective creativity and innovation.

Advantages of Collective Creativity and Innovation

Creativity could be referred to as one of the greatest potential sources of competitive advantage in the 21st century (Amabile, 2011). Survival of business organizations in the modern economy is largely dependent on creative capabilities of individuals, teams and management boards. The reason is not far-fetched, state-of-the-art products and services one can count on today emerged from collaborative creativity. According to Articles (n.d.) the following are advantages of collective creativity to business organizations:

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- **Better Teamwork and Team Bonding:** Collaborative creativity enhances interpersonal relationships within groups. Organizations that generate ideas through the practice of collective culture stand to experience team efficiency.
- **Increased Workplace Engagement and Interaction:** Generally, collaborative brainstorming improves communication and employee involvement in decision making process both at groups and organizational levels.
- **Improved Ability to Attract and Retain Quality Employees:** The sensitive issue of employee retention can be overcome by recognition of creative ideas of competent employees. This gives a sense of belonging and boosts employees' level of engagement and creativity.
- **Increased Staff Morale, Fun and Happiness:** Collective intelligence could be used a motivational tool to improve employees level of productivity, in terms of quality and quantity of units produced or quality of service delivery.
- **Increased Workplace Problem Solving and Productivity:** Involvement of stakeholders in diagnosing and problem solving process puts an organization ahead its competitors. Particularly, when such information are well coordinated, the result; which is collective genius is far rewarding compared to individual intelligence (Hill, Brandeau, Truelove, & Lineback, 2014).

Therefore, this chapter submits that collective creativity and innovation will impact more on organizational productivity and competitive advantage; when the processes are well managed at all level in an organization. In addition, collective green creativity and eco-innovation in organizations and amongst various organizations and industries can create novel sustainable ideas and solutions that mankind has never thought about that can prevent or decrease the 6th extinction to allow mankind to save the planet and all life on it. It is clear that we cannot save the planet with the same kind of thinking used when we are busy destroying it. Mankind still have a long way to go, but we have creative and innovative intelligence that can change the current fate of the planet.

Disadvantages of Organizational Creativity and Innovation

There are however a negative side to creativity and innovation, specifically in the 21st century. It is one of the reasons why our planet is in distress in the first place. Mankind only focused on the ideas and novel innovations without considering the consequences on the planet. In the 21st century, "*an excess of creativity can lead to a breakdown between the phases of the innovation process with detrimental consequences"* (Del-Corte-Lora, Vallet-Bellmunt & Molina-Morales, 2015, p. 4). Accordingly, an overflow of collaborative ideas may cause an adverse effect on organizational productivity, due to issues of absorptive capacity and timing problem. The authors are supporting the positive side of collective creativity and innovation to business organizations, but are aware that excessive creativity may leads to confusion or business failure if not managed properly and sustainably as well. For example, when a creativity idea failed to materialised into desired outcomes after huge investments at the implementation stage. This kind of result may cause a serious setback to an organization, if no provision was made for such circumstance.

Technological innovations around the world created dependency on technology for daily survival (Belcher, n.d.). As such, technological breakdown often disabled humans until the problem is fixed. Another shortcoming of digital automation is that it contributes to the high rate of unemployment, by

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

continuously putting less value in human capital (Belcher, n.d.; Rotman, 2013). Rotman (2013), reports that the service industry contributed 79.7% to the United States (US) Gross Domestic Product (GDP) in 2013, as a result of automation in the US service industry. Automation has taken over jobs meant for employees around the world, for example, the use of electronic banking applications (Automated Teller Machine (ATM), online banking, and mobile banking have displace human resources worldwide in the banking industry. Similarly, Nisen (2013) alerts that advances in artificial intelligence could cause up to 75% unemployment rate in the global environment. This is a projection that requires all hands on deck in developing collective green ideas and eco-innovation to savage employment generation in the knowledge economy. The paradigm shift from collective genius (Hill, Brandeau, Truelove & Lineback, 2014) to artificial intelligence (Gurkaynak, Yilmaz & Haksever, 2016; Rodríguez, Soria & Campo, 2016) is another shortcoming of creativity and innovation, considering its negative influence on humans. The greatest danger is that artificial intelligence might subdue human intelligence in the nearest future (Gurkaynak, Yilmaz & Haksever, 2016). The following are some of the shortcomings of technological innovations in the manufacturing industry, according to Payne (2013):

- **Less Versatility:** Advances and adoption technological innovations in the manufacturing plants displace the human element in an unprecedented proportion.
- **More Pollution:** The use of machines in factories has negative impact on human environment (Melville, 2010). The practice of corporate social responsibility as a compensation is often not commensurate with the amount of damages done to the natural environment (Carroll & Shabana, 2010; Melville, 2010).
- **Large Initial Investment:** It requires huge amounts of money for purchase of automated machines and huge investment are usually made regarding technical know-how and costs of maintenance.
- **Increase in Unemployment:** The high rates of unemployment recorded in the global environment could be traced to utilization of digital automation in workplaces around the world (Nisen, 2013; Rotman, 2013). Therefore, collective efforts are required in building green business models and eco-innovations for the sake of sustainability in the global business environment. The next section unveils the determinants for effective collective green creativity and eco-friendly innovations in modern organizations.

Determinants for Successful Organizational Creativity and Innovation

This chapter submits that collective green creativity and eco-innovations are essential requirements for sustainable business models/practices. One of the basic determinants for sustainable business practices is a corporate culture that supports collaborative ideas and green products development (Chen & Chang, 2013; Im, Montoya & Workman, 2013; Martins & Terblanche, 2003). A cultural pattern that embraces team learning, free flow of information, and shapes attitudes as well as behavioural patterns is effective in stimulating collective creativity and organizational innovation (Martins & Terblanche, 2003; Yoon, Song, Lim & Joo, 2010). Such cultural values are usually aligned with the organizational strategy, structures and objectives. Knowledge management could be regarded as a key determinant for effective collaborative creativity and new products development (Lee, Leong, Hew & Ooi, 2013). Knowledge management at individual, team and organizational levels need to be well planned, delivered and transferred into outstanding discovery and innovation.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Apart from culture and knowledge management that supports collective creativity, superior capability in managing team dynamics is also crucial in building sustainable business models in the 21st century. For instance, Im et al. (2013), found that managing team dynamics and interpersonal relationships are a forerunner to generating collective intelligence, thereby resulting into new products development. The question of newly developed products meeting the global requirements in reducing the issue of global warming is at the centre stage of sustainable business models. Work groups in the 21st century need *green dynamic capabilities*, and *green creativity* in accordance with the global demand for eco-innovation (Chen & Chang, 2013). Accordingly, green dynamic capabilities is the ability of an organization to exploit current resources and collective intelligences to rejuvenate or enhance its business models in responding to business demands in the 21st century. Chen et al. (2015) submit that green creativity is more essential for business organizations operating under the context of eco-innovation and sustainable business practices.

Green transformational leadership is another determinant for sustainable business models and eco-innovation in the global economy (Chen & Chang, 2013; Gumusluoglu & Ilsev, 2009). Green transformational leadership could be referred to as a set of behavioural patterns of business leaders in motivating their organizational members to generate eco-friendly creative ideas and inspire teams to surpass the requirements of eco-innovation (Chen & Chang, 2013). Personality traits of leaders in business organizations can either support or demean collective intelligence in developing new products. For example, transformational leaders could assist in creating new ideas by providing a vision and boosting followers' morals toward development of innovative products or services.

Risk-taking capabilities and willingness to finance creative ideas is a powerful determinant for successful organizational creativity and innovation (Stanley, 2016). Organizations are sometimes sceptical in exploring new products development due the level of risk involved. The fact remains that no creative idea can materialise in new products or services without adequate investments of both financial and non-financial resources (Leachman, 2014). Financial analysis of risk and uncertainty is a key factor to consider in new product development (Mazzucato, 2013). Such analysis would help in making decisions about calculated risk and uncertainty. Rather than treating each determinant for effective organizational creative and innovation in isolation, Parjanen (2012), submits that all determinants should be logically aligned to arrive at expected outcomes. That is, the organizational vision and mission statements should be logically aligned with the corporate/business strategies, organizational culture, structure and leadership, methods of managing team dynamics, knowledge sharing capabilities and approaches of financing innovation.

RECOMMENDATIONS

The threat of the 6th extinction is real and should be treated as such. Organizations can no longer continue on the same path and repeat the old and unsustainable business practices of the past. It is important that organizations understand their impact on the planet and not remain indifferent due to the Cassandra syndrome, and that the various stakeholders of these organizations ensure that organizations behave ethically and sustainably. Various organizational watchdogs should be set up that support the United Nations Global Compact initiative and communities should use their collective power to force organizations to behave responsibly towards the environment and their communities.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Creativity is often seen as a rare gift only given to a selected few. Greater awareness is needed to develop the understanding that creativity is a skill that everyone is born with and this skill can be developed through training and development. Organizations specifically should not only see innovation as an important aspect in business to ensure a competitive advantage, but realise that innovation starts with creativity at an individual level which are then enhanced through collaborative problem solving, discovery-driven learning and integrated decision making to attain collective genius (collective green creativity and eco-innovation for example) in organizations. Organizations need to incorporate creativity and innovation awareness programmes in the training and workshops of all employees at all the various levels in the organization, focusing on individual and collective creativity and innovation.

Organizations should manage creativity and innovation from a strategic perspective by incorporating it in the shared vision, strategic goals and policies. Green creativity and eco-innovation should specifically be focused on to create sustainable business practices and problem-solving. This also calls for organizational intrapreneurship to create strategic renewal, sustained regeneration and pioneering strategies. Leadership should be aligned to the green shared vision and transformational leadership should be developed to encourage team learning, team development and the development of an organizational culture that supports creative and innovative thinking. This may sound easy, however some organizations might struggle to change the current organizational culture that supports unsustainable business practices and where unethical behaviour is rife. It is critical that the top management understands and supports green creativity and eco-innovation before transformation of an organization can start.

Technology will be an important and critical key component to initiate, drive and implement collective green creativity and eco-innovation. Ideas will need to be captured and evaluated using technology. Collective activities should be documented to ensure that a record is kept of all the ideas and innovations to not generate similar ideas and waste time, but rather to encourage building on ideas already identified previously but not implemented. People sharing ideas need to feel that their efforts are not a waste of time and that it is evaluated fairly. A reward system can be an important driver in the process.

There are various recommendations which cannot all be provided in this chapter. It is the hope of the authors that readers will also consider the recommendations provided in other chapters and then to develop a unique and creative strategy for their specific organization.

FUTURE RESEARCH DIRECTIONS

The Fields collective green creativity and eco-innovation framework needs to be empirically tested in various organizations in various countries to specifically focus on the outcome (for example, green and eco-friendly products, services, processes, business practices) and its impact on sustained sustainability for organizations, communities and the planet.

Concepts like green mindfulness, green self-efficacy, collective intelligence and collective exchange in sustainable businesses development should be explored in more detail. Specific processes and techniques should then be developed to enable organizations to implement collective green creativity and eco-innovation in their organizations

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

CONCLUSION

'Believing Cassandra' is the only way to avoid a predicted disaster of a sixth extinction. Mankind need to take corrective action to ensure that the Cassandra syndrome is recognized and that predictions and warnings are taken seriously. Business organizations also have active and important roles to play in safe--guarding the natural environment. Rather than just considering the customers' needs, technology, investments and profitability, the environmental impacts of new products and services should be taken seriously in the 21st century. The environmental impact, points to the importance of collective green creativity and eco-innovation to develop sustainable business practices in the global economy. Industrial organizations could utilised collective creative intelligences in creating green creativity to solve business and environmental problems, such as; melting glaciers, resource depletion, ocean acidification, and deforestation. This implies that an organization can be conscious of its environment in formulating competitive strategies and design of new products and services. An organization could achieve eco-innovation and sustainable business practices by tapping into the collective creative genius of its members through green mindfulness, green self-efficacy and shared vision, green transformational leadership, and green creativity. Therefore, collective green creativity and eco-innovation can offer novel solutions to the 'wicked problem' we are faced with of unsustainability and the possibility of a global extinction event caused by mankind.

REFERENCES

Aarikka-Stenroos, L., & Jaakkola, E. (2012). Value co-creation in knowledge intensive business services: A dyadic perspective on the joint problem solving process. *Industrial Marketing Management*, *41*(1), 15–26. doi:10.1016/j.indmarman.2011.11.008

Afolabi, M. O., Dionne, S., & Lewis, H. (2009). *Are we there yet? A Review of Creativity Methodologies*. Retrieved May 19, 2015, http://www.cs.cornell.edu/Conferences/ASEE2006/ASEE%20Papers/Session%204/ASEE%20Final%20vs%203_Afolabi.pdf

Amabile, T. M. (2011). How to kill creativity. In S. Johnson (Ed.), *The innovator's cookbook: Essentials for inventing what is next* (pp. 38–63). New York, NY: RiverheadBooks.

Anderson, N., Potočnik, K., & Zhou, J. (2014). Innovation and creativity in organizations a state-of-the-science review, prospective commentary, and guiding framework. *Journal of Management*, *40*(5), 1297–1333. doi:10.1177/0149206314527128

Articles. (n.d.). *The benefits of creative workplace*. Retrieved August 18, 2016, from http://www.best-practiceconsulting.com.au/_blog/Articles/post/Fostering_creativity_in_the_workplace/

Bandi, N. (2007). *United Nations Global Compact: impact and its critics*. Retrieved May 25, 2016, from http://www.ethicalquote.com/docs/UnitedNationsGlobalCompact.pdf

Beauregard, E. (2015). *Top Ten Reasons Climate Change is a Hoax*. Retrieved May 25, 2016, from http://www.globalclimatescam.com/opinion/top-ten-reasons-climate-change-is-a-hoax/

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Belcher, L. M. (n.d.). *Advantages and Disadvantages of Technology Advances*. Retrieved August 19, 2016, from http://smallbusiness.chron.com/advantages-disadvantages-technology-advances-12579.html

Benyus, J. M. (2002). *Biomimicry: Innovation Inspired by Nature*. New York, NY: Perennial.

Bhattacharya, A., Mohapatra, P., Kumar, V., Dey, P. K., Brady, M., Tiwari, M. K., & Nudurupati, S. S. (2014). Green supply chain performance measurement using fuzzy ANP-based balanced scorecard: A collaborative decision-making approach. *Production Planning and Control*, *25*(8), 698–714. doi:10.1080/09537287.2013.798088

Bissola, R., & Imperatori, B. (2011). Organizing individual and collective creativity: Flying in the face of creativity clichés. *Creativity and Innovation Management*, *20*(2), 77–89. doi:10.1111/j.1467-8691.2011.00597.x

Boden, M. A. (2004). *The Creative Mind: Myths and Mechanisms*. London: Routledge.

Carroll, A. B., & Shabana, K. M. (2010). The business case for corporate social responsibility: A review of concepts, research and practice. *International Journal of Management Reviews*, *12*(1), 85–105. doi:10.1111/j.1468-2370.2009.00275.x

Chen, Y. S., & Chang, C. H. (2013). The determinants of green product development performance: Green dynamic capabilities, green transformational leadership, and green creativity. *Journal of Business Ethics*, *116*(1), 107–119. doi:10.100710551-012-1452-x

Chen, Y. S., Chang, C. H., Yeh, S. L., & Cheng, H. I. (2015). Green shared vision and green creativity: The mediation roles of green mindfulness and green self-efficacy. *Quality & Quantity*, *49*(3), 1169–1184. doi:10.100711135-014-0041-8

Chesbrough, H. (2010). Business model innovation: Opportunities and barriers. *Long Range Planning*, *43*(2), 354–363. doi:10.1016/j.lrp.2009.07.010

Conway, S., & Steward, F. (2009). *Managing and shaping innovation*. New York, NY: Oxford University.

Cropley, D. H. (2016). Creative products: Defining and measuring novel solutions. In J. Plucker (Ed.), *Creativity and Innovation: Theory, Research, and Practice* (pp. 61–74). Austin, TX: Prufrock.

Cropley, D. H., & Cropley, A. J. (2010). Functional Creativity: Products and the generation of effective novelty. In J. C. Kaufman & R. J. Sternberg (Eds.), *Cambridge Handbook of Creativity* (pp. 301–320). New York, NY: Cambridge University. doi:10.1017/CBO9780511763205.019

De Sousa, F. C., Pellissier, R., & Monteiro, I. P. (2012). Creativity, Innovation and Collaborative Organizations. *The International Journal of Organizational Innovation*, *5*(1), 26–64.

Decuyper, S., Dochy, F., & Van den Bossche, P. (2010). Grasping the dynamic complexity of team learning: An integrative model for effective team learning in organisations. *Educational Research Review*, *5*(2), 111–133. doi:10.1016/j.edurev.2010.02.002

Del-Corte-Lora, V., Vallet-Bellmunt, T., & Molina-Morales, F. X. (2015). Be creative but not so much. Decreasing benefits of creativity in clustered firms. *Entrepreneurship & Regional Development*, *27*(1-2), 1–27. doi:10.1080/08985626.2014.995722

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Dell'Amore, C. (2014). *Species Extinction Happening 1,000 Times Faster Because of Humans? National Geographic Reports*. Retrieved May 25, 2016, from http://news.nationalgeographic.com/news/2014/05/140529-conservation-science-animals-species-endangered-extinction/

Elgueta, D. (2014). *The Cassandra Syndrome - Ancient Greek Myth*. Retrieved May 25, 2016, from http://www.pseudoparanormal.com/2014/02/the-cassandra-syndrome-ancient-greek.html

Faraj, S., Jarvenpaa, S. L., & Majchrzak, A. (2011). Knowledge collaboration in online communities. *Organization Science*, *22*(5), 1224–1239. doi:10.1287/orsc.1100.0614

Flieschmann, K., & Hutchinson, C. (2012). Creative exchange: An evolving model of multidisciplinary collaboration. *Journal of Learning Design*, *5*(1), 23–31.

Florida, R. (2002). *The rise of the creative class and how it's transforming work, life, community and everyday life*. New York, NY: Basic Books.

Gino, F., Argote, L., Miron-Spektor, E., & Todorova, G. (2010). First, get your feet wet: The effects of learning from direct and indirect experience on team creativity. *Organizational Behavior and Human Decision Processes*, *111*(2), 102–115. doi:10.1016/j.obhdp.2009.11.002

Global, N. A. S. A. Climate Change. (2016). *Climate change: how do we know*. Retrieved June 19, 2016, from http://climate.nasa.gov/evidence/

Global Sustainability Standards Board (GSSB). (2015). *G4 Sustainability reporting guidelines. Global reporting initiative*. Retrieved June 1, 2016, from https://www.globalreporting.org/standards/g4/Pages/default.aspx

Gong, Y., Kim, T. Y., Lee, D. R., & Zhu, J. (2013). A multilevel model of team goal orientation, information exchange, and creativity. *Academy of Management Journal*, *56*(3), 827–851. doi:10.5465/amj.2011.0177

Gore, A. (2014). Without a Trace. *The New York Times*. Retrieved June 2, 2016, from http://www.nytimes.com/2014/02/16/books/review/the-sixth-extinction-by-elizabeth-kolbert.html?_r=0

Greek Myths & Greek Mythology. (2016). *The Myth of Cassandra*. Retrieved June 2, 2016, from http://www.greekmyths-greekmythology.com/the-myth-of-cassandra/

Groenwald, D. (Ed.). (2013). *Contemporary Management Aspects*. Cape Town: Juta.

Gumusluoglu, L., & Ilsev, A. (2009). Transformational Leadership, Creativity, and Organizational Innovation. *Journal of Business Research*, *62*(4), 461–473. doi:10.1016/j.jbusres.2007.07.032

Gurkaynak, G., Yilmaz, I., & Haksever, G. (2016). Stifling artificial Intelligence: Human perils. *Computer Law & Security Review*. Retrieved June 2, 2016, from http://www.elig.com/docs/0bc70-stifling-artificial-intelligence-human-perils.pdf

Haim, A. (2003). *The Manager's Pocket Guide to Creativity*. Mumbai: Sanman.

Hamel, G., & Breen, B. (2007). *The future of management*. Boston, MA: Harvard Business School Publishing.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Hill, L. A., Brandeau, G., Truelove, E., & Lineback, K. (2014). Collective genius. *Harvard Business Review*, *92*(6), 94–102. PMID:25051858

Holthaus. (2015). The point of no return: climate change nightmares are already here. *Rolling Stone*. Retrieved June 15, 2016 from http://www.rollingstone.com/politics/news/the-point-of-no-return-climate-change-nightmares-are-already-here-20150805

Im, S., Montoya, M. M., & Workman, J. P. Jr. (2013). Antecedents and consequences of creativity in product innovation teams. *Journal of Product Innovation Management*, *30*(1), 170–185. doi:10.1111/j.1540-5885.2012.00887.x

Jackson, N. (2006). Creativity in Higher Education – creating tipping points for cultural change. *SCEP-TrE Scholarly Paper*, *3*, 25.

Jacobson, L. (2016). *Yes, Donald Trump did call climate change a Chinese hoax*. Retrieved June 15, 2016 from http://www.politifact.com/truth-o-meter/statements/2016/jun/03/hillary-clinton/yes-donald-trump-did-call-climate-change-chinese-h/

Jones, G. R., & George, J. M. (2012). *King Report on Corporate Governance in SA*. Retrieved June 15, 2016 from http://www.iodsa.co.za/?kingIII

Kirkman, B. L., Rosen, B., Tesluk, P. E., & Gibson, C. B. (2004). The impact of team empowerment on virtual team performance: The moderating role of face-to-face interaction. *Academy of Management Journal*, *47*(2), 175–192. doi:10.2307/20159571

Kirschner, P. A., Buckingham-Shum, S. J., & Carr, C. S. (2012). *Visualizing argumentation: Software tools for collaborative and educational sense-making*. Berlin: Springer Science & Business Media.

Kolberg, E. (2014). *The sixth extinction: an unnatural history*. New York: Henry Holt and Company, LLC.

Lapia, R., & Knight, L. (2011). *Recycle, reuse, design: eco-creativity in Rome*. Retrieved August 20, 2016, from http://www.cafebabel.co.uk/culture/article/recycle-reuse-design-eco-creativity-in-rome.html

Leachman, S. (2014). *Investing in ideas*. Retrieved August 20, 2016, from http://www.news.ucsb.edu/2014/014462/investing-ideas

Lee, V. H., Leong, L. Y., Hew, T. S., & Ooi, K. B. (2013). Knowledge management: A key determinant in advancing technological innovation? *Journal of Knowledge Management*, *17*(6), 848–872. doi:10.1108/JKM-08-2013-0315

Machiba, T. (2010). Eco-innovation for enabling resource efficiency and green growth: Development of an analytical framework and preliminary analysis of industry and policy practices. *International Economics and Economic Policy*, *7*(2-3), 357–370. doi:10.100710368-010-0171-y

Marquardt, M. (2011). *Building the learning organization: Achieving strategic advantage through a commitment to learning*. Boston, MA: Nicholas Brealey.

Martins, E. C., & Terblanche, F. (2003). Building organisational culture that stimulates creativity and innovation. *European Journal of Innovation Management*, *6*(1), 64–74. doi:10.1108/14601060310456337

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Mazzucato, M. (2013). Financing innovation: Creative Destruction vs. Destructive Creation. *Industrial and Corporate Change*, *22*(4), 851–867. doi:10.1093/icc/dtt025

McGrath, R. G. (2010). Business models: A discovery driven approach. *Long Range Planning*, *43*(2), 247–261. doi:10.1016/j.lrp.2009.07.005

Melville, N. P. (2010). Information Systems Innovation for Environmental Sustainability. *Management Information Systems Quarterly*, *34*(1), 1–21.

Muhammad, U. (2015). *Mass Extinction: Is the Enemy Us?* Retrieved June 19, 2016, from http://www.greattransition.org/images/GTI_publications/Muhammad-Mass-Extinction-Is-the-Enemy-Us.pdf

National Advisory Committee on Creative and Cultural Education (NACCCE). (1999). *All Our Futures: Creativity, Culture and Education*. London: Department for Education and Employment.

Nisen, M. (2013). *Robot Economy Could Cause Up To 75 Percent Unemployment*. Retrieved August 19, 2016, from http://www.businessinsider.com/50-percent-unemployment-robot-economy-2013-1

Organisation for Economic Co-Operation and Development (OECD). (2009). *Sustainable manufacturing and eco-innovation - Framework, Practices and Measurement*. Synthesis Report. Retrieved August 19, 2016, https://www.oecd.org/innovation/inno/43423689.pdf

Parjanen, S. (2012). Experiencing creativity in the organization: From individual creativity to collective creativity. *Interdisciplinary Journal of Information, Knowledge, and Management*, *7*, 109–128.

Payne, B. B. (2013). *Advantages and Disadvantages of Automation in Manufacturing*. Retrieved August 19, 2016, from http://www.vista-industrial.com/blog/advantages-and-disadvantages-of-automation-in-manufacturing/

Plucker, J. A., Beghetto, R. A., & Dow, G. T. (2004). Why isn't creativity more important to educational psychologists? Potentials, pitfalls, and future directions in creativity research. *Educational Psychologist*, *39*(2), 83–96. doi:10.120715326985ep3902_1

Puccio, G. J., & Cabra, J. F. (2010). Organizational creativity: A systems approach. In J. C. Kaufman & R. J. Sternberg (Eds.), *The Cambridge handbook of creativity* (pp. 145–173). New York: Cambridge University Press.

Rodríguez, G., Soria, Á., & Campo, M. (2016). Artificial intelligence in service-oriented software design. *Engineering Applications of Artificial Intelligence*, *53*, 86–104. doi:10.1016/j.engappai.2016.03.009

Rotman, D. (2013). *How Technology Is Destroying Jobs*. Retrieved August 19, 2016, from https://www.technologyreview.com/s/515926/how-technology-is-destroying-jobs/

Runco, M. A. (2007). *Creativity. Theories and themes: Research, development and practice*. Amsterdam: Elsevier.

Scarborough, N. M., & Cornwall, J. R. (2015). *Entrepreneurship and effective small business management* (11th ed.). Boston: Pearson Education Limited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Sherwin, C. (2011). *Creativity: missing from the sustainability jigsaw? Forum for the future.* Retrieved August 20, 2016, from https://www.forumforthefuture.org/blog/creativity-missing-sustainability-jigsaw

Smith, D. (2010). *Exploring Innovation* (2nd ed.). Berkshire, UK: McGraw-Hill Education.

Stanley, M. (2016). *Creative Capital Innovates & Sustains*. Retrieved August 20, 2016, from http://www.morganstanley.com/ideas/theme-sustainable-investing-and-creative-capital

Sung, S. Y., & Choi, J. N. (2012). Effects of team knowledge management on the creativity and financial performance of organizational teams. *Organizational Behavior and Human Decision Processes*, *118*(1), 4–13. doi:10.1016/j.obhdp.2012.01.001

The Biomimicry Institute. (2015). *Biomimicry 101*. Retrieved July 20, 2016, from https://biomimicry.org/what-is-biomimicry/#.V8XApPl97IU

United Nations Global Compact Report. (2015). *Global opportunity Report 2015*. Retrieved June 19, 2016, from https://www.unglobalcompact.org/docs/publications/Global_Opportunity_Report.pdf

Vaidyanathan, G. (2016). 10 ways climate science has advanced since An Inconvenient Truth. *Climate Wire*. Retrieved June 19, 2016, from http://www.scientificamerican.com/article/10-ways-climate-science-has-advanced-since-an-inconvenient-truth/

Vince, C. (2012). *A looming mass extinction caused by humans*. Retrieved August 20, 2016, from http://www.bbc.com/future/story/20121101-a-looming-mass-extinction

Vygotsky, L. S. (2004). Imagination and Creativity in childhood. *Journal of Russian & East European Psychology*, *42*(1), 7–97.

Wati, Y., & Koo, C. (2011, January). An Introduction to the Green IT balanced scorecard as a strategic IT management system. In *The 44th Hawaii International Conference on System Sciences*. 10.1109/HICSS.2011.59

Yoon, S. W., Song, J. H., Lim, D. H., & Joo, B. K. (2010). Structural Determinants of Team Performance: The mutual influences of Learning culture, Creativity, and Knowledge. *Human Resource Development International*, *13*(3), 249–264. doi:10.1080/13678868.2010.483815

Zhang, A. Y., Tsui, A. S., & Wang, D. X. (2011). Leadership behaviors and group creativity in Chinese organizations: The role of group processes. *The Leadership Quarterly*, *22*(5), 851–862. doi:10.1016/j.leaqua.2011.07.007

KEY TERMS AND DEFINITIONS

Collective Creativity: Collective of creative people working as a team to create new and novel ideas and solutions.

Creativity: Creativity is about solving problems and satisfying needs by developing novel and useful solutions.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Eco-Innovation: The production, assimilation or exploitation of a novelty in products, production processes, services or in management and business methods, which aims, throughout its lifecycle, to prevent or substantially reduce environmental risk, pollution and other negative impacts of resource use.

Green Creativity: The generation of new and novel environmentally friendly and sustainable business ideas.

Innovation: The implementation and commercialisation of new and problem-solving ideas, practices or products through which change is brought about.

This research was previously published in Collective Creativity for Responsible and Sustainable Business Practice edited by Ziska Fields, pages 1-25, copyright year 2017 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 23
A Business Model Framework for Crowd-Driven IoT Ecosystems

Xenia Ziouvelou
University of Southampton, UK

Frank McGroarty
University of Southampton, UK

ABSTRACT

This article describes how the era of hyper-connectivity is characterized by distributed, crowd-centric ecosystems that utilise cutting edge technology so as to harness the collective power, co-creation ability and intelligence of the crowd utilising under open participatory value creation models. The Internet of Things (IoT) has fueled the emergence of such ecosystems that leverage not only the power of physical things connected to the Internet but also the wisdom of the crowd to observe, measure, and make sense of phenomena via user-owned mobile and wearable devices. Existing business modelling literature has to date, placed no research attention on business models for such emerging ecosystems. This article aims to fill this gap by examining the dynamics of crowd-driven IoT ecosystems and introducing a business model framework for such environments, encompassing all relevant value-creating actors, activities and processes, facilitating this way a holistic ecosystem business model analysis.

1. INTRODUCTION

A hyperconnected world is emerging; a world where people (Internet of People) and things (Internet of Things) are linked together providing anyone with "anytime, anywhere" access to information (Gomez et al., 2013). This environment intensifies collaboration and facilitates the emergence of new participatory value creation models driven by users and empowered by technological advancements. This era of hyper-connectivity is no longer characterized by centralised firm-centric business structures but rather from distributed, ecosystemic structures that utilise cutting edge technology in order to harness the collective power, co-creation ability and intelligence of the crowd. In these complex technologically advanced and

DOI: 10.4018/978-1-5225-7915-1.ch023

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

constantly evolving inter-connected ecosystems, it is the ecosystem's ability to bring together a variety of strategic business elements in order to jointly co-create shared value; defining this way its success.

The Internet of Things (IoT), as a network that links digital and physical entities via information and communication technologies, has moved to a new era that goes beyond the introduction of new types of services and applications, focusing upon the introduction of new ways of leveraging distinct, distributed and embedded value. As such, the role of IoT is catalytic in the emerging crowd-driven value co-creation paradigms as it introduced new user-centric archetypes, like mobile crowd sensing (MCS) (Burkel et al., 2006; Ganti et al., 2011), that go beyond traditional sensing techniques (e.g., sensor networks, etc.). These archetypes leverage the power, the devices (user-owned mobile devices and wearable devices) and the wisdom of the crowd to observe, measure, and make sense of phenomena (crowdsourcing). In this context, co-creation occurs both among and between crowd participants and systems (mobile crowdsourcing and mobile crowdsensing (participatory and opportunistic sensing)). A number of crowd-driven IoT ecosystems (Ziouvelou & McGroarty, 2017) have emerged elevating the role and collective efforts of people for enhancing the shared value creation under a "contextual open innovation 2.0" model that integrates the "environment" as an underlying value component in an IoT setting. Such ecosystems evolve in a "Quintuple Helix" innovation system where cooperation is established between five helices, namely: university, industry, government, civic society and the environment (Carayannis & Campbell, 2010; Carayannis & Campbell, 2014).

However, despite this change in the business logic of emerging IoT ecosystems, there is still a limited understanding of the business dynamics and business models of these emerging, technologically advanced, crowd-driven ecosystems. Based on the analysis of Ziouvelou & McGroarty (2017), the prevalent view of existing research in the area of IoT business models is still primarily firm-centric (Bilgeri & Wortmann 2017; Ju et al., 2016; Weinberger et al., 2016; Dijkman et. al., 2015; Chan 2015; Fleisch, et al., 2015; Hui 2014; Qin & Yu, 2014; Fleisch et al., 2014). Only a few studies adopt an ecosystemic view (Schladofsky et al., 2016; Rong et al. 2015; Turber et al., 2014; Westerlund et al., 2014; Leminen et al., 2012). However, even these studies tend to adopt firm-centric analytical modeling tools such as the business model canvas (Osterwalder & Pigneur, 2010) and only a few propose ecosystem-centric models placing emphasis upon value creation and value capture components (in the context of: (a) Industrial IoT (Iivari et al., 2016) and (b) IoT (Westerlund et al., 2014)) among others[1]. On the contrary, there are no studies defining business models for crowd-driven ecosystems in the context of IoT. However, given the nature of the crowd-driven ecosystems, current approaches to developing business models (firm-centric approaches) fail to capture their dynamics and thus their full potential (Ziouvelou & McGroarty, 2017). This indicates the need for new business model frameworks and components that reflect the dynamic nature of these emerging value ecosystems.

This study aims to fill this gap and shed light into the emergence of crowd-driven IoT ecosystems and their business models utilising an exploratory and explanatory research approach. Initially an exploratory review analysis, of existing research in the area of ecosystems and business models related to the IoT, is provided. This is followed by a classification of existing research under an explanatory framework that facilitates the analysis of crowd-driven IoT ecosystems and their business models and the introduction of an integrated conceptual crowd-driven ecosystem business model framework, which supports the creation of business models for these environments. The proposed Crowd-driven Ecosystem Business Model Framework (CEF) corresponds to the needs of ecosystem-centric IoT environments by integrating all relevant value network participants and value-related activities and processes in an open, ecosystem-centric context.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The article is structured as follow. Section 2 provides an overview of the approach that has been adopted in this study. Section 3 investigates the emergence of crowd-driven IoT ecosystems and Section 4 explores business models for crowd-driven IoT ecosystems and provides an explanatory framework that classifies existing studies. Section 5 introduces a new business model framework for designing ecosystemic business models for the crowd-driven IoT environment and Section 6, concludes this study and reviews its key implications.

2. THE STUDY APPROACH

The goal of this research is to explore research in the area of crowd-driven IoT ecosystems, their business models and analytical frameworks and to create a business model framework for such technologically advanced environments. For this reason, both an exploratory and explanatory research approach is employed. At first, an exploratory review analysis is presented that integrates two research streams namely, ecosystem research (Moore 1993; Carayannis, 2010) and business model research (Afuah & Tucci, 2000; Afuah, 2003; Osterwalder et al, 2005; Amit & Zott 2015) aiming to reflect upon the notion of crowd-driven IoT ecosystems (Ziouvelou et al. 2017; Ziouvelou & McGroarty, 2017). The methodological process of this analysis involves the exploration of numerous publications, from several sources (journals, academic books, digital research libraries, etc.) in order to identify the most significant publications based on their citations. This is followed by a classification of existing research under an explanatory framework that facilitates the analysis of crowd-driven IoT ecosystems and their business models. Based on this analysis, we were able to introduce an integrated conceptual crowd-driven ecosystem business model framework, which supports the creation of business models for these environments. The proposed Crowd-driven Ecosystem Business Model Framework (CEF) corresponds to the needs of ecosystem-centric IoT environments by integrating all relevant value network participants and value-related activities and processes in an open, ecosystem-centric context.

3. CROWD-DRIVEN ECOSYSTEMS AND CROWD-DRIVEN IOT ECOSYSTEMS

Ecosystem research bridges a number of scientific fields from ecology, to business, and technology. The ecosystemic perspective has to date triggered a lot of research attention focusing on the evolving complex ecosystemic landscapes across disciplines. From biological ecosystems found in the natural world, ecosystems have over the past few years emerged as a business construct that facilitates the description and analysis of the complex networks that populate our hyperconnected society (Lehto et al., 2013; Durst & Poutanen, 2013). This emerging view reflects a much deeper structural shift and change in the way value is created and captured in today's networked society: from standalone companies to integrated corporate constellations and from closed ecosystems to open, crowd-driven ecosystemic structures powered by technology, user participation and open collaborative innovation (Chesbrough & Appleyard, 2007). As such although in firm-centric structures, value creation and value capture are central to the company itself (the buyer captures value by consuming the product), the ecosystemic view provides a broader more inclusive perspective where value mechanisms are embedded within the whole ecosystem, making value creation and capture a collaborative effort (Le & Tafardar, 2009; Lehto et al., 2013; Iivari et al., 2016; Letaifa, 2014). Some important dimensions of value emerge from crowd-driven ecosystems and

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

these relate to the fact that: (1) value emerges from a distributed network rather than a linear corporate function (Kohler, 2015), and (2) value is not only co-created (Allee, 2003; Prahalad & Ramaswamy, 2004) and co-captured but also co-distributed among network participants and contributors acting as an ongoing, circular value creation model (Ziouvelou et al., 2017). This emerging participatory value model mirrors an ongoing process of joint value creation, value capture and value distribution where the later manifests as open "value sharing" across the ecosystem's value-creating participants, accounting for their contribution, as opposed to closed, firm-centric value models where value is captured centrally. In order for this model to function effectively, each value domain should operate in the same way, since a weakness in any domain will undermine the performance of the whole ecosystem.

Despite the business logic shift, from firm-centric to ecosystem-centric and crowd driven ecosystem-centric (Ziouvelou et al., 2017), the prevalent view of existing research in the area of business models is still primarily company centric. As a consequence, the business model analytical frameworks facilitating the development, analysis and implementation of business models that are utilised adopt static, firm-centric tools (Ziouvelou & McGroarty, 2017). However due to the nature of the crowd-driven ecosystems and crowd-driven IoT ecosystems in particular current business model approaches and frameworks, facilitating the development, analysis and implementation of business models, are not directly applicable. As such novel frameworks need to evolve that will be targeting the needs of such ecosystems and adopt a dynamic flexible business model framework (Ziouvelou & McGroarty, 2017).

3.1. Ecosystems: From Biological to Crowd-Driven Ecosystems

The notion of the ecosystems lies in the natural world and in the science of biology. Biological ecosystems are communities of living organisms, combining organic and inorganic matter forming "the productive engines" of the planet (Rosen, 2000, p. 3). Such ecosystems are dynamically evolving, "constantly remaking themselves, reacting to natural disturbances and to the competition among and between species" (Rosen 2000, p. 11). The British botanist Arthur Tansley coined the term in 1935, in order to denote a community of living organisms interacting with each other and their environment as a dynamic system. A few decades later one can identify the first biological analogies in the business (Moore, 1993) and in the economic (Rothschild, 1990) fields. Moore perceives individual corporate structures as members of a broader business ecosystem that crosses a variety of industries. According to this view a business ecosystem as "an economic community supported by a foundation of interacting organizations and individuals – the organisms of the business world" (Moore, 1996), that like biological ecosystems are characterized by high complexity, interdependence, cooperation, competition and coevolution (Moore, 1996; Lehto et al., 2013; Jansson et al., 2014) and are formed both intentionally and as a result of an accident. According to Moore it is "conscious choice" that differentiates between ecological and social systems (Moore, 1996, p. 18). Rothschild, on the other hand, sees the global economy as an ecosystem similar to biological ecosystems, facilitating continuous interactions among participating entities. Existing literature indicates that the natural ecosystem model presents an ideal metaphor for numerous ecosystem types, such as: knowledge, industrial, economic, business, innovation and crowd-driven ecosystems research. However, biological ecosystems also present fundamental differences with other systems such as cultural ones (Norton et al., 1997; Ring, 1997; Ayres, 2004). Some of the drawbacks of this analogy, according to Corallo and Propata, 2007, in the business and economic research are firstly the "intentionality" of human activities toward a specific goal and the satisfaction of human wants, as opposed to biological systems that are governed by no intentionality. The second is that although biological species do not

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

interbreed (exceptions are species with smallest levels of complexity, such as genes and microbes), human beings produce novel outcomes via the combination of heterogeneous facts, skills and ideas on a scale that is unparalleled in the rest of nature (Corallo and Propata, 2007). In the sections that follow we present a brief overview of these six ecosystem analogies, as well as a taxonomy following the analysis of (Ziouvelou et al., 2017, Ziouvelou & McGroarty, 2017) (see Table 1).

- *Knowledge ecosystems* are complex systems integrating organisations, people, technologies, processes and data (knowledge resources, databases, etc.) that via collaborative knowledge interaction they share and reuse existing knowledge and they create and co-create new one. These ecosystems act as evolutionary networks of collaboration (Bray, 2007) that enhance knowledge creation and the speed of innovation diffusion (Baptista, 1998). Such knowledge interactions occur between: (a) geographically clustered organisational entities that enjoy numerous advantages as they can benefit from their co-location, their collective resources and the dynamic knowledge interactions that occur between them (Almeida & Kogut, 1999) and (b) in the online environment, within and between communities that exhibit virtual proximity/co-location (Coughlan, 2014).
- *Business ecosystems* are viewed as economic communities of interacting "organisms of the business world" (Moore, 1996, p. 9), focusing on knowledge commercialisation and delivery value to the end users (Clarysse et al., 2014, Valkokari, 2015). Such business structures have many horizontal "co-opetitive" (collaborative and competitive) interactions (Moore, 1993, Brandenburger & Nalebuff, 2011) that aim towards the joint delivery of products or services to customers (Clarysse et al., 2014). Their actors of these nested networks, according to Moore, are: customers, lead producers, competitors, and other stakeholders[2]. Unlike knowledge ecosystems, which are usually university/academia-centered, business ecosystems are market driven and centered on large companies (Clarysse et al., 2014). "Keystone species" (star structure model, often hierarchical (Mazhelis et al., 2012) versus flat ecosystem model composed by mainly SMEs in addition to large companies (Corrallo et al., 2007) are leading, highly influential business actors (Moore, 1996, p. 25).
- *Digital business ecosystems* are business ecosystems in the online environment that enhance cooperation, knowledge sharing and value creation among their interacting digital species[3] (Nachira, 2002, Nachira et al., 2007, Stanley & Briscoe, 2010). Brought about the diffusion of ICT (information and communication technology) and the convergence of ICT networks, social networks, and knowledge networks (Nachira et al., 2007), digital business ecosystems are seen as a partial digital representation of a physical business ecosystem (Nachira et al., 2007). These ecosystems facilitate the emergence of new forms of dynamic business interactions between human and digital entities, systems as well as global cooperation among companies, public and private organisations, business communities and the academic community (a Triple Helix innovation model of university–industry–government (UIG) (Etzkowitz & Leydesdorff, 2000)) fostering this way economic growth at a local and regional level.
- *Innovation ecosystems* are multilevel, multimodal, multinodal, and multiagent system (Carayannis, 2010) where innovation and co-innovation occur in order to generate shared value (Lee et al., 2012) and provide an economic context (milieu) to catalyse innovation and growth (Russell et al., 2015). Such ecosystems are physical, online or virtual networks that nurture creativity, enable the "cross-pollination" of ideas (Luoma-aho & Halonen, 2010), while at the same time trigger, develop and diffuse innovation in an open or closed innovation context. Thus, they augment the

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

organisational ability to create/co-create value and collaboratively innovate, at a level and pace greater than their competitors. These dynamic collaborative networks exhibit sustainable linkages between four key collaborating entities under a Quadruple helix model (Quadruple helix model: university–industry–government-civic society (UIGC) (Carayannis & Campbell, 2010). Innovation ecosystems, are designed ecosystems that differ from natural ecosystems firstly in the presence of intention and teleology and secondly in the acknowledged importance of governance (Papaioannou et al., 2007).

- *Crowd-driven ecosystems* are powered by technology, open innovation, and participatory value creation/co-creation processes driven by and for users (Ziouvelou et al., 2017). These distributed ecosystems leverage the dispersed network effects and harness the collective power and intelligence of the user community that massively collaborates (Tapscott & Williams, 2008) creating shared value (Porter & Kramer, 2011). As such, crowd-driven ecosystems facilitate the creation of a meta-environment driven by and for users, who are active co-creators, collaborators, co-innovators and co-investors; who communicate their ideas, share data, best practices, create new knowledge (crowdsourcing) and provide their funds (crowdfunding), enhancing the innovation potential of our society. Such dynamic networks, explore the direct and indirect interactions of diverse stakeholder segments with the user community, under a Quadruple helix model (university–industry–government-civic society (UIGC)) (Carayannis & Campbell, 2010). In these setting, the competitive advantage of the network is strongly dependent on the ability of the ecosystem core (single entity or group of entities) to stimulate value co-creation with the crowd and the network participants, co-capture and co-distribute it with the ecosystem members.
- *Crowd-driven IoT ecosystems* (Ziouvelou et al., 2017; Ziouvelou & McGroarty, 2017) utilise advanced Internet of Things (IoT) technological platforms in order to elevate the role and collective efforts of people for enhancing the shared value creation/co-creation under a "Quintuple Helix" model (Carayannis & Campbell, 2010; Carayannis & Campbell, 2014) where cooperation is established between the Quadruple Helix (UIGC) actors and one additional helix "environment" (natural environment as a contextual IoT setting). The Internet of Things (IoT) has acted as a catalyst for harnessing the capacity of the crowd, as it facilitated the introduction of new user-centric paradigms, such as mobile crowd sensing (MCS) (Burkel et al., 2006; Ganti et al., 2011). MCS goes beyond traditional sensing techniques (sensor networks, etc.) leveraging both the power and the wisdom of the crowd (participatory sensing (Burke et al., 2006) and opportunistic sensing (Lane et al., 2010) paradigms) in order to sense, observe, measure and make sense of real-world conditions (environmental, etc.,) and activities (personal activities and interactions, etc.,) using user-owned mobile and wearable devices. Crowd-driven IoT ecosystems can exist in many forms, concentrating on specific crowd-driven functions such as crowdsourcing, crowdsensing and crowdfunding, among others, or, increasingly, they can be hybrid; not tied to a specific mode. One can identify numerous IoT crowdsourcing (e.g., OpenStreetMap - crowdsourced world map, Waze - crowd-driven traffic navigation) and crowdsensing networks (e.g., PhoneLab - open access smartphone testbed, Ushahidi - user geo-location data, APISENSE - crowd-sensing for experimental datasets) that monitor diverse elements ranging from city noise (Rana et al., 2010), to climate (Thepvilojanapong et al., 2010) and emergencies (Ludwig et al., 2014). Furthermore, one can find only a few crowd-driven IoT ecosystems that are "hybrid" assimilating both crowdsourcing and crowdsensing parameters. Examples of such ecosystems are *mCrowd* (crowdsourcing and participatory sensing) (Yan et al. 2009) and *EpiCollect* (crowdsourcing and crowdsensing

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

for survey purposes) (Aanensen et al., 2009). However, the coverage of both crowdsourcing and crowdsensing elements is partial, in these hybrid ecosystems, while at the same time they do not facilitate the integration of physical IoT testbeds and FIRE testbeds with crowd-driven resources such as smartphones. To date, the only crowd-driven IoT ecosystem that manages to successfully integrate crowdsourcing, crowdsensing (opportunistic and participatory sensing) and crowdfunding to a certain degree, while at the same time extends existing IoT testbeds with smartphones is *IoT Lab* (Fernandes, et al., 2015, Ziouvelou et al., 2017).

Table 1 summarises and provides a classification of the different types of ecosystems based on their key characteristics. This taxonomy, builds upon existing work in the area (Ziouvelou et al., 2017; Ziouvelou & McGroarty, 2017) presenting some of the key distinctive feature of ecosystems such as:

Table 1. A Classification of the different types of ecosystems

	Knowledge Ecosystem	**Business Ecosystem**	**Digital Business Ecosystem**	**Innovation Ecosystem**	**Crowd-Driven Ecosystem**	**Crowd-Driven IoT Ecosystem**
Function	New knowledge creation/co-creation	Customer value (knowledge commercialisation)	Customer value (knowledge commercialisation)	Innovation creation/ co-innovation	Crowd-driven shared value creation/co-creation	Crowd-driven shared value creation/co-creation
Connectivity	Decentralised and distributed	Geographically clustered	Global and distributed	Geographically clustered or Global and distributed	Global and distributed	Global and distributed
Mode	Physical or online	Physical	Online & virtual	Physical, online & virtual	Online & virtual	Online & virtual
Relationships	Synergetic and co-operative	Competitive and collaborative ("co-opetition")	Competitive and collaborative ("co-opetition")	Co-operative and collaborative	Co-operative, synergetic and collaborative (mass collaboration)	Co-operative, synergetic and collaborative (mass collaboration)
Openness	High degree of openness or closed	Various degrees of openness	Various degrees of openness	High degree of openness or closed	High degree of openness	High degree of openness
Structure	Dynamic inter-organisational, inter-personal	Dynamic or static, and inter-organisational	Dynamic or static, and inter-organisational	Dynamic inter-organisational and inter-personal	Dynamic, complex	Dynamic, complex
Key actors	University, research organisation/ institute	Large company	Large company/ group of companies	Large company/ group of companies, community, University/Research center	NGO/Non-profit initiative – community, company, University/ Research center	NGO/Non-profit initiative – community, company, University/ Research center
Helices Model	Triple Helix	Triple Helix	Triple Helix	Quadruple Helix	Quadruple Helix	Quintuple Helix
Innovation Model	Closed Innovation or Open Innovation	Closed Innovation	Closed Innovation or Open Innovation[4]	Open Innovation or Open Innovation 2.0[5]	Open Innovation 2.0	Contextual Open Innovation 2.0 [*]
Ecosystem Value Model	Value creation/co-creation, capture	Value creation, capture	Value co-creation, capture	Value creation/co-creation, capture	Shared value co-creation, co-capture, co-distribution	Shared value co-creation, co-capture, co-distribution

[*] "Contextual Open Innovation 2.0" integrates the notion of the environment (as a contextual parameter) in an open, ecosystem-centric innovation paradigm based on the principles of Open Innovation 2.0 (Curley & Salmelin, 2013). (extending Ziouvelou & McGroarty, 2017; Ziouvelou et al. 2017; Valkokari, 2015; Clarysse et al., 2014)

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

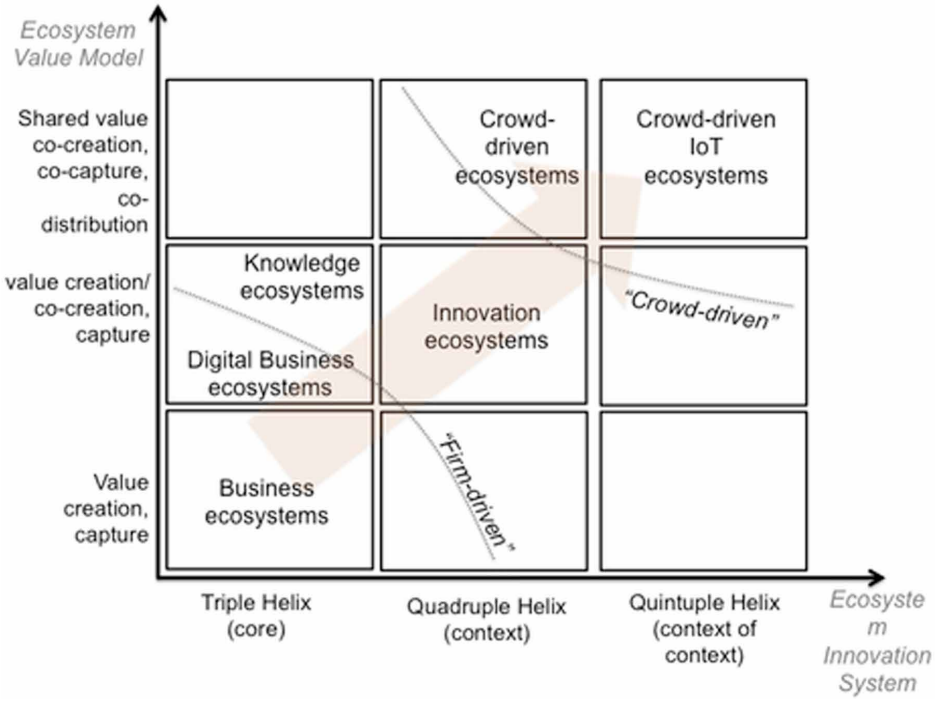
function, connectivity, mode, relationships, openness, structure, key actors, helices model, innovation model and the ecosystem value model. It is important to note that each new ecosystemic phase does not make the previous one 'obsolete', but instead extends it (e.g., knowledge ecosystem still exist for new knowledge creation purposes). Also, the last ecosystem type, namely crowd-driven IoT ecosystems, extends crowd-driven ecosystems beyond the Quadruple Helix model of innovation (context) by integrating the "environment" in the innovation model (Quintuple Helix - context of context) so that crowd-driven share value co-creation as well as co-innovation are being contextualized by the natural environment of society (Carayannis & Campbell, 2014).

3.2. Ecosystems: A Taxonomy

The emergence of crowd-driven IoT ecosystems based on value co-creation, co-capture and co-distribution, driven by and for users, demonstrate clearly the two key differentiating aspects of existing ecosystems: (a) *the value model*: specifying the orientation of the ecosystem in relation to value creation, capture and distribution practices and (b) *the innovation system:* denoting the innovation orientation of the ecosystem in relation to the innovation process and architecture (knowledge production and knowledge application (innovation) Carayannis & Campbell 2010). This allows us to identify three generic and distinct phases of ecosystems, adopting an evolutionary perspective, as it can be seen in the taxonomy presented in Figure 1. These phases are:

Phase 1: Closed, firm-centric ecosystems. This phase entails ecosystems that focus on value creation and value capture, under a closed innovation regime (closed company controlled innovation). These

Figure 1. Ecosystems taxonomy



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

ecosystems embed university–industry–government (UIG) relationships (Triple Helix, Etzkowitz & Leydesdorff, 2000). In these settings, users act as consumers and are not directly involved in the value creation process but rather capture value by consuming the product/service.

Phase 2: Hybrid ecosystems. The ecosystems of this phase focus on value creation and co-creation in addition to value capture. These ecosystems embed collaborative creation both under either a Triple or a Quadruple Helix model and a closed or open innovation (Chesbrough, 2003) regime. Under a closed innovation model, value can be collaboratively created under a closed, controlled environment usually led by a single entity (e.g., closed digital business ecosystems, closed knowledge ecosystems), as opposed to an open innovation model where value is co-created in an open and collaborative manner (e.g., open digital business ecosystems, open knowledge ecosystems, open innovation ecosystems). In addition, under an open innovation 2.0 model (Curley & Salmelin, 2013), value is based on the principles of integrated collaboration, co-created shared value and cultivated innovation (e.g., open innovation ecosystem 2.0). Phase 2 ecosystems are manifested either in a Triple or Quadruple Helix architecture. In the latter case, in addition to the three other classes of stakeholders (UIG), the role of the users is active, acting both as producers/creators and consumers of value. As such, these ecosystems leverage the collective intelligence of the society in a collaborative, multi-actor innovation environment.

Phase 3: Inclusive, crowd-driven ecosystems. This phase involves ecosystems that embed a broader more inclusive value perspective, a participatory value model driven by and for users. These ecosystems embrace a circular value creation model, where value is co-created, co-captured and co-distributed among network participants and contributors. The value structures of these ecosystems are expressed in an integrated collaboration, co-created shared value mode of open innovation 2.0 (Curley & Salmelin, 2013) and under a Quadruple or Quintuple Helix innovation architecture. In the latter case (i.e., crowd-driven IoT ecosystems[6]), the "environment" (fifth helix) is the contextual IoT setting of the crowd-driven ecosystems thus "contextually" extending the integrated OI2.0 model of innovation. As such this emerging form of ecosystems can be seen as an amalgam of different networks that consist of economic agents such as civil society, universities, industry, public sector and non-economic ones, such as the environment, technology and their constantly evolving relations.

Although crowd-driven IoT ecosystems constitute a reality, when business modelling for such ecosystems is examined, one can identify a gap in existing research (Ziouvelou & McGroarty, 2017). Existing research in the area place emphasis principally upon the technical aspects of crowd-driven IoT ecosystems mainly related to their development and limited work can be found emphasising upon non-technical elements for such ecosystems such as design (Ziouvelou et al. 2017) and business model considerations (Ziouvelou & McGroarty, 2017). Hence, there is a need for a systematic analysis of business models for such emerging dynamic environments that will address their needs and specifications in order to presented analogous business model analytical frameworks.

4. BUSINESS MODELS FOR CROWD-DRIVEN IOT ECOSYSTEMS

The concept of "business model" has to date received a lot of research attention. Since the late 1990's, the notion of business models has started to gain widespread popularity among scholars and practitioners. The advent of the Internet and the changing firm boundaries enhanced further the interest in the notion

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

of business models and played a critical role for its enhancement (Afuah & Tucci, 2000; Afuah, 2003). However, despite the fact that business models have been considered from multiple perspectives (Zott et al., 2011), no commonly accepted view of the concept specificities and components can be found (Osterwalder et al., 2005; Morris et al., 2005). Instead, a wide array of idiosyncratic views (Zott et al., 2011) exist, which to some extent may be attributed to the different perspectives (organisational, social, economic, strategic, etc.) and research areas (i.e., technology, e-business, m-business, etc.) (Shafer, et al., 2005). In general, one can observe an evolution of the business model conceptualisation over the past decade across a number of perspectives: (a) from firm-centric to ecosystem-centric business models, (b) from static to dynamic, and (c) from closed to open crowd-driven. These perspectives are presented in the sections that follow.

4.1. From Firm-Centric to Ecosystem-Centric Business Models

Over the past few years, there has been a fundamental change in the logic of business models, from firm-centric business models ((BM1.0) Magretta, 2002; Osterwalder et al., 2005; Casadesus-Masanell & Ricart, 2010) to ecosystem-centric ((BM2.0) Westerlund et al. 2014; Rong, et al. 2015; Schladofsky et al., 2016) and crowd-driven ecosystem-centric one ((BM3.0) Ziouvelou et al. 2017; Ziouvelou & McGroarty, 2017). This change, reflects a greater structural shift in the way value is created and captured in today's networked society; that is from open, crowd-driven ecosystemic structures powered by technology, user participation and open collaborative innovation, instead of standalone companies and closed innovation ecosystems. In direct alignment with these transformations, the business model concept has evolved from a construct that explains how a firm creates and captures value in a profitable manner (Baden-Fuller & Morgan, 2010) by interacting with suppliers, customers and partners (Zott & Amit, 2003), to a broader business logic that describes the open, participatory value mechanisms of emerging ecosystems. Unfolding this way, the dynamic, ongoing interactions of the diverse ecosystem actors (economic and non-economic actors) towards joint value creation, value capture and value distribution (circular value creation model). As such the notion of business models has advanced from a corporate blueprint linking strategy and business processes to a constantly evolving network architecture that describes embedded inter-connected value processes. These processes represent a new dimension of innovation that is critical in today's hyper-connected network economy. Product, process and organisational innovation alone are no longer sufficient for companies to stay competitive (Zott et al., 2011; Massa & Tucci, 2014), as such business models constitute a critical new innovation component that complement existing ones (Zott et al., 2011) facilitating success in contemporary complex business ecosystems as they innovate upon the core logic of value creation and value capture.

4.2. From Static to Dynamic Business Models

As the networked economy grows and the market environment changes, the value creation and capture processes have undergone a significant shift. Powered by technology, user participation and open collaborative innovation, value emerges from integrated multi-actor constellations and open, crowd-driven ecosystemic structures rather than standalone companies and closed innovation settings. However, these broader more inclusive of value mechanisms, assimilate interdependencies and side effects that need to be considered in order not to ripple through the entire ecosystemic structure. As a consequence, business models need to move beyond the static firm-centric nature of the industrial era into a dynamic, fluid

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

ecosystem-centric nature aligned with the needs of the hyper-networked economy. Therefore, emerging business model frameworks and analytical tools need to adopt taking into account the needs and specifications of today's environment while making the business model reinvention a continual and inclusive process (Red Queen effect, Defus et al., 2008).

4.3. From Closed to Open, Crowd-Driven Business Models

Similarly, in a world of openly communicated knowledge and co-created innovation, closed firm-centric business models can no longer be sustainable, instead open, collaborative and crowd-driven ecosystem-centric business models are needed. This view extends existing work in the area of open business models (Chesbrough, 2006, 2007), that embrace open innovation principles, indicating that companies should look for ways of tapping into and harnessing the ideas that lie beyond their formal boundaries; as well as crowdsourcing business models (Kohler, 2015; Kohler & Nickel, 2017) that is open business models that leverage technology in order transfer value creating activities to the crowd. Open crowd-driven business models are ecosystem-centric rather than firm-centric open business models. As such, they focus on a broader multi-actor value system that is not only integrating crowdsourced value and innovation (outside in) or making unused innovations and value more accessible to external users (inside out) but rather embeds collaborative value mechanisms within the whole ecosystem for co-creation, co-capture and co-distribution of value among the ecosystem stakeholders and contributors in an ongoing circular value creation model. Users, from passive consumers act as empowered collaborators and partners that not only provide but also receive value aligned with their contribution as opposed to closed, firm-centric models where value is captured centrally.

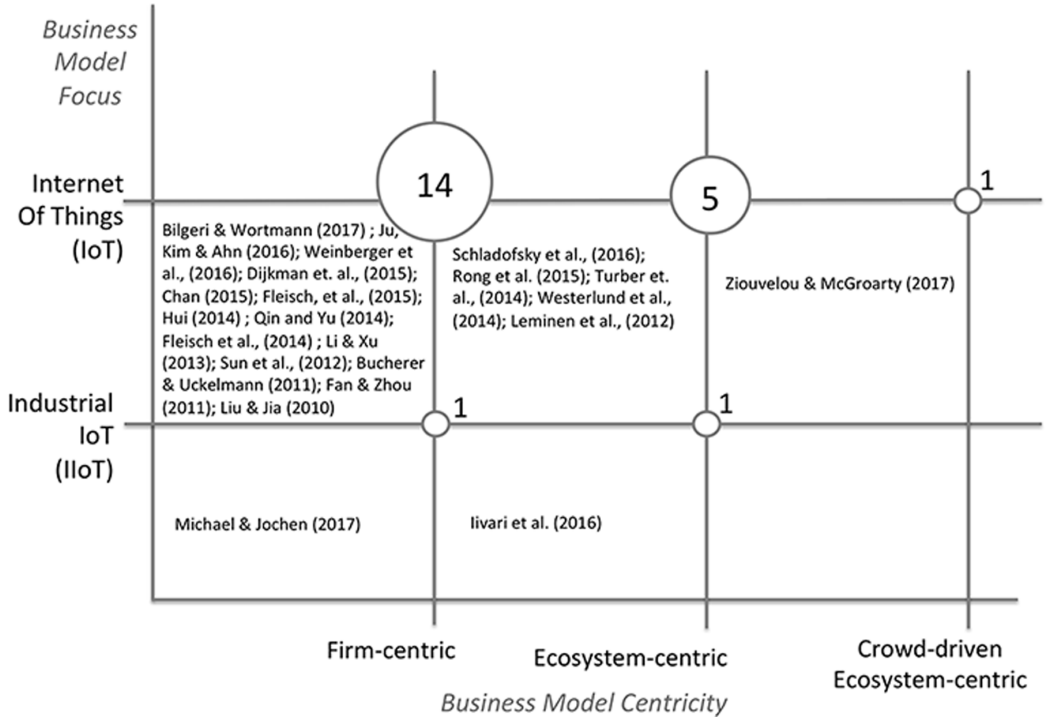
4.4. Business Model Frameworks: A Taxonomy

Aiming to explore existing literature in the area, we performed an exploratory study that builds upon the analysis of Ziouvelou & McGroarty (2017). Utilising a structured approach, we examined numerous interdisciplinary databases and leading journals in the area of IoT business models, which lead us to the identification of the most cited research studies. This exploration, lead us to the identification of research dimensions that facilitate the creation of an explanatory framework. The framework (see Figure 2) classifies existing research along two key research dimensions namely, the (a) analytical focus: denoting the focal area of the business model research either on Internet of Things (IoT) or on Industrial IoT (IIoT) and the (b) analytical context focusing upon the context of each research study (business model centricity) examining an IoT business context (firm-centric), an IoT ecosystem context (ecosystem-centric) or a crowd-driven IoT ecosystem context (crowd-driven ecosystem-centric).

As it can be seen in Figure 2 the prevalent view of existing research (15 out of the 22 studies) is still primarily firm-centric and only a few studies examine ecosystem-centric business models (6 out of the 22 studies). Crowd-driven ecosystem-centric business models are only now starting to emerge, specialising mainly in the IoT context (1 out of the 22 studies). In the context of IoT we see that the vast majority of studies focus on the broader IoT business context (20 out of the 22 studies (Bilgeri & Wortmann (2017); Ju, Kim & Ahn (2016); Weinberger et al., (2016); Dijkman et. al., (2015); Chan (2015); Fleisch, et al., (2015); Hui (2014); Qin and Yu (2014); Fleisch et al., (2014) among others)) and only two studies examine Industrial IoT business models either from a firm or ecosystem-centric perspective (Michael & Jochen, 2017; Iivari et al., 2016).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 2. Crowd-driven IoT business models literature taxonomy



In accordance with the findings of Ziouvelou & McGroarty (2017), one can observe that research focusing on ontological perspectives among ecosystem-centric IoT business models exhibits an emphasis upon the introduction of distinct business models that do not present any direct alignment with existing firm-centric business model frameworks (i.e., the Business Model canvas, Osterwalder & Pigneur, 2010) or either between them. As such, novel frameworks are presented that focus on the notion of value (value creation and value capture) (Iivari et al., 2016; Westerlund et al., 2014) or develop distinct frameworks that adopt the ecosystemic perspective (an integrated 6C framework - Rong et al., 2015; 2 dimensional model - Leminen et al., 2012). However, no study presents a business model framework tailored to the needs of crowd-driven IoT ecosystems. Aiming to fill in this research gap we introduce a specialised business model framework that align with the needs of these ecosystems.

5. A BUSINESS MODEL FRAMEWORK FOR CROWD-DRIVEN IOT ECOSYSTEMS

Building from the literature and aiming to facilitate the analysis of business models of crowd-driven IoT ecosystems we introduce a business model framework for such environments. The proposed model extends existing firm-centric and ecosystem-centric models and aligns with the needs of crowd-driven ecosystems in a broader context as well as in the area of IoT aligned with the findings of existing research in the area (Ziouvelou & McGroarty, 2017).

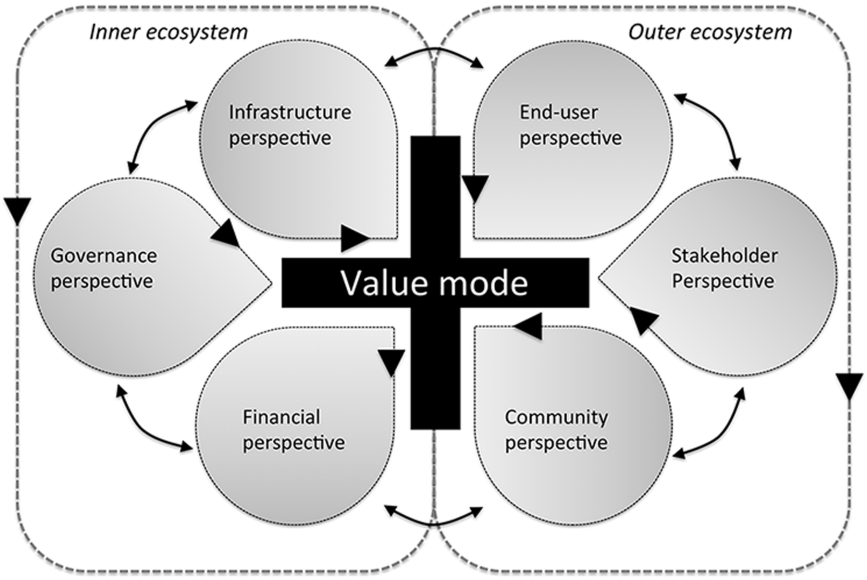
EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The Crowd-driven Ecosystem business model Framework (CEF), seen in Figure 3, utilises seven generic building blocks and within each block three key components have been identified (see Table 2). More specifically, the CEF integrates all relevant value network participants and value-related activities and processes in an open, ecosystem-centric context, addressing both the "inner" and the "outer" ecosystem components. In particular, CEF adopts an open, dynamic, participatory approach towards value co-creation, co-capture and co-distribution, providing a holistic view on value mechanism underlying the business model of technologically advanced crowd-driven ecosystems. The generic CEF perspectives and the key elements within each answer four critical business model questions: *What, For/With Whom, How and How Much.*

An overview of the CEF components and sub-components are presented in the sections that follow:

1. **Value Perspective:** This building block constitutes the central pillar of the CEF as it describes the value-creating mode of the business model that links that "inner" with the "outer" ecosystem. The value pillar (what) is an aggregation of the: (a) value dimensions of the ecosystem: an overview of the distinct dimensions of value such as economic, social, environmental value as well as financial and non-financial value; (b) value drivers: the individual and shared value drivers and needs of the diverse ecosystem stakeholders; and (c) value proposition: the integrated public and private benefits for specific actor segments (end-users, ecosystem actors, ecosystem community and society at large).
2. **End-user Perspective:** This building block describes the end-users of the ecosystem; those that will be reached and whose needs will be served. Towards this aim this pillar integrates the following components: (a) end-user segments: the homogeneous groups (same needs, requirements, etc.) of end-users (individual, corporate, public sector users) that will be served via the ecosystem; (b) end-user relation: the segment-specific relationships that the ecosystem will develop with each

Figure 3. Business Model Framework for Crowd-driven Ecosystems (CEF)



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

group; (c) value delivery: the process that the ecosystem will reach (communication, service/product distribution, etc.) its end-user segments in order to communicate and deliver the co-created value.

3. **Stakeholder Perspective:** This perspective describes the broader value network actors (collaborators, partners, etc.). In particular this building block entails the: (a) key ecosystem stakeholders: the internal (partners, internal-collaborators, etc.) and external (complementors, external collaborators, etc.) ecosystem actors; (b) stakeholder drivers: the needs and drivers of each stakeholder segment inside and outside the ecosystem; and (c) stakeholder relation: the actor-specific relations that the ecosystem has and/or will develop.
4. **Community Perspective:** This building block describes the ecosystem community, which constitutes a key value co-creating pillar. The components of this block include the: (a) community/crowd structure: the crowd/community groups and the needs of their members, (b) community/crowd drivers: the individual and shared motives of the different crowd-community segments; and (c) incentive model: the incentivisation schemes for the crowd-community (taking into account the crowd-activities and the crowd-cost) and the rest of the ecosystem stakeholders.
5. **Financial Perspective:** This category represents that financial framework of the business model. In particular, this building block entails the: (a) cost model: the costs incurred by the ecosystem; (b) revenue model: the revenue generation framework of the ecosystem that essentially mirrors the value capture mechanism of the crowd-driven network; and (c) revenue sharing model: this element details the value distribution framework of the ecosystem towards value creating/co-creating segments. This element implicates that value distribution is an important part of the crowd-driven ecosystem business model.
6. **Governance Perspective:** This building block involves the governance model of the orchestration of the broader crowd-driven ecosystem. It denotes the activities and processes underpinning the ecosystem management across multiple levels. The components of this pillar integrate the: (a) ecosystem governance: this element describes the high level ecosystem governance model that entails multiple governance modes (i.e., open vs. closed, for-profit vs. non-profit, hierarchical top-down vs. collaborative bottom-up governance, etc.); (b) technology governance: comprises the technological infrastructure (core system and components as well as the evolving integrated system), the technological mechanisms and rules for the efficient functioning of the broader ecosystem; and (c) community governance: the community principles (control and autonomy within the ecosystem, etc.) and the rules for participation, communication, sharing and co-creation within the ecosystem.
7. **Infrastructure Perspective:** This perspective details the infrastructure underpinning the crowd-driven ecosystem. The components of this pillar include the: (a) ecosystem infrastructure: the multilevel foundation (technical, business, etc.) needed for the ecosystem to make its business model work; (b) key resources: the critical resources (tangible and intangible assets) that are needed in order to support the implementation of a functional ecosystem; and (c) key activities: the activities and processes that should be performed in order for the ecosystem to deliver value to its members, the end-users and the broader community.

These building blocks and their associated components relate to the needs of crowd-driven IoT ecosystems at a particular time period. Given the constantly changing dynamics of these ecosystems, the evolutionary parameter of their business model should be acknowledged and accounted for. This implies both the evolution of the ecosystem itself but also the evolution of the ecosystem community within the network. Future research in the area should address these challenges.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

6. CONCLUSION

Distributed, ecosystemic structures prevail in our hyperconnected world. Such structures utilise cutting edge technology and open participatory value creation models to harness the collective power, intelligence and co-creation ability of the crowd. These complex technologically advanced and constantly evolving inter-connected ecosystems have brought about changes across all business functions, redefining business success, which now lies upon the ecosystem's ability to jointly co-create shared value. The Internet of Things has fueled these emerging crowd-driven ecosystems by introducing new user-centric archetypes that leverage not only the power of physical things connected to the Internet but also the wisdom of the crowd to observe, measure, and make sense of particular phenomena by exploiting user-owned mobile and wearable devices.

Although this business logic shift has become the focus of recent studies in the area (Schladofsky et al., 2016; Rong et al. 2015; Turber et al., 2014; Westerlund et al., 2014; Leminen et al., 2012), very little research has been conducted in the business dynamics of these emerging, technologically advanced ecosystems (Ziouvelou et al., 2017; Ziouvelou & McGroarty, 2017) and no study, to our knowledge, has examined business models for these environments. Due to the nature of crowd-driven ecosystems and crowd-driven IoT ecosystems in particular, existing firm-centric business model approaches and frameworks are not directly applicable since they fail to address a number of ecosystemic parameters. As such novel frameworks are needed that will concentrate upon the specificities of these ecosystems and adopt a dynamic flexible business model nature (Ziouvelou & McGroarty, 2017).

Aiming to fill this gap and contribute to this emerging research field, this study examined the dynamics of crowd-driven IoT ecosystems and explored the literature of IoT business models. In particular, it provided an exploratory review analysis of the current scientific knowledge in the context of crowd-driven ecosystems in general as well as in the context of IoT and their business models. This investigation enabled the classification of existing research under two explanatory frameworks that facilitate the analysis of crowd-driven IoT ecosystems and their associated business models.

In addition, this analysis highlighted some key dimensions of crowd-driven ecosystems in general and in the context of IoT. Firstly, the change in the value logic, which adopts a broader more inclusive perspective, as value emerges from a distributed crowd-driven network under a participatory value model. This model depicts an ongoing circular process of joint value co-creation, co-capture and co-distribution. It has been argued, in the course of this paper, that the emerging value component manifests as open "value sharing" across the ecosystem's value-creating participants, accounting for their contribution, as opposed to closed, firm-centric value models where value is captured centrally. Subsequently, it was identified that crowd-driven IoT ecosystems in particular adopt a "Quintuple Helix" innovation system as opposed to crowd-driven ecosystems that utilise a Quadruple Helix one. This implies that cooperation is established between the Quadruple Helix actors (university–industry–government-civic society) and one additional helix the "environment"; natural environment as a contextual IoT setting. This gives rise to a contextual Open Innovation 2.0 paradigm, were innovation emerges in an open, ecosystem-centric, cross-actor innovation process that assimilates the environment. Future research will shed light deeper upon this model and its implications.

This study provided grounds for a new integrated business model framework for crowd-driven ecosystems in general and in the context of IoT, which supports the creation of business models for such environments. The proposed Crowd-driven Ecosystem Business Model Framework (CEF) corresponds to the needs of technologically advanced crowd-driven ecosystems. The seven building blocks of the tool

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 2. Components of the crowd-driven ecosystem business model framework (CEF)

Focus	Perspectives	Key Elements
What	Value Perspective	• Ecosystem value dimensions • Value drivers • Ecosystem value proposition
For/with whom	End-user perspective	• End-user segments • End-user relation • Value Delivery
	Stakeholder perspective	• Key ecosystem stakeholders • Stakeholder drivers • Stakeholder relation
	Community perspective	• Community structure • Community drivers • Incentive model
How	Governance perspective	• Ecosystem governance • Technology governance • Community governance
	Infrastructure perspective	• Ecosystem Infrastructure • Key resources • Key activities
How much	Financial perspective	• Cost model • Revenue model • Revenue sharing model

integrate all relevant value network participants and value-related activities and processes in an open, ecosystem-centric context, addressing both the "inner" and the "outer" ecosystem components. That way, they explain the underlying value mechanism of the ecosystem from a holistic perspective, taking into account the all relevant value sources within the ecosystem and their dependencies. Additional research in this area will examine the diverse life-cycle phases of crowd-driven value-centered ecosystems and identify the implications for the value mechanism of these ecosystems as well as the CEF model in general.

The results of this study should be assessed in the light of their limitations. One general limitation of this study is that it is limited by the number of previously published research studies and their availability. Therefore, on-going research is needed in this emerging research area so as to enhance our understanding further. Another limitation of this research relates to the need to empirically test the CEF model. Empirical validation of this theoretical framework is needed in order to examine its ability to describe the complexity of business models for crowd-driven IoT ecosystems and crowd-driven ecosystems in general (e.g., mobility ecosystems, etc.). As such future research will focus upon the application of the model in an empirical context.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

REFERENCES

Aanensen, D. M., Huntley, D. M., Feil, E. J., & Spratt, B. G. (2009). EpiCollect: Linking smartphones to web applications for epidemiology, ecology and community data collection. *PLoS One*, *4*(9), e6968. doi:10.1371/journal.pone.0006968 PMID:19756138

Afuah, A. (2003). Redefining firm boundaries in the face of the Internet: Are firms really shrinking? *Academy of Management Review*, *28*(1), 34–53. doi:10.2307/30040688

Afuah, A., & Tucci, C. L. (2000). *Internet business models and strategies: Text and cases*. McGraw-Hill Higher Education.

Allee, V. (2003). *The Future of Knowledge. Increasing Prosperity Though Value Networks*. Burlington, MA: Elsevier.

Almeida, P., & Kogut, B. (1999). Localization of knowledge and the mobility of engineers in regional networks. *Management Science*, *45*(7), 905–917. doi:10.1287/mnsc.45.7.905

Amit, R., & Zott, C. (2015). Crafting business architecture: The antecedents of business model design. *Strategic Entrepreneurship Journal*, *9*(4), 331–350. doi:10.1002ej.1200

Ayres, R. U. (2004). On the life cycle metaphor: Where ecology and economics diverge. *Ecological Economics*, *48*(4), 425–438. doi:10.1016/j.ecolecon.2003.10.018

Baden-Fuller, C., & Morgan, M. S. (2010). Business models as models. *Long Range Planning*, *43*(2), 156–171. doi:10.1016/j.lrp.2010.02.005

Baptista, R. (1998). Clusters, innovation and growth: a survey of the literature. In G. M. P. Swann, M. Prevezer, & D. Stout (Eds.), *The dynamics of industrial clusters: international comparisons in computing and biotechnology* (pp. 13–51). Oxford: Oxford University Press.

Bilgeri, D., & Wortmann, F. (2017). Barriers to IoT Business Model Innovation.

Brandenburger, A. M., & Nalebuff, B. J. (2011). *Co-opetition*. Crown Business.

Bray, D. (2007). Organizational Dynamics of Technology-Based Innovation: Diversifying the Research Agenda. In T., McMaster, D., Wastell, E., Ferneley et al. (Eds.), IFIP International Federation for Information Processing (Vol. 235, pp. 457-462). Boston, MA: Springer.

Burke, J., Estrin, D., Hansen, M., Parker, A., Ramanathan, N., Reddy, S., & Srivastava, M. B. (2006). Participatory Sensing. In *Workshop on World-Sensor-Web (WSW 2006): Mobile Device Centric Sensor Networks and Applications* (pp. 117–134).

Carayannis, E. G. (2010). *Innovation, Technology, and Knowledge Management*. New York: Springer.

Carayannis, E. G., & Campbell, D. F. (2014). Developed democracies versus emerging autocracies: Arts, democracy, and innovation in Quadruple Helix innovation systems. *Journal of Innovation and Entrepreneurship*, *3*(1), 12. doi:10.118613731-014-0012-2

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Carayannis, E. G., & Campbell, D. F. J. (2010). Triple Helix, Quadruple Helix and Quintuple Helix and How Do Knowledge, Innovation and the Environment Relate To Each Other? A Proposed Framework for a Trans-disciplinary Analysis of Sustainable Development and Social Ecology. *International Journal of Social Ecology and Sustainable Development*, *1*(1), 41–69. doi:10.4018/jsesd.2010010105

Casadesus-Masanell, R., & Ricart, J. E. (2010). From Strategy to Business Models and onto Tactics. *Long Range Planning*, *43*(2-3), 195–215. doi:10.1016/j.lrp.2010.01.004

Chan, H. C. Y. (2015). Internet of Things Business Models. *Journal of Service Science and Management*, *8*(04), 552–568. doi:10.4236/jssm.2015.84056

Chesbrough, H. W. (2003). *Open Innovation: The new imperative for creating and profiting from technology*. Boston: Harvard Business School Press.

Chesbrough, H. W. (2006). *Open Business Models: How to Thrive in the New Innovation Landscape*. Boston, MA: Harvard Business School Press.

Chesbrough, H. W. (2007). Why Companies Should Have Open Business Models. *MIT Sloan Management Review*, *48*(2), 22–28.

Chesbrough, H. W., & Appleyard, M. M. (2007). Open innovation and strategy. *California Management Review*, *50*(1), 57–76. doi:10.2307/41166416

Clarysse, B., Wright, M., Bruneel, J., & Mahajan, A. (2014). Creating value in ecosystems: Crossing the chasm between knowledge and business ecosystems. *Research Policy*, *43*(7), 1164–1176. doi:10.1016/j.respol.2014.04.014

Corallo, A., Passiante, G., & Prencipe, A. (2007). *Digital Business Ecosystems*. Cheltenham: Edward Elgar Publishing. doi:10.4337/9781781009925

Corallo, A., & Protopapa, S. (2007). Business Networks and Ecosystems: Rethinking the Biological Metaphor. In F. Nachira, A. Nicolai, P. Dini et al. (Eds.), Digital Business Ecosystems: The Results and the Perspectives of the Digital Business Ecosystem Research and Development Activities in FP6 (pp. 60–64). Luxembourg: European Commission.

Coughlan, T. (2014). Enhancing innovation through virtual proximity. *Technology Innovation Management Review, 4*(2).

Curley, M., & Salmelin, B. (2013). Open Innovation 2.0: a new paradigm (white paper). OISPG.

Derfus, P. J., Maggitti, P. G., Grimm, C. M., & Smith, K. G. (2008). The Red Queen effect: Competitive actions and firm performance. *Academy of Management Journal*, *51*(1), 61–80. doi:10.5465/AMJ.2008.30708624

Dijkman, R. M., Sprenkels, B., Peeters, T., & Janssen, A. (2015). Business models for the Internet of Things. *International Journal of Information Management*, *35*(6), 672–678. doi:10.1016/j.ijinfomgt.2015.07.008

Durst, S., & Poutanen, P. (2013). Success factors of innovation ecosystems – Initial Insights from a literature review. In: Smeds R and Irrmann O (Eds.), *CO-CREATE 2013: The Boundary Crossing Conference on Co-Design in Innovation* (pp. 27–38). Aalto University Publication.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Etzkowitz, H., & Leydesdorff, L. (2000). The dynamics of innovation: From National Systems and "Mode 2" to a Triple Helix of university–industry–government relations. *Research Policy*, *29*(2), 109–123. doi:10.1016/S0048-7333(99)00055-4

Fernandes, J., Nati, M., Loumis, N. S., Nikoletseas, S., Raptis, T. P., Krco, S., . . . Ziegler, S. (2015, April). IoT Lab: Towards co-design and IoT solution testing using the crowd. In *Proceedings of the 2015 International Conference on Recent Advances in Internet of Things (RIoT)*. IEEE.

Fleisch, E., Weinberger, M., & Wortmann, F. (2014). Business models and the internet of things. In Bosch IoT Lab White Paper.

Fleisch, E., Weinberger, M., & Wortmann, F. (2015). Business Models and the Internet of Things. In P. Z. Ivana, P. Krešimir, & S. Martin (Eds.), *Interoperability and Open-Source Solutions for the Internet of Things*. Berlin: Springer.

Ganti, R. K., Ye, F., & Lei, H. (2011). Mobile crowdsensing: Current state and future challenges. *IEEE Communications Magazine*, *49*(11), 32–39. doi:10.1109/MCOM.2011.6069707

Gomez, J., Huete, J. F., Hoyos, O., Perez, L., & Grigori, D. (2013). Interaction System Based on Internet of Things as Support for Education. *Procedia Computer Science*, *21*, 132–139. doi:10.1016/j.procs.2013.09.019

Hui, G. (2014). How the Internet of Things Changes Business Models. *Harvard Business Review*.

Iivari, M., Ahokangas, P., Komi, M., Tihinen, M., & Valtanen, K. (2016). Toward Ecosystemic Business Models in the Context of Industrial Internet. *Journal of Business Models*, *4*(2), 42–59.

Jansson, N., Ahokangas, P., Iivari, M., Perälä-Heape, M., & Salo, S. (2014). The competitive advantage of an ecosystemic business model: The Case of OuluHealth. *Interdisciplinary Studies Journal*, *3*(4), 282–294.

Ju, J., Kim, M. S., & Ahn, J. H. (2016). Prototyping Business Models for IoT Service. *Procedia Computer Science*, *91*, 882–890. doi:10.1016/j.procs.2016.07.106

Kohler, T. (2015). Crowdsourcing-Based Business Models. *California Management Review*, *57*(4), 63–84. doi:10.1525/cmr.2015.57.4.63

Kohler, T., & Nickel, M. (2017). Crowdsourcing business models that last. *The Journal of Business Strategy*, *38*(2), 25–32. doi:10.1108/JBS-10-2016-0120

Lane, N. D., Miluzzo, E., Lu, H., Peebles, D., Choudhury, T., & Campbell, A. T. (2010). A survey of mobile phone sensing. *IEEE Communications Magazine*, *48*(9), 140–150. doi:10.1109/MCOM.2010.5560598

Le, T. T., & Tafardar, M. (2009). Business ecosystem perspective on value co-creation in the Web 2.0 era: Implications for entrepreneurial opportunities. *International Journal of Entrepreneurial Venturing*, *1*(2), 112–130. doi:10.1504/IJEV.2009.029099

Lee, S. M., Olson, D. L., & Trimi, S. (2012). Co-innovation: Convergenomics, collaboration, and co-creation for organizational values. *Management Decision*, *50*(5), 817–831. doi:10.1108/00251741211227528

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Lehto, I., Hermes, J., Ahokangas, P., & Myllykoski, J. (2013). Collaboration in cloud businesses–value networks and ecosystems. *Communications of the Cloud Software.*

Leminen, S., Westerlund, M., Rajahonka, M., & Siuruainen, R. (2012). Towards IoT ecosystems and business models. In *Internet of Things, Smart Spaces, and Next Generation Networking* (pp. 15-26).

Letaifa, S. B. (2014). The uneasy transition from supply chains to ecosystems – The value- creation/ value-capture dilemma. *Management Decision*, *52*(2), 278–295. doi:10.1108/MD-06-2013-0329

Ludwig, T., Siebigteroth, T., & Pipek, V. (2014). CrowdMonitor: Monitoring Physical and Digital Activities of Citizens During Emergencies. *Social Informatics*, *8852*, 421–428.

Luoma-aho, V., & Halonen, S. (2010). The intangibles and innovation: the role of communication in the innovation ecosystem. *The Innovation Journal*, *7*(2), 1–20.

Magretta, J. (2002). Why Business Models Matter. *Harvard Business Review*, *80*, 86–92. PMID:12024761

Massa, L., & Tucci, C. L. (2014). Business Model Innovation. In M. Dodgson, D. M. Gann, & N. Phillips (Eds.), *The Oxford Handbook of Innovation Management* (pp. 420–441). Oxford, UK: Oxford University Press.

Massa, L., & Tucci, C. L. (2014). Business Model Innovation. In M. Dodgson, D. M. Gann, & N. Phillips (Eds.), *The Oxford Handbook of Innovation Management* (pp. 420–441). Oxford, UK: Oxford University Press.

Mazhelis, O., Luoma, E., & Warma, H. (2012). Defining an internet-of-things ecosystem. In Internet of Things, Smart Spaces, and Next Generation Networking. Springer Berlin Heidelberg. doi:10.1007/978-3-642-32686-8_1

Michael, E., & Jochen, W. (2017). Unlocking value from machines: Business models and the industrial internet of things. *Journal of Marketing Management*, *33*(1-2).

Moore, J. F. (1993). Predators and prey: A new ecology of competition. *Harvard Business Review*, 71(3), 75–86. PMID:10126156

Moore, J. F. (1996). *The Death of Competition: Leadership & Strategy in the Age of Business Ecosystems*. New York: HarperBusiness.

Morris, M., Schindehutte, M., & Allen, J. (2005). The Entrepreneur's Business Model: Toward a Unified Perspective. *Journal of Business Research*, *58*(6), 726–735. doi:10.1016/j.jbusres.2003.11.001

Nachira, F. (2002). Towards a network of digital business ecosystems fostering the local development. European Commission Discussion Paper.

Nachira, F., Nicolai, A., Dini, P., Le Louarn, M. & Leon, L.R. (2007). Digital business ecosystems.

Norton, B., Costanza, R., & Bishop, R. C. (1997). The evolution of preferences—Why 'sovereign' preferences may not lead to sustainable policies and what to do about it. *Ecological Economics*, *24*(2-3), 193–211. doi:10.1016/S0921-8009(97)00143-2

Osterwalder, A., & Pigneur, Y. (2010). *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers*. Zurich, Switzerland: Business Model Foundry.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Osterwalder, A., Pigneur, Y., & Tucci, C. L. (2005). Clarifying Business Models: Origins, Present and Future of the Concept. *Communications of the Association for Information Science*, *16*(1), 1–25.

Papaioannou, T., Wield, D., & Chataway, J. (2007). Knowledge ecologies and ecosystems? An empirically grounded reflection on recent developments in innovation systems theory. In *Proceedings of the 6th International Triple Helix Conference on University-Government-Industry Relations*, Singapore, May 16–18.

Porter, M. E., & Kramer, M. R. (2011). Creating Shared Value. *Harvard Business Review*, *89*(1-2).

Prahalad, C. K., & Ramaswamy, V. (2004). *The Future of Competition: Co-Creating Unique Value with Customers*. Boston, MA: Harvard Business Press.

Qin, Q., & Yu, H. (2014). Research on the Internet of Things Business Model of Telecom Operators Based on the Value Net. *Management & Engineering*, *21*(8).

Rana, R. K., Chou, C. T., Kanhere, S. S., Bulusu, N., & Hu, W. 2010. Ear-Phone an End-to-End Participatory Urban Noise Mapping System. In *Proceedings of the 9th ACM/IEEE International Conference on Information Processing in Sensor Networks*, Stockholm, Sweden, April 12–16 (pp. 105-116).

Ring, I. (1997). Evolutionary strategies in environmental policy. *Ecological Economics*, *23*(3), 237–250. doi:10.1016/S0921-8009(97)00582-X

Rong, K., Hu, G., Lin, Y., Shi, Y., & Guo, L. (2015). Understanding business ecosystem using a 6C framework in Internet-of-Things-based sectors. *International Journal of Production Economics*, *159*, 41–55. doi:10.1016/j.ijpe.2014.09.003

Rosen, C. (Ed.). (2000). *World Resources 2000-2001: People and ecosystems: The fraying web of life*. Elsevier.

Rothschild, M. (1990). *Bionomics: economy as ecosystem*. New York: Henry Holt and Company.

Russell, M. G., Huhtamäki, J., Still, K., Rubens, N., & Basole, R. C. (2015). Relational Capital for Shared Vision in Innovation Ecosystems. *Triple Helix*, *2*(1), 1–36. doi:10.118640604-015-0017-2

Schladofsky, W., Mitic, J., Megner, A. P., Simonato, C., Gioppo, L., Leonardos, D., & Bröring, A. (2016, November). Business Models for Interoperable IoT Ecosystems. In *International Workshop on Interoperability and Open-Source Solutions* (pp. 91-106). Springer, Cham. Chicago.

Shafer, S. M., Smith, H. J., & Linder, J. C. (2005). The power of business models. *Business Horizons*, *48*(3), 199–207. doi:10.1016/j.bushor.2004.10.014

Stanley, J., & Briscoe, G. (2010). The ABC of digital business ecosystems. arXiv:1005.1899

Tansley, A. G. (1935). The use and abuse of vegetational concepts and terms. *Ecology*, *16*(3), 284–307. doi:10.2307/1930070

Tapscott, D., & Williams, A. D. (2008). *Wikinomics: How mass collaboration changes everything*. Penguin.

Thepvilojanapong, N., Ono, T., & Tobe, Y. A. (2010). Deployment of Fine-Grained Sensor Network and Empirical Analysis of Urban Temperature. *Sensors (Basel)*, *10*(12), 2217–2241. doi:10.3390100302217 PMID:22294924

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Turber, S., Vom Brocke, J., Gassmann, O., & Fleisch, E. (2014, May). Designing business models in the era of internet of things. In *Proceedings of the International Conference on Design Science Research in Information Systems* (pp. 17-31). Springer. 10.1007/978-3-319-06701-8_2

Valkokari, K. (2015). Business, innovation, and knowledge ecosystems: how they differ and how to survive and thrive within them. *Technology Innovation Management Review*, *5*(8).

Weinberger, M., Bilgeri, D., & Fleisch, E. (2016). IoT business models in an industrial context. *Automatisierungstechnik*, *64*(9), 699–706. doi:10.1515/auto-2016-0054

Westerlund, M., Leminen, S., & Rajahonka, M. (2014). Designing business models for the internet of things. *Technology Innovation Management Review*, *4*(7), 5.

Yan, T., Marzilli, M., Holmes, R., Ganesan, D., & Corner, M. (2009). mCrowd: a platform for mobile crowdsourcing. In *Proceedings of the 7th ACM Conference on Embedded Networked Sensor Systems* (pp. 347-348). ACM. 10.1145/1644038.1644094

Ziouvelou, X., & McGroarty, F. (2017). (forthcoming). Business Models for Crowd-driven IoT Ecosystems: A Review. *International Journal of Computer & Software Engineering*.

Zott, C., & Amit, R. (2003). *Business model design and the performance of entrepreneurial firms* (Working Paper 2003/94/ENT/SM/ACGRD 4). INSEAD, Fontainebleau France.

Zott, C., Amit, R., & Massa, L. (2011). The Business Model: Recent Developments and Future Research. *Journal of Management*, *37*(4), 1019–1042. doi:10.1177/0149206311406265

ENDNOTES

1. Extended analysis of existing literature in the area of IoT business models can be found at (see Ziouvelou & McGroarty (2017).
2. See Koening (2012) for an overview of business ecosystems and literature in relation to peripheral and non-peripheral actors in the business ecosystem definition.
3. The notion of "digital spies" is direct metaphor of natural species in biological ecosystem theory (Corrallo et al., 2007).
4. Chesbrough (2003)
5. Open Innovation 2.O (OI2) is an innovation paradigm based on "the principles of integrated collaboration, co-created shared value, cultivated innovation ecosystems, unleashed exponential technologies, and extraordinarily rapid adoption" (Curley & Salmelin, 2013, p. 2).
6. Please note that crowd-driven IoT ecosystems can be either inclusive and participatory (i.e., value co-creation, co-capture, co-distribution) or partially inclusive and participatory (i.e., value co-creation and value capture).

This research was previously published in the International Journal of Social Ecology and Sustainable Development (IJSESD), 9(3); edited by Elias G. Carayannis, pages 14-33, copyright year 2018 by IGI Publishing (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Section 3
Tools and Technologies

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 24
Green Attitudes and Thinking in The New Green Market:
Using Mathematical Modeling to Satisfy Green Customers' Needs

Nicoleta Valentina Florea
Valahia University of Targoviste, Romania

ABSTRACT

People are concerned by the implications of product consumption on their health, which is why they become followers of a healthy and sustainable lifestyle, using green products and becoming aware of a sustainable environment. To have a viable business and to respond to customers' needs, the organization must have an attractive product that offers utility, value, health, joy, and satisfaction to consumers. This chapter analyses a few approaches regarding the implementation of green marketing policies and the situation of green marketing in the world and in Romania. Green customers' behaviour in choosing a green product (using Markov chains), the impact this could have on the number of specialists and the surfaces used in ecological agriculture on green production (using a regression function) are also anaylsed, and the author developed some measures in order to improve companies' involvement in implementing green activities.

INTRODUCTION

The world is facing enormous challenges like never before. The Earth's systems are under constant pressure due to adverse impacts from human activity: using more energy, creating more waste, and produce more air pollutants (Iannuzzi, 2016, p. xiii). The world is constantly changing and is trying to have a sustainable behaviour and attitude. Global companies have embraced sustainability and are triggering companies to build eco-innovation into their product offerings. Governments have responded by putting pressure on product developers to consider tough new requirements such as removing materials of concern, designing more recyclables, and minimizing packages and facilitating product take-back.

DOI: 10.4018/978-1-5225-7915-1.ch024

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

These global regulations started out in Europe and have exploded throughout the world, making it very complicating for business to keep up with the ever-changing requirements and be compliant.

Global companies must eco-innovate products for the market and its customers from the new green economy—who is favoured by politicians, businesses, and policy-makers (Gasparatos &Willis, 2015, p. 19)—and generate economic growth and protect the environment (Vasile & Nicolo, 2017, p. xiv), bringing changes first in the culture (Danaher, Biggs, & Mark, 2016). They must inform their customers about this thing, because a greener product is useless if no one knows it exists. Appropriate marketing of eco-improved products is a critical aspect of a sustainability program (Iannuzzi, 2016, p. xiv). Degradation of environment led to green economy (Ayuk, Oku, Asubonteng, & Nutakor, 2017, p. 1) and its role is to minimize or to eliminate the factors that affect the environment (Nhamo & Mjimba, 2017, p. 3). This analysis is relatively recent and focuses on the need of reaching the consumer with wide spectrum of environmentally friendly products. A window of opportunity has opened up for those firms willing to take the lead in establishing positions of advantage based on greenness (Sahay, Stough, Sohal, & Goyal, 2006, pp. 96-97). It is clear now that the demands will continue to grow, and firms must respond to this challenge to achieve performance.

Every activity supposes a high cost for every stakeholder; this cost consists of consumption of valuable, rare, and unique resources: human, financial, technological, and especially natural. This affects the stakeholder efficiency and also the environment: use of energy for electronics and houses, driving cars, wearing trend-driven fashion, enjoy a wide range of fresh and processes food (Ha, 2008, p. 9). Every product bought is an investment of resources, and its production can contribute to pollution, climate change, and the destruction of habitats. Ecological footprinting has become a popular way of measuring the environmental impact of a given person's way of life. The interest in environmental, organizational, and individual protection and safety is growing every day. Starting in 1960s, the attention grew for environmental issues (Telesiene & Gross, 2016, p. 1; Kahle & Gurel-Atay, 2015), and for green economy, starting with 2000s (Shmelev, 2016, p. 143), and this has created many changes: policies, regulations, rules, and many studies and research made for a greener lifestyle, greener innovations (Peiry, Ziegler, & Baumgartner, 2016, p. xv), and green marketing. Thus, many studies regarding green marketing policies, green consumers' attitudes, green products characteristics, and green thinking and behaviours have been done.

Green business has grown rapidly and it has important expectations from customers, employees, managers, organizations, politicians, and the world in general. Green is not just about protection of the environment; it is about protection and safety of humans and organizations. Before, in order to develop a sustainable strategy, time to convince management to obtain the benefits was needed, but now major companies are making sustainability a platform for growth and funding significant advertising campaigns. Today's climate encourages sustainability improvements and shows how these can help us in the marketplace. People have moved from looking at environmental issues as a risk management function to something that has enormous potential for innovation and growth. Greener products play a bigger role than ever before and should be a growing part of every company's business model (Iannuzzi, 2016, p. 3).

Concern for the environment first appeared in the 1970s, gained momentum for the next two decades, and in recent years, has exploded onto the world business scene (Iannuzzi, 2016, p. 4). Using a green behaviour, the benefits are for everyone: saving resources consumption (natural, human, money), (re) using of waste, and improving personal and professional life.

This chapter brings to the foreground the literature made in the green marketing field, the behaviours of individuals and organizations, the policies made, especially the measures taken by our specialists at

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

the Romanian level compared to European level. The objective of this chapter is to analyse the green market on the Romanian level by simulating customers' behaviours using probabilities calculations and Markov chains. The model used consists of analysing the impact the number of specialists and the surfaces used could have on ecological agriculture and green production by using a simulation model and Excel program. Using these calculations, we proposed some measures in order to improve companies' involvement in developing green activities and improve behaviours with green consumers.

The chapter starts with the definition of the concept of green marketing, and then with a brief discussion about some new ideas: green strategy, objectives, management and employees, green marketing and its four green Ps, and green consumers. These aspects are important for any manager who wants to use the limited resources to obtain maximum performance; this means that by acting efficiently into a new green economy, they could obtain important benefits for their organizations, for their employees, for customers, for the environment, and for stakeholders by implementing a green perspective. This is a step in showing how profitable a green strategy can be for the people, organization, and for the environment.

Green behavior is broader than IT and more global than the Internet and is about developing innovative solutions to advance our society while enhancing our most valuable asset: Earth (Koester, 2016, p. xxv). The best and most successful entrepreneurs recognize an opportunity and create products, services, and businesses that fill that unmet need. As sustainability evolves and takes into account social considerations, a change is occurring in green marketing: to be sustainable the reduction of energy and the resource consumption is needed, and to be green means to change behaviours (Polonsky, 1999, p. 12).

Along the years, some changes have occurred in the managerial perspective, thus appeared the new green marketing perspective. In the opinion of Saxena (2005, p. 657) these changes that affect the green marketing are goals (customer satisfaction, organizational goals, ecosystem compatibility), decision-making (integrated thinking, boundary spinning, long-term orientation), philosophical basis (biocentric, ecosystem a physical limiting factor, eco-costs must be paid), ecological accountability/responsibility (product risk, global/international, full accounting of ecological costs, PSLC members are mutually accountable, joint public-private sectors are mutually accountable), general tools (use life cycle assessment and environmental audits to minimize the impact, the waste, focus on industrial processes, total quality environmental management, use of strategic alliances to accomplish sustainable goals). As the concern for the environment increased in the past three decades, organizations had in mind two goals (Cox, 2010, p. 335): link corporate goals and behavior to the values of environmental quality and avoid if possible any additional environmental regulations that will affect their business.

To define what green means is difficult (The John Marshal Review of Intellectual Property Law, 2010), thus, in this chapter we offer some ideas about what green marketing is:

- Is a term used to refer to a corporation's attempt to associate its products, services, or identity with environmental values and images (Cox, 2010, p. 335).
- Presents managers with the challenge to turn environmentalism into a source of differential advantage and growth (Sahay, Stough, Sohal, & Goyal, 2006, p. 97).
- Is a strategic process involving stakeholders in order to create meaningful long-term relationships with customers while maintaining, supporting, and changing the natural environment (Ferrell, 2008, p. xix).
- Is an ecological issue that concerns all corporates who are called to maintain the ecological balance through developing biodegradable products and reducing the consumption of natural resources (Saxena, 2005, p. 653).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- Is an initiative that has been started by the business professionals where the focus is on the conservation of natural resources (Tehrani & Sinha, 2011, p. 328).
- Seeks to inform and persuade consumers about environmentally friendly options (including product labeling and advertising) (Cook & Ryan, 2015, p. 350).
- Is friendly with the environment, developing a success marketing strategy (Johnson, 2011).
- Influences and models the consumers' attitudes and life styles (Grant, 2009).
- Is the marketing of products that are presumed to be environmentally safe (AMA).
- Incorporates a broad range of activities (product modification, changes to the production process, packaging changes, promotion changes) which happen in a manner that is less detrimental to the environment (Chandrasejar, 2010, p. 458).

Marinova, Annandale, and Phillimore (2008, p. 257) say that for any organization to have green marketing activities they must achieve some important tasks such as:

- **Targeting:** Developing a new business unit must design promotion targeting on specific segments of consumers.
- **Green Design:** Production process must be integrated environmental principles to remain competitive.
- **Green Positioning:** The firm must promote the product or the firm's environmental performance as being a core component.
- **Marketing Waste:** The firm seeks to improve efficiency and to reduce waste and to identify viable consumers of waste products.
- **Green Alliances:** Developing joint activities that have some environmental linkage: co-branding activities, more substantive programs, work together to deal with environmental issues.

In the opinion of Florea (2011, p. 283), to obtain success in implementing green marketing the organizations must:

- Increase investment in green branding (without spending money and time) and technology,
- Make green innovation,
- Produce green products,
- Procure green materials,
- Make green manufacturing, advertising, sales, distribution,
- Be implicated in green awareness, education, development, evaluation and monitoring of employees,
- Attract, retain, and maintain green employees and customers.

Many people associated green marketing with organic, biodegradable, carbon neutral, energy efficient, natural, environmentally friendly, low carbon technology, sustainable, and renewable energy used (Kaufmann, 2014, p. 134).

Kotler says that to understand green marketing one also must understand some approaches such as (Rajagopal & Castano, 2015, p. 73-74):

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- **Product:** Product design should carefully consider the materials and designs used in order to reduce the amount of materials, waste, and the energy required to produce products.
- **Price:** Businesses can offer products that vary in their level of environmental friendliness and price to appeal to consumers with different environmental and price sensitivities.
- **Place:** Production and distribution facilities can be placed closer to the market. More local production and decentralized distribution can be implemented.
- **Promotion:** Businesses should consider shifting promotion from print to online. Labels and advertising should be more specific about ingredients, sourcing, and carbon footprint.

With rising awareness among the mass market consumers about green products and practices, organizations are changing their manufacturing process and marketing strategy. The purchases of the consumers directly affect the manufacture of products and the purchasing decisions of the organization. When the demand of green products increases in the consumer market, the organizations have to produce green products to stay competitive (Tehrani & Sinha, 2011, p. 334).

ISSUES, CONTROVERSIES, CONSEQUENCES

Green is no longer simply a market position, it is a feature (Management Assoc, Info Res, 2014, p. 91) and an important element for the success of every organization, but in this new environment, it must be also important for every leader, manager, supervisor, employee, customer, supplier, producer.

Green business is a complex aspect and analysed by different specialists in the field, and in this chapter, we analysed its importance and its role in the present market by describing some important issues: green strategy, green objectives, green management, green employees, green product, price, place and promotion, green consumers, and green organizations (behavious and attitudes). Understanding these features of the green market all the participants will have a new vision on these relationships, attitudes, behaviours, businesses, and environment – a green one.

Green Strategy

Now is the moment for managers to have a green strategy (Roettgers, 2011, p. 9) and to satisfy the green needs.

From the studies made on this issue are extracted and presented two visions:

- **First Vision:** The firms have developed green strategies based on the 4Rs (reduction, recycling, reusing, and retrieval), which must be reviewed with regard to design and selection of environmentally friendly packaging method (Kirgiz, 2016), and sustainable consumption consists of the 3Rs (reduce, reuse, recycle) view, providing an interesting contrast to traditional environmental views (Kaufmann, 2014, p. 134). Recycling has a positive impact on performance activity of organizations by reducing their costs (OECD, 2015, p. 163).
- **Second Vision:** Based on the benefits the organization could win, it develops a strategy seated on the "4S", going from the green product concept (Kirgiz, 2016):
  - **Satisfaction:** Satisfying the needs of consumers.
  - **Social Acceptability:** Acceptance as a product or a firm being friendly with the environment.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- **Safety:** Not jeopardizing the health of individuals.
- **Sensitivity:** Companies are realising their products according to the sensitivity of the environment and its pressures: economical, social, political, environmental.

More and more analyses and studies describe the importance of implementation of green strategies; thus, Ottman defines its seven winning strategies for green marketing (Ottman, 2011, p. 47):

- Understand environmental and social beliefs and values of consumers and other stakeholders and develop a long-term plan to align with them.
- Create new products/services that balance consumers' desires for quality, convenience and affordability with minimal impact on environment.
- Develop brands that offer practical benefits with empowering and engaging consumers in meaningful ways about the important issues that affect their lives.
- Establish credibility for your efforts by communicating your corporate commitment and striving for complete transparency.
- Be proactive to solve emerging environmental and social problems. Go beyond what is expected from stakeholders.
- Think holistically. Underscore community with users and with the broad array of corporate environmental and societal stakeholders.
- Don't quit. Promote responsible product use and disposal practices. Continuously strive for "zero" impact.

Sahay, Stough, Sohal, and Goyal (2006, p. 104) say that a strategy for green marketing must have four pillars:

- **Promoting Reconsumption:** The ability to use and reuse goods in whole or in part.
- **Redirecting Customer Needs:** Redirect them towards consumption and the current marketing tools toward such redirection.
- **Reorienting the Entire Marketing:** Everything from product and packaging may be reoriented, but also through assessing the impact of manufacturing, content, package, label, advertising, distribution, use, and disposal of its products on environment.
- **Reorganizing Business:** Restructure and redesign of many processes and systems within a corporation according to the green vision encouragement.

The central idea of achieving green advantage is consisting of the four Ps (Boston Consulting Group, in Tehrani & Sinha, 2011, p. 333):

- **Planning:** Embedding green targets and green resources into corporate strategy (Corporate Social Responsibility).
- **Process:** Reducing wastes in operations, encouraging others especially their suppliers, partners, partners and customers to operate in green way.
- **Promotion:** Communicating the message of company sustainability to its various stakeholders.
- **Products:** Determining offerings, packaging, and pricing, Innovating the consumers to live a green way, knowing which green benefits will really matter to the consumer.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Green Objectives

In the opinion of Cohen (2011, p. 400), the organization will successfully implement green strategies if they align green objectives to the vision of the organization.

Unhelkar (2016, p. 65) thinks that green objectives are the core objectives of a business undertaking green transformation and these may be:

- Ensuring a synergy between the core business objectives and the accompanying green objectives.
- Length of time for potential application: 3-5 years being ideal.
- Key drivers and dimensions that are impacting the organization.
- Identify the growth potential and means for the returns on green investment.
- Finding the niche where the competitive advantage for the organization lies.
- Identifying the areas for formal green IT audits.
- Development of green HR as a part of the strategy.
- Optimization and integration of supply chain systems.
- Attention to collaborative opportunities.
- Incorporation of government rules and regulations.

Green Management

Sustainability of an organization is given by the capabilities and the skills of the leadership to obtain resources used in order to obtain organizational efficiency. Accepting sustainability in a world where the resources are limited involve responsibility towards future generations. Social responsibility belongs to sustainability, due to resource depletion.

Successful leadership requires a more complex mix of skills than in the past. Managers will need to be able to recognise and understand trends and to navigate roadblocks effectively. They must be capable of developing efficient and innovative responses to key challenges and opportunities since the sustainability concept is relatively new (Polonsky, 1999, p. 9). To make decisions and balancing different domains, the managers are facing challenges such as environmental protection, satisfaction of new green demands of consumers, be socially responsible, and offer environmentally friendly products and services. Eco-efficiency is driven by the vision of making the challenge of sustainability a business opportunity.

Green Employees

Employees involved in the sustainable activities and adopting sustainable development principles will become sustainable human resources (Florea & Florea, 2009). Human factor is known as one of the key factors in obtaining international organization success (Holbeche, 2012). The practitioners recognize the importance of the role played by human resources in achieving the objectives of the organizations (Edstrom & Lorange, 1984).

According to the principle "healthy people in healthy organizations", human resources must play an important role in applicating the sustainable development activities. In the last decade, human resources management has played an important role in solving problems like recruitment and selection, performance evaluation, training, processes based on not-discriminating, ethics, equity, diversity, and sustainable development principles. The efficiency of a human resources system is given not only by

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

human resources behavior, knowledge, and capabilities but by the strategic human resource management ethics and sustainable development. Ulrich (1997) says that human resources professionals must create politics and practices that make the employees more competitive (Burke & Cooper, 2005).

Green Product

Products today need to be green and brands need to be socially responsible (Management Assoc, Info Res, 2014, p. 91). To understand better the green product we offer a few definitions from specialists in the field.

Thus, green products:

- Are the products which don't pollute the world or deplete natural resources and are recyclable or preservable and do not threaten the human or animal health. No product has zero impact on the environment, thus any organization must minimize the use of energy, the waste, and the unnecessary use (Kirgiz, 2016).
- Refer to those products that incorporate the strategies in recycling or with recycled content, reduced packaging or using less toxic materials to reduce the impact on the natural environment (Chen & Chai, 2010, p. 29).
- Need special efforts to be noticed by consumers. Since consumers are unwilling to pay more for green products, they need to be persuaded by marketing communication strategies. Advertising is the most popular way to promote awareness of environmental products and create demand for them (Kaufmann, 2014, p. 134). The first environmental advertisements appeared in the late 1960s, and in 1980s green advertising started to become a popular marketing strategy, and 1990s represented the period of making false messages and give confusion among consumers.
- Are generally regarded as more expensive than other alternatives (Kaufmann, 2014, p. 137).

We also offer and present other features linked by product:

- **Green Packaging**: Packaging is costing, thus the producers, the consumers and the activists search for cost-efficiently (Kirgiz, 2016), environmentally friendly and sustainable packaging, focusing on functionality, cost-effectiveness, and support for long-term human and ecological health. Green packaging means that the containers are not affecting future generations (Mansvelt, 2010, pp. 329-330) and must not go to waste and reduce the use of underground resources, respect human needs in terms of pay, working conditions (Mansvelt, 2010, p. 330). Using biodegradable materials in place of plastic which take centuries to decompose, the decomposition takes few weeks.
- **Green Labels**: (Or eco-labels) help consumers differentiate between green and non-green choices by emphasizing various green attributes (rigor and credibility). Some of green labels are carefully regulated by the government entities or nonprofit groups (Cook & Ryan, 2015, p. 350).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Green Price

Green price takes into consideration the people, planet and profit in a way that takes care of the health of employees and communities and ensures efficient productivity (Patil & Bhakkad, 2014, p. 85). Value can be added by changing ways of thinking, behaviours, and attitudes.

Green price mix aims at delivering superior value and greater benefits to price ratio guided by the objectives of green marketing-oriented companies rather than factors determining sales. For example, high quality standards can be promoted for money can be promoted for low-priced green products (Management Assoc, Info Res, 2014, p. 2001). Green price is an area of concern (Chandrasekar, 2010, p. 462). Most of the products are being sold at a premium which makes it unattractive. Considering that it is not mandatory on the part of the people to buy the green products, the prices in the initial times are definitely higher. Economies of scale can provide a lower price. Green pricing take into consideration the people, planet and profit in a way that takes care of the health of employees and communities and ensures efficient productivity. Value can be added to it by changing its appearance, functionality through customization. Organic vegetables, products are priced at a premium and are now unaffordable to masses. Green products need to be offered through the government's support channel and create more awareness among people. The firm must move beyond simply discussing out of cost price to identify the price of utilizing the good green logistics must be designed to minimize the utilization of resources that will frequently include reverse logistic systems that move packaging and used products back to the firm (Marinova, Annandale, & Phillimore, 2008, p. 257).

Green Place

The distribution of goods generates noise and vibration, causes accidents, and contributes to global warming, being the reason it needs to be analysed in order to decrease its impact on environment (McKinnon, Browne, & Whiteing, 2015, p. 3). Economic theory tells us that higher priced products can and should result in lower levels of customer participation and renewable energy purchases (Wilson & Olson, 2004, p. 25).

Green logistics:

- Is about managing logistics to cut down on transportation emissions (Patil & Bhakkad, 2014, p. 85), thereby in effect aiming at reducing the carbon footprint (Chandrasekar, 2010, p. 462).
- Must be designed to minimize the utilization of resources that will frequently include reverse logistic systems that move packaging and used products back to the firm (Marinova, Annandale, & Phillimore, 2008, p. 257).
- Meaning green transportation and green warehousing consist of pollution prevention, emission control, reduce costs, and fast deliveries (Emmet & Sood, 2010, p. 132).
- Is about saving money and reduces the effects on environment, having economic and social implications (McKinnon, Browne, & Whiteing, 2015, p. 4).

Green logistic is a relatively young but rapidly evolving subject. Without green logistics, a green supply chain will have not ensure success (Emmet & Sood, 2010, p. 132). The supply chains changed, too; now, the green products are found into specialized stores or on the online sites of organizations (Ottman, 2011, p. 8).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Green Promotion

Green promotion involves configuring the tools of promotion, such as advertising, marketing materials in such a manner that will not affect environment (Patil & Bhakkad, 2014, p. 85). Green promotion mix effectively communicates the value in a company's green product offerings in forms of environmental information about green products, processes and practices, and their environmental significance (Management Assoc, Info Res, 2014, p. 2001). Green marketers link green products and green promotion to enable them making effective purchase decisions. Green promotion involves the tools, such as advertising, marketing materials, signage, white papers, web sites, videos and presentations by keeping people, planet, and profits in mind (Chandrasekar, 2010, p. 462). The firm must include information in its promotional activities that mention environmental benefits of products in addition to other activities green logistics must be designed to minimize the utilization of resources that will frequently include reverse logistic systems that move packaging and used products back to the firm (Marinova, Annandale, & Phillimore, 2008, p. 257).

Green advertising has risen since 1980s and is the inclusion of environment-friendly features and attributes as a persuasive selling point. Criticism on green advertising relies on superficial and unsubstantiated claims at best, misleading and deceptive claims at worst. To protect consumers from false green advertising, the official commissions changed theirs guides and advised marketers on making claims about green product attributes that are truthful and nondeceptive (Cook & Ryan, 2015, p. 351).

The awareness of green products is done through green advertising, blogs, and social networking sites. In green advertising, the green ads are created to influence the homemakers to buy and use environmentally friendly products in their day-to-day activities (Tehrani & Sinha, 2011, p. 328). Green awareness among consumers may occur by using blogs. Green blog is a website that hosts daily updates and posts from people around the world solely devoted to environmental actions and discuss only with green community.

The most successful green marketing campaigns must (Iannuzzi, 2016, p. xv):

- Have a credible greener product story,
- Meet customers' greener product demands,
- Appropriately communicate the products greener attributes.

Green Consumers

Green consumers are sincere in their intentions, with a growing commitment to greener lifestyles (Patil & Bhakkad, 2014, p. 85). They are the individuals who are careful to purchase products that are biodegradable, recyclable or otherwise safe for the environment. They are sometimes called "tree huggers" because of their concern for preserving natural resources. Consumers' attitudes towards green products is increasing (Kaufmann, 2014, p. 128). If producers want to attract the green consumers, then they must have to understand the stages of consumer behavior and try to engage the green consumer more with their green products. To create awareness organizations must develop simple messages according to AIDA principle (attention, create interest, desire and action itself), targeting the wanted consumers, use promotion and focus on positive impacts (Tehrani & Sinha, 2011, p. 323).

A green consumer is someone who make purchases on the basis of firms' roles in society, who is concerned about their everyday habits and the impact on the environment, who translate their environ-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

mental concern into actively purchasing green products commitment, who is aware of and interested in environmental issues, who usually makes organized petitions, boycotted manufacturers, and actively promotes the preservation of the planet, and who wants a higher quality and is willing to pay a higher price (Universal-Publishers, 2011, p. 46). With the commencement of the new millennium and consumers became center of interest, in 2000s consumers started questioning eating habits, fuel consumption, car usage, energy saving, and recycling methods (Kaufmannn, 2014, p. 129).

The evolution of green marketing made develop a green consumer typology (Kaufmann, 2014, pp. 129-130):

1. Made by Ogilvy and Mather:
    a. **Activists (16%):** Likely to buy green products and services,
    b. **Realists (34%):** Are worried about the environment but skeptical about the green bandwagon,
    c. **Complacents (28%):** See the solution as somebody else's problem,
    d. **Alienated (22%):** Are unware of green issues or see them as transient.
2. Made by US Roper Starch Worldwide:
    a. **True Blue Greens (11%):** Major green purchasers and recyclers,
    b. **Greenback Greens (5%):** Will buy or give green but won't make lifestyle changes,
    c. **Sprouts (33%):** Care but would only spend a little more to buy green,
    d. **Grousers (18%):** Environment is somebody else's problem,
    e. **Basic Browns (31%):** Essentially don't/won't care.

Green Organizations: Behaviours and Attitudes

The environment, the options, the needs, and the consumers' desires, leading implicitly to changing products, vision, mission, behaviours and organization strategies are changing. Thus, a continuous loop of product and organization development according to environment changing and consumers desires is created.

Changes in consumer behaviour (Megicks, Donnelly, & Harrison, 2009, p. 51; Florea, 2014, p. 114):

1. Demographic
    a. Access to sport, due to a rapid aging process of young people and children and exposition to the new technologies and media campaigns,
    b. Changing family relationships (a more reduce size of the houses).
2. Segment Structure
    a. Appearance of monoparental families,
    b. Large number of single persons,
    c. Raising number of working women (70%).
3. Social
    a. Raising the percentage of using the internet (the number of Internet users worldwide increased from 0.36 mil. in 2000 to 19.66 mil. in 2010, to 30.35 mil. in 2014 and to 36.11 mil. in 2016 [www.internetworldstats.com], the growth from 2000 to 2016 being of 900.4%).
    b. Raising the percent for online orders and home deliveries,
    c. Concern for prices raising,
    d. Raising the importance of relationship quality/price/value.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

4. Ethical
    a. Equity in buying,
    b. Buyers with conscious,
    c. Cynicism,
    d. Raising degree of knowing and information,
    e. Implication, human and environment rights defence,
    f. Lifestyle,
    g. Knowing the risks of smoking and alcohol consumption,
    h. Adapting of a healthy lifestyle,
    i. Raising the level of green products consumption.
5. Cultural
    a. Minimizing sugar consumption,
    b. Decreasing the consumption of products with a great level of fat,
    c. Participating to sport activities and fitness.
6. Natural Marketing Institute survey (2009) offered some data in which show, that the green concept became a normal phenomenon for customers and organizations, implying (Ottman, 2011, p. 8):
    a. Recycling materials from plastic, glass and paper (65% of consumers),
    b. Affecting less of the environment,
    c. Consuming less of the resources,
    d. Throwing less of toxic substances in the environment,
    e. Using bicycles (31%), and common transportation (subway and by bus), reducing the consumption of fuel (17%),
    f. Making shopping and using recyclables bags (48%),
    g. Preserving energy by stopping the light sources (95%) and water (85%),
    h. Producing clothing articles using recyclables or natural fibres, eco-detergents, raising healthy animals, making bio dyings, biological pesticides (84% from organizations).

Many organizations made new products, which are at fashion (Ottman, 2011, p. 2):

- Cell-phones which use solar batteries,
- Cars who use eco-fuels,
- Food and juices who are natural in a great proportion,
- Clothes made form recyclable materials,
- Packaging for cosmetics which are made from recyclable paper,
- Phosphate-free detergents (Soundarapandian, 2007, p. 221),
- Cadmium-free batteries,
- Energy-efficient computers,
- Solar water heating (Koester, 2016, p. 48),
- Water purifying systems,
- Cool roofing installation,
- Green building,
- Green cement.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

And many other organizations are implicated in developing new green products in order to satisfy green consumers:

- Toyota Prius had made the first car that has had a green platform from its inception (Iannuzzi, 2016, p. 6).
- Starbucks is well known for their fair and ethical sourcing of coffee and their sustainability program to the visible part of their product (their cup, who ensure that 100% of their cups are reusable or recyclable.
- Kimberly Clarck initiated an advertising campaign about their new, sustainable toilet paper, without the cardboard tube under the brand name "Scott Naturals".
- Toyota presented in 1997 the rechargeable electrical hybrid vehicle and it provides performance and fuel economy today (Kirgiz, 2016).
- Ecologist Dish Washer is one of the best examples of the environmentalist production approach in all products developed by Arcelik A.S.
- AEG Electrolux use a diminished quantity of water, and lowering energy.
- McDonalds is using paper packages in lieu of plastic packages.
- Cell phone producers announce when the battery is fully charged to unplug the charger.
- Olive oil producers like Paksoy are using glass bottles.
- The producers of glass bottles lightening their weight in order to reduce the consumption of natural resources.
- IKEA started charging consumers when they opted for plastic bags and encouraged people to shop using its "Big Blue Bag".
- WalMart unveiled its first recyclable cloth shipping bag (Chandrasekar, 2010, p. 462).

These actions lead to obtaining profit by healthy organizations, growing the level of health of the population, and developing a healthy environment.

Benefits Obtained by Stakeholders by Implementing Green Marketing

Green market is growing, evolving due to new legislation and rules realized for a green consumer, which bring development opportunities for organizations, growing opportunities for sales, increasing opportunities for market shares or in positioning on a new segment and in satisfying new consumers desires. All stakeholders will have to gain, and all will receive benefits.

Using green products conducted to benefits as benefits for organizations and their brand.

Companies all over the world are striving to reduce the impact of products and services on the climate and other environmental parameters. Marketers have taken the cue and are going green (Chandrasekar, 2010, p. 458).

Implementing green marketing, the organizations could obtain the following benefits:

- Increasing the operational costs (Johnson, 2011), including for recruitment and selection (Florea, 2013, p. 56), offering a healthy work environment (Stegaroiu & Florea, 2013, p. 12),
- Reducing the degree of the competition,
- Reducing the consumption of materials.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Companies like Coca Cola (has lightened the silhouette of bottles by reducing the consumption of glass and plastic), Este Lauder (found a new melting method for packaging), Nestle, Procter & Gamble (offers products which are not transported in cardboard boxes), and McDonalds (who is using recycling for packages) are contributing to the reduction of costs and for attracting the attention of customers (Kirgiz, 2016).

Organizations who apply green marketing are:

- Increasing the morale of the employees (Ottman, 2011, p. 2),
- Making a correct functioning of all activities,
- Establishing clear objectives, who may be achieved on long term,
- Encouraging green employees,
- Recruiting of talented green employees,
- Growing the motivation of employees,
- Growing the degree of innovation,
- Growing the level of employees' skills,
- Ensuring price positioning over market value (Kirgiz, 2016),
- Preventing information tangle,
- Protecting against competitive attacks,
- Raising productivity,
- Creating loyalty in the consumer.

Benefits for Consumers

Organizations and retailers came in front of green consumers with new tactics:

- Offer recyclable packaging (for example, McDonalds and Burger King have offered these packaging in order to reduce waste, Coca-Cola pumped syrup directly from tank instead of plastic saving money) (Patil & Bhakkad, 2014, p. 85),
- Offer reduced air pollution for consumers (for example Sheraton Hotels used furniture made of wood harvested from managed forests and all carpets, draperies, paint and wall paper were made free of toxic chemicals; they forbade smoking and use ventilation systems that ensures fresh air in all rooms),
- Retailers use tools to save environment (for example, Wal-Mart runs videos to educate consumers, open ecofriendly stores where rainwater is collected from parking lots, and use solar powered for road signs) (Chandrasekar, 2010, p. 463),
- Safer products (Iannuzzi, 2016, p. 6),
- Saving money through energy efficiency.

Benefits for Society

To be green, organizations must implement (Johnson, 2011) reasonable actions, real advertising campaigns, one research in implementing eco-marketing, green labeling for qualitative products, recyclable measures for energy and paper, maintain sustainable ecological optimism, develop online green marketing opportunities, create eco-niche marketing.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Green market and implication of organizations in green marketing will lead to (Ottman, 2011, p. 3):

- Raising organization reputation,
- Raising the degree of sustainable resources consumption,
- Raising the degree of green consumers satisfaction,
- Raising the life cycle of green markets and green products,
- Raising the quality of environment and the concern for the limited resources.

Benefits for Employees

By implementing green strategies, an organization obtains competitive advantage, satisfies better the needs of all stakeholders and implicitly the employees' needs (Kaufmann, 2014, p. 128). Applying green marketing, the organization may attract better employees. Employees feel betters when they know that they are working for an environmentally responsible company. To not take the wrong actions in green marketing, the firms must find a balance between consumers' expectations, government regulations, science, corporate profit, societal long-term welfare, and motivating employees.

Green isn't just about environment; it also represents a way of seeing the business and its facing challenges through a new lens, which can bring risks but also opportunities. This behaviour has impact on microlevel (save money for all stakeholders, cut wastes, reduce use of resources), and also on macrolevel (impact on jobs, economic development, balance of payments, quality of life, improve infrastructure, reduce financial crises) (Friend, 2009, p. ix).

METHODOLOGY

The main objective of this study is to analyse the actual situation of green marketing in Romania and to:

- Analyse the green customers behaviours using probabilities calculations, MATLAB and Markov chains,
- Analyse the impact could have the number of specialists and the surfaces used in ecological agriculture on green production by using a simulation model and Excel program,
- Propose some measures in order to improve the companies' involvement in developing green activities and improve behaviours with green consumers.

Data Presentation and Analysis

Green Marketing in Romania: Initiatives and Opportunities Through the Prism of Green Agriculture

This chapter will analyse the role of green agriculture, its role being to produce cleaner food in correlation with environment preservation and development. Increase of organic farming areas shows that the first European country has almost 19 percent of total utilised agricultural area (in 2005 having almost 17), while Romania has in 2013 a little over 2 percent (in 2005 having under 1 percent) (ec.europa.eu, EU27, RES 2015, p. 42). The total area under organic farming across Europe increased from 5.9 million ha in

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

2003 to 9.6 million ha in 2011 (63% growth). It is estimated that organic is the fastest growing sector of the food industry, with global revenues increasing from $18 billion in 2000 to $72 billion in 2013, i.e., a fourfold increase in just over a decade (first 2014 estimate being close to $80 billion).

Romania presents some structural characteristics alike with the other agricultural sectors form other EU member countries, but it is unique through the gap between the category of large farms and the small ones, and also through the prevalence of subsistence/semi-agriculture. In 2010, 93% from Romanian exploitations were in these two categories; from these, three quarters were operating on less than 2 hectares and more than a quarter were managed by farmers with age over 65 years (http://www.madr.ro/docs/agricultura/strategia-agroalimentara-2020-2030.pdf). From economical point of view, 73% from the exploitations offered less than 2,000 Euros, which places almost 2.7 mill. exploitations in economic non-viable farms category (being 5% of the surfaces cultivated from EU). Thus, a significant percent of these surfaces from Romania is linked by the agriculture sub-optimal activities, who stay as a barrier in achieving its high potential.

Tough economical conditions after the crisis from 2009 made that 120,000 farms to become farms under 2,000 Euros category (comparing to 2007) and they caused a step back from the condition who limited their percent to two thirds from the total.

A positive aspect is this field is that demographic transition from Romanian agriculture brought positive transformations (http://www.madr.ro/docs/agricultura/strategia-agroalimentara-2020-2030.pdf):

- Between 2005-2010, the number of farms decreased with 400,000 farms,
- The number of young farm managers increased in 2010 (23% of the farmers have less than 45 years comparing with only 17% in 2005).
- Young farm managers contributed more and more to standard agricultural production: 29% in 2010, comparing to just 18% in 2005.
- The average size of the farms grew up modestly (from 3.11 ha in 2002 ha to 3.45 ha in 2010 and to 3.6 ha in 2013), due to the diminishing phenomenon of the used agricultural surfaces.
- The implementation of a life rent schema, favoured a transfer rather through lease (247 thousand ha) then through selling (82 thousand ha), having also a positive role.

The same source (The Romanian Ministry of Agriculture), says that the problems of Romanian agriculture is facing are due to the following factors (www.madr.ro):

- Reluctance to land consolidation,
- Agriculture is still a less attractive field for young entrepreneurs,
- The incomes are too reduced,
- The import of food is growing,
- Agricultural machines are insufficient and under the European standards,
- The agro-food chains are inefficient,
- The access to credits for agricultural investments are deficit areas,
- The conditions for raising animals are poor,
- The promotion of Romanian agricultural and food products is poor,
- A national brand for products is missing,

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- The capacity for storage is insufficient.

To show a view regarding the current state of some indicators in this study are presented some surveys results:

- The Resource Efficiency Scoreboard (RES) (EU28, 2015) showed that the most reduces levels of resource productivity/indicator are registered in eastern European countries (Romania, Bulgaria). The same report analyses the recycling rates in 2013; more European countries (EU27) are over 40 percent, Romania being the only one under 10 percent (actually being under 5 percent) (ec. europa.eu/RES, 2015, p. 31).
- Eco-innovation index (ec.europa.eu/RES, 2015, p. 33) shows that Romania obtained a little over 300 (being on the 21th place from 28 European countries), the first having an index of over 700.
- Flash Eurobarometer 367 (25568 respondents) made in 2015 showed that a very high proportion of citizens buy environmentally-friendly products so are classified into the two maintenance categories (80%). More than half of respondents are classified as occasional maintenance (54%) and another quarter as regular maintenance (26%). In total, 15% of EU citizens do not buy environmentally-friendly products (ec.europa.eu/public_opinion /flash/fl_367_sum_en.pdf).

The organic products on the Romanian market are quite reduced. The most food, among canned vegetables, fruits, certain breads, are brought form abroad. The total selling of bio Romanian products are representing less than 1% from the retail market, toward the European average of 5-6% (http://www.infomina.ro). In October 2007, Romania had a production from ecologic agriculture of 7457 thousand tones (only for cereals), and the total surface used for this type of agriculture is of 190129 ha, toward 31.4 mil. ha at global level. The consumption for ecologic products is of 1% against other countries as Germany (5%), England and Austria (3%). Romania is one of the East EU members who grew up at bio production, next to the Czech Republic and Poland, but is important to grow to processing and selling too (http://www.ziare.com). Romania has exported in 2014 agri-food products with 6.1% more than previous year, while the imports have grown in a slower pace, surpassing with 2.6% the value obtained in 2013 (http://www.madr.ro/schimburi-comerciale-cu-produse-agroalimentare.html).

The analyses, surveys, and the trends show that in the next years the green market from Romania has a great potential of development in the European organic industry. The most important issues being for Romanian green market that there are no companies for processing the ecological products, thus the raw materials being exported, and they are coming back (processed, labeled, transported) a few times more expensive.

Green Marketing Evolution in Romania Using Simulation Techniques

To understand better the evolution of green marketing in Romania based on the analyses presented above and past data registered officially at European level are implement some models and are used some simulation techniques.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Case 1: Analysing the Actual Situation of Green Marketing in Romania and Implementing Mathematical Calculation to Measure the Impact of Different Factors on Green Marketing Efficiency

This research is made departing from a survey made by Flash Eurobarometer 367 (2013, pp. 8, 10) on 28 countries from Europe:

- In the first case (Table 1) are extracted from Question 5 data just for four countries from South-East of Europe (Romania, Croatia, Bulgaria, and Hungary, noted as RO, HR, BG, and HU) regarding the fact that choosing a labelled green product will cause less damage to the environment.
- In the second case are extracted from Question 2 and calculations regarding the decisions of respondents on what aspects are important when they are buying a product: the quality, the price, the impact on the environment and the brand (name) of the product.

Departing from these data it is seen in tables data extracted from questions Q2 and Q5, developing some calculations using Markov chains.

And then it is build a matrix formed by four lines and four columns, according to the registered data.

$$\begin{pmatrix} 0.15 & 0.31 & 0.45 & 0.09 \\ 0.16 & 0.52 & 0.24 & 0.08 \\ 0.17 & 0.53 & 0.21 & 0.09 \\ 0.22 & 0.44 & 0.27 & 0.07 \end{pmatrix} \tag{1}$$

It is also taken into account the fact that when the respondents are deciding on what aspects are important when are buying a product; they are taking into account the quality, the price, the impact on the environment and the brand (name) of the product.

Making the calculation, according to the registered data at Q2 presented in Table 2, the following scores are obtained:

Below are calculated the scores obtaining:

- For quality:

$$q = (65 \times 5 + 32 \times 4 + 2 \times 3 + 1 \times 2 + 1 \times 1) \div 100 = 4.61 \tag{2}$$

Table 1. Data regarding the confidence that labelled green products cause less damage to the environment

Country/Scale	5	4	3	2 and 1	Total
RO	15	31	45	9	100
HR	16	52	24	8	100
BG	17	53	21	9	100
HU	22	44	27	7	100

Source: data extracted from Flash Eurobarometer 367, 2013, Q5, p. 8.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 2. Factors important when choosing a green product

Analysed Factor/ Scale	5 (Very Important)	4 (Fairly Important)	3 (Not Very Important)	2 (Not at All Important)	1 (Don't Know)
Quality	65	32	2	1	1
Price	40	47	10	2	1
Environment	38	46	12	3	1
Brand	14	32	36	17	1

Source: data extracted from Flash Eurobarometer 367, 2013, Q2, p. 10.

- For price:

$$p = (40 \times 5 + 47 \times 4 + 10 \times 3 + 2 \times 2 + 1 \times 1) \div 100 = 4.23 \tag{3}$$

- For environment:

$$e = (38 \times 5 + 46 \times 4 + 12 \times 3 + 3 \times 2 + 1 \times 1) \div 100 = 4.17 \tag{4}$$

- For brand:

$$b = (14 \times 5 + 32 \times 4 + 36 \times 3 + 17 \times 2 + 1 \times 1) \div 100 = 3.41 \tag{5}$$

To transform into a stochastic matrix, are made the summing up of the scores, which is 16.42, and then is divided each score to this sum, obtaining the following elements of the line vector:

$$T_0 = \begin{pmatrix} 0.28 & 0.26 & 0.25 & 0.21 \end{pmatrix} \tag{6}$$

It is considered that T_0 is the actual moment, thus it will be used the simulation (using Markov chains) of the actual values for the next three years till 2019.

$$\begin{pmatrix} 0.15 & 0.31 & 0.45 & 0.09 \\ 0.16 & 0.52 & 0.24 & 0.08 \\ 0.17 & 0.53 & 0.21 & 0.09 \\ 0.22 & 0.44 & 0.27 & 0.07 \end{pmatrix} \times \begin{pmatrix} 0.28 & 0.26 & 0.25 & 0.21 \end{pmatrix} \tag{7}$$

Using MATLAB, are obtained the following results for quality, price, environment and brand for green products (noted as QPEB). It is observed that these results tend to stabilize and are presented in Table 3.

It is observed that in the next three predicted years, the quality is continuing to decline slightly starting from 0.28 and reaching in 2019 at 0.17 being on the third place in a predicted future; the price is continuing to grow in the next year, and then is stabilizing reaching to 0.48; the value for environment

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 3. The trend of QPEB for the next three years

Analysed Elements/T	T_0	T_1	T_2	T_3
Quality	0,28	0,17	0,17	0,17
Price	0,26	0,45	0,48	0,48
Environment	0,25	0,30	0,27	0,27
Brand	0,21	0,08	0,08	0,08

is rising from 0.25 to 0.30 in the next year, and then is stabilizing at 0.27; the brand diminish its values from 0.21 in T0 to 0.08 in the next three years, stabilizing itself.

The conclusion of this new matrix, where the respondents from the four analysed South-Eastern European, including Romania, is that the analysed countries will change their vision regarding the four analysed elements of a green product: if in T0 the most important element was the quality in choosing a green product, now remain the second (from 0.28 to 0.17), the price which was on the second preferred element in the predicted future is the first (from 0.26 to 0.48), the environment is gaining preference from 0.25 (the third place) to 0.27 (the second place), and the brand is losing in the predicted future reaching from 0.21 in T0 to 0.008 in T3 being on the last place, far from the other values.

Thus, in the present, a buyer prefers a green product after the quality, the price, the environment, and the brand; into a simulated future the buyers will choose a green product after the price (increasing to 0.48 from 0.28), the environment (increasing from 0.25 to 0.27), the quality (decreasing from 0.28 to 0.17), and then the brand (decreasing from 0.21 to 0.08). So, the future buyer is choosing a green product depending on the price and its impact on the environment, choosing to be aware of the consequences on the health of the environment and the consumption of the resources.

Case 2: Analysing the Green Market From Romania and the Impact It Could Have on the Number of Specialists and the Surfaces Used in Ecological Agriculture on Green Production in Romania Using a Simulation Model and Excel Program

This analysis started from data presented in Table 4, in which are presented three variables, one chosen as being dependent and two independent, and the goal is to see if there is a relationship between them. For this it is applicated the regression function and Excel calculation.

Pearson correlation coefficient (Table 5) is equal to 0.9779. The coefficient is positive, so the correlation between variables is direct and very strong (close to 1).

The R value (the value of the correlation coefficient) indicates whether or not there is correlation between the dependent variable (Y) and the independent variable (X1 and X2). The R value is equal to 0.9779, so it can be said that there is a very close, positive, and direct connection between the analysed variables.

R^2 means that 95.63% of the variance in the dependent variable Y is predicted or explained by the independent variables X_1 and X_2.

There are obtained in the Table 6 the values of the regression parameters and the values of a and b (Unstandardized Coefficients) (a is 0.0753 and b is – 0.3134).

Lower 95%, Upper 95% – upper and lower limits of the confidence interval for the parameter. The limits for 0.05 are calculated automatically, regardless of the initialization procedure Regression. It could

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 4. Data regarding the ecological Romanian production and the two analysed variables

Years	Production in Ecologic Agriculture in Romania: Cereals (Thousand Tones) (Y)	Total Surface Used in Ecologic Agriculture (Ha) (X1)	Nb of Operators Certified in Ecologic Agriculture (X2)
2007	7457	190129	3834
2008	16288	221410	4191
2009	14430	202058	3673
2010	16226	182706	3155
2011	13113	229946	9703
2012	12288	288261	15544
2013	20198	301148	15194
2014	20903	289252	14470

Sursa: www.madr.ro, www.maap.ro.

Table 5. Model summary output

Regression Statistics	Multiple R	R Square	Adjusted R Square	Standard Error	Observations
Values obtained	0.9779	0.9563	0.7824	3776.49	8

Table 6. The parametres of the regression

The Parametres	Unstandardized Coefficients	Standard Errors	T Stat	Sig.	Lower 95%	Upper 95%
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A
a (total surface)	0.0753	0.0153	4.9	0.002	0.0377	0.1128
b (nb. of operators)	-0.3134	0.3648	-0.859	0.42	-1.206	0.5793

be said that the linear model parameters are within the following ranges: a between 0.0377 and 0.1128 and b between -1.206 and 0.5793.

The estimated model of regression is:

$$y = 0.0753 \times x_1 - 0.3134 \times x_2 \tag{8}$$

From the formula founded by the computer simulation model results that X1 and X2 (the two analyzed variables) are very important factors in the evolution of Y (production in ecologic agriculture). To increase with a monetary unit the X2 will get an increase of 0.0753 monetary units of X1 and an increase with a monetary unit of X1 will get a decrease of 0.3134 monetary units of X2. It must be noted that the value of free term is zero allowing us to conclude that the factors were not taken into account in the model construction have not any material impact on the evolution of the Y.

Correlation table (Table 7) shows the values of correlation coefficients between the variables “total surface” and “nb. of operators”.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 7. Correlations

	Total Surface	Nb. of Operators
Total surface Pearson correlation Sig. (2-tailed)	1.000	0.9979 0,.42
Nb. of operators Pearson correlation Sig. (2-tailed)	0.9779 0.42	1.000

The T test is applied to check whether there is a significant correlation between the two variables. The Sig Value corresponding of T test is equal with 0,42 so, it can be concluded that it has achieved significant correlation (correlation is significant at the 0.01 level [2-tailed]).

RESULTS, DISCUSSIONS, AND RECOMMENDATIONS

This study aims to highlight the importance of green market in the vision of the green organizations by analysing some important concepts as green strategies, green management and objectives, the four green Ps, green consumers, and green organizations.

The main objectives of this study were to analyse the actual situation of green marketing in Romania by using:

- Probabilities calculations and Markov chains,
- a simulation model (regression function) and Excel program,
- Propose some measures in order to improve the companies' involvement in developing green activities and improve behaviours with green consumers.

Our study reflected that applying a model of linear regression function, one of the most complex procedures of processing and statistical analysis package from Excel, enables statistical and economic analysis, but also builds the necessary fit to the linear model. It was found that by implementing a computer-based simulation model, the two analyzed factors are very important factors in the evolution of the first variable.

After analysing some important green issues in this chapter, some research hypothesis were launched with some recommendations which may help organizations to overcome barriers that stand in front of green consumption and green behaviors/attitudes.

First, this study offers the idea that organizations that are challenged to have a good involvement and a healthy thinking may offer to the new consumers the desired product/service according to the principle of determining the factors which can influence the choosing process.

Thus, we proposed the following recommendations:

- Proposing a plan and some measures to improve the companies' involvement in developing green activities and improve behaviours with green consumers. Starting from the idea that analysing customers' needs and making a segmentation of these customers, the organizations could satisfy them by implementing a plan necessary for improving green implementation. To have a strong

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

and clear green plan the organizations must in have in mind the main objectives of the green marketing:

- Developing New Green Standards:
  - Creating differentiations: products, brand and organization image which is greener than the alternatives,
  - Launching new green products.
- Developing New Green Responsibilities:
  - The way of using the products of consumers to be greener,
  - The campaigns for encouragement of consuming green and healthy products.
- Sustaining the Greenest Innovations:
  - Creating new lifestyles,
  - Creating new business models, normal and acceptable (obtaining green profit).

Thus, we have developed a new marketing style, the niche marketing or the green marketing, which has success with the fulfilment of the following conditions:

- Raising the degree of education of the population in order to understand the impact of the consumption of resources on environment,
- Raising the level of culture,
- Raising the degree of changing the lifestyle,
- Raising the degree of choosing the attractive alternatives: the green alternatives,
- Developing new practices which may substitute the old practices which were based on consumerism and affecting the environment.
  - Making an analysis of the consumers based on segmentation, analysing the internal and the external factors which may influence the green behaviour of consumers.

To improve the consumption of green products and to make aware the consumers about the firm products, the firm must make a segmentation based on some important factors, internal and external. This segmentation consists in determining the internal and the external factors that influence the consumption of green products:

Internal Factors

- **Contextual Factors:** Availability on shelf, location, the moment of consumption, accessibility, consumption opportunity, the way of use, perceived quality, perceived characteristics (flavor, taste, flavor, nutritional value, texture), past experience with the product/brand/manufacturer.
- **Behavioral Factors:** Searched advantages, the importance given to the shopping, attitude and the status of the user, the frequency of the using/shipping, the loyalty, \the increasing level of consumer needs, the size of the shopping.
- **Physiological Factors:** Health state, metabolism, allergies, genetic factors, fashion, comfort, healing sensation/capacity.
- **Socio-Cultural Factors:** Consumer preference, religion, habits, norms, traditions, lifestyle, personality, personal opinion, and values.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

External Factors

- **Technological Factors:** The degree of innovation, R&D, use optimization of resources through human resources quality development.
- **Economic Factors:** Income, price influence, suppliers' attitudes, nature of the competitors, rapid obtaining of profit, continuity of transactions, decision quality in risk conditions, the rapid exchange of goods/services for consumer need satisfaction.
- **Demographic Factors:** Level of education, sex, age, size of the family/house, life cycle of the family, nationality, race, marital status, profession,
- **Political Factors:** Economic politics, legislation, rules, regulations, stability/force of the politic parties.

CONCLUSION AND FUTURE WORK DIRECTIONS

Now, people are living in a new world where they are aware of the impact of their actions on environmental health and also of the consumption of those products that have impact on their health. The goal of this chapter is to implicate all the participants on the market in implementing green issues in business practice to make a difference, so our society will continue to develop in harmony with the nature.

This study presents the role of green issues in our daily lives, such as green strategies, green objectives, green management, green employees, green product, price, place and promotion, green consumers and green organizations. It is known that is difficult for organizations to establish policies and strategies at corporate level who must be in accordance with environmental issues, due to the costs involved (necessary for modifying the marketing process, the way of production, the way of thinking or the attitudes). But trying is not costly, and the results are on long-term, especially for the future generations. It is known from schools that resistance to change is the most important barrier in obtaining performance, so accepting that healthy products, healthy organizations, healthy employees, healthy thinking and attitudes means healthy consumers and environment is the beginning. Changing must start with us, now, and green marketing strategies must be perceived by organizations as a competitive tool that will bring performance on long-term. Everything the organizations and people are doing in present will leave a footprint on the future; thus, they might be responsible of the present actions by implicating in the three Rs actions: reducing, recycling, and reusing.

The strength of this chapter is consisting in using simulation methods (Markov chains, regression function, and IT programs such as Excel and MATLAB) in order to offer for managers and organizations a simple and cost-effective way of analysing the future impact of their actions and decisions on performance and environment, and also on resources consumption. Using such simulation techniques, the managers can see the future trends of green behavior as being a future opportunity for organizations and environment, and the organizations may predict future problems and may solve them in time and with minimum effort.

The limitations of this chapter are the not so very large analyzed period and the analysed data captured in just one moment in time, but this study could offer new opportunities for further research, and a new necessity to investigate the importance of using mathematical simulation in order to determine the future green performance.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

As future work directions, it is proposed to use in any field, not only in green marketing, due to their advantages for future prediction and reduced costs. So, this will lead to a green future that will surely consist of developing clear regulations, offering the necessary equipment to transform, produce, and sell green products, and change step-by-step the thinking and the attitudes regarding the behaviour towards the environment.

REFERENCES

Ayuk, E., Oku, E., Asubonteng, K., & Nutakor, P. (2017). *Promoting Green Economy: Implications for Natural Resources Development, Food Security and Poverty Reduction in Africa*. United Nations University Institute for Natural Resources in Africa.

Burke, R. J., & Cooper, C. L. (2005). *Reinventing human resources management:Challenges and new directions*. Routledge.

Chandrasekar, R. S. (2010). *Marketing Management. Text and cases, India*. McGraw Hill.

Chen, T. B., & Chai, L. T. (2010). Attitude towards the Environment and Green Products: Consumers' Perspective. *Management Science and Engineering*, *4*(2), 27–39.

Cohen, N. (2011). *Green business: and A-to-Z guide*. Sage Pub. doi:10.4135/9781412973793

Cook, D. T., & Ryan, J. M. (2015). *The Wiley Blackwell encyclopedia of consumption and consumer*. John Wiley & Sons. doi:10.1002/9781118989463

Cox, R. (2010). *Environmental communication and the public sphere*. Sage.

Danaher, K., Biggs, S., & Mark, J. (2016). *Building the Green Economy: Success Stories from the Grassroots*. Routledge.

Edstrom, A., & Lorange, P. (1984). Matching strategy and HR in multinational corporation. Journal of International Business Studies.

Emmet, S., & Sood, V. (2010). *Green supply chains: an action manifesto*. John Wiley & Sons.

Ferrell, W. P. (2008). *Marketing*. Cengage Learning.

Florea, N. V. (2011). Using branding to attract, recruit and retain talented staff. *Marketing & Management Review*, *9*(2), 283–297.

Florea, N.V. (2013). *Auditul resurselor umane*. Bucuresti, Romania: C. H. Beck.

Florea, N.V. (2014). *Planul de marketing*. Bucuresti, Romania: C. H. Beck.

Florea, N. V., & Florea, D. (2009). *Integrating sustainable development in human resources recruitment and employment processes. In Conferinta Dezvoltarea Durabila şi energii regenerabile, Univ* (pp. 260–264). Spiru Haret.

Friend, G. (2009). *The truth about green business*. Que Publishing.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Gasparatos, A., & Willis, K. (2015). *Biodiversity in the green economy*. Routledge.

Grant, J. (2009). *The green marketing manifesto*. West Sussex, UK: John Wiley & Sons.

Ha, T. (2008). *The Australian green consumer guide: choosing products for a healthier home,planet and bank balance*. UNSW.

Holbeche, L. (2012). *Aligning human resources and business strategy*. Butterworth-Heinemann.

Iannuzzi, A. (2016). *Greener products: the making and marketing of sustainable brands*. CRC Press.

Johnson, F. K. (2011). *Green marketing concepts. How to cash in with ecological Niche marketing*. PLR Rights Marketing.

Kahle, L., & Gurel-Atay, E. (2015). *Communicating sustainabilityfor the green economy*. Routledge.

Kaufmann, H. R. (2014). *Hanbook of reserach an consumerism in business and marketing: concepts and practices*. IGI Global. doi:10.4018/978-1-4666-5880-6

Kirgiz, A. (2016). *Green marketing: a case study of the sub-industry in Turkey*. Springer.

Koester, E. (2016). *Green entrepreneur handbook: the guide to building and growing a green and clean business*. CRC Press.

Management Assoc. Info Ress. (2014). Marketing and consumer behavior: Concepts, methodologies, tools, and applications. IGI Global

Mansvelt, J. (2010). *Green consumerism: an A-to-Z guide*. London, UK: Sage Pub.

Marinova, D., Annandale, D., & Phillimore, J. (2008). *The international handbook on environmental technology management*. Edward Elgar Oublishing.

McKinnon, A., Browne, M., & Whiteing, A. (2015). *Green logistics: improving the environmental sustainability of logistics*. London, UK: Kogan Page Pub.

Megicks, P., Donnelly, R., & Harrison, G. (2009). *The marketing planning process*. Butterworth-Heinemann.

Nhamo, G., & Mjimba, V. (2017). *Sustainability, climate change and the green economy*. Africa Institute of South Africa.

OECD. (2015). *OECD Green Growth Studies Material Resources, Productivity and the Environment*. Paris: OECD Publishing.

Ottman, J. A. (2011). *The new rules of green marketing. Strategies, tools, and inspiration for sustainable branding*. Berrett-Koehler Pub.Inc.

Patil, D. B., & Bhakkad, D. D. (2014). *Redifining management practices and marketing in modern age*. Atharva Pub.

Peiry, K., Ziegler, A., & Baumgartner, J. (2016). *Waste managementand the green economy*. Edward Elgar Pub. doi:10.4337/9781783473816

Polonsky, M. J. (1999). *Greener marketing: a responsible approach to business*. Greenleaf Pub.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Rajagopal & Castano, R. (2015). Understanding consumer behavior and consumption experience. IGI Global.

Roettgers, F. (2011). *Going green together: how to align employees with green strategies*. Environmental Pioneers.

Sahay, B. S., Stough, R. R., Sohal, A., & Goyal, S. (2006). *Green business*. Allied Publishers.

Saxena, R. (2005). *Marketing management*. New Delhi, India: Tata McGraw-Hill Education.

Shmelev, S. (2016). *Green economy reader*. Springer.

Stegaroiu, I., & Florea, N.V. (2013). *Tehnici si instrumente de recrutare si selectie*. C. H. Beck.

Tehrani, N., & Sinha, S. (2011). *Understanding green business*. Bloomington, IN: AuthorHouse.

The John Marshal Review of Intellectual Law. (2010). *The intersection of intellectual property law and the green movement: RPL's Green Issue 2010*. Quid Pro Books.

Unhelkar, B. (2016). *Green IT strategies and applications: using environmental intelligence*. CRC Press.

Universal-Publishers. (2011). *International Journal of Economic and Political Integration*, *1*(1).

Vasile, A., & Nicolo, D. (2017). *Sustainable entrepreneurship and investments in the green economy*. IGI Global. doi:10.4018/978-1-5225-2075-7

Wilson, R., & Olson, S. (2004). *Utility green pricing programs: a statistical analysis of program effectiveness*. Diane Pub. Retrieved from http://www.wall-street.ro/articol/Economie/69736/Scadere-de-15-pentru-productia-de-produse-ecologice-in-2009.html

KEY TERMS AND DEFINITIONS

Green Economy: An economy responsible and sustainable who comes with healthy regulations and policies for every stakeholder.

Green Employees: Are those employees who act according to those principles based on social responsibility, sustainable development, ethics, equity and not-discrimination.

Green Marketing: Is an activity who must concern every employee and organization in order to offer an opportunity of development and future performance for future generations.

Green Product: An eco-friendly product who does not affect consumers and environment.

Green Strategy: A planning activity and establishing objectives who are made to be safety and to satisfy stakeholders and environment.

This research was previously published in Driving Green Consumerism Through Strategic Sustainability Marketing edited by Farzana Quoquab, Ramayah Thurasamy, and Jihad Mohammad, pages 72-98, copyright year 2018 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 25
Green Marketing as a Tool for Reducing Environmental Footprint of the Construction Industry

Begum Sertyesilisik
Istanbul Technical University, Turkey

ABSTRACT

The world's habitat is being deteriorated in an accelerated way. Construction industry is one of the industries which affect the environment adversely due to its processes' and outputs' environmental footprint. Green marketing can play an important role in changing unsustainable production and consumption patterns in the construction industry and in enhancing its sustainability performance. For this reason, this chapter aims to introduce green marketing as a tool for reducing environmental footprint of the construction industry for establishment of the sustainable built environment. This chapter covers the following topics: need for reducing environmental footprint of the construction industry; need for and ways of as well as advantages of, potential drivers for and barriers against using green marketing as a tool for reducing environmental footprint of the construction industry.

INTRODUCTION

Environmental footprint of the construction industry is affected not only by its production processes (e.g. construction process, project management etc.) but also by its outputs (e.g. built environment). Even if the world's cities occupy 2% of the Earth's land, they cause 60-80% of total energy consumption and 75% of total carbon emissions (UN website, 2014). The construction industry has adverse impacts on: forests and trees, coral reefs, air quality, water, ozone, and the amount of land for agriculture (Dixon, 2010; Hawken, Lovins & Lovins, 1999; Hill & Bowen, 1997; Shen, Tam, Tam & Ji, 2010). Construction industry's activities are CO_2 emissions intensive (Gardezi, Shafiq, Zawawi, Khamidi, & Farhan, 2016, p. 292). Sinha, Lennartsson, & Frostell (2016, p. 162) emphasized the need for reducing construction

DOI: 10.4018/978-1-5225-7915-1.ch025

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

industry's environmental footprint and highlighted that buildings consume "40% of the total energy use, cause more than 1/3 of greenhouse gas emissions, 30% of raw materials use, 25% of water use, 12% of land use, and 25% of solid waste generation (Bribian, Uson, & Scarpellini, 2009; UNEP 2009a, 2009b)". Building material production phase influences construction industry's environmental footprint as well (Sim & Sim, 2017, p. 172). Yeo, Ng, & Song (2016, p. 135) emphasized the importance of materials' environmental footprint and embodied emissions of buildings underlining the fact that approximately 30 billion tons of materials are used in buildings annually (Rincon, 2011). Legislations encourage the construction industry to reduce its environmental footprint and the CO_2 emissions throughout the construction project management phases and outputs (e.g. built environment). Furthermore, the EU policies encourage the reduction in CO_2 emissions. Construction business development towards sustainable products/constructions and production/construction process is needed for creation of value for the nature and for the future generations. Changing unsustainable production and consumption patterns has been identified in the 2002 World Summit on Sustainable Development as one of the objectives of sustainable development (UN, 2002; Barber, 2007, p. 499). Sustainable society needs to rely on sustainable consumption as well as on sustainable production (Lorek & Spangenberg, 2014). Marketing can act as a change agent in the economic system (Polonsky, 2011, p. 1314), and it can play a key role in changing unsustainable production and consumption patterns. Green marketing has a great potential for acting as an effective tool for reducing construction industry's environmental footprint and for enhancing sustainability performance of the demand and supply sides in the construction industry. For this reason, this chapter aims to introduce green marketing as a tool for reducing environmental footprint of the construction industry for establishment of the sustainable built environment. Within the scope of this chapter green marketing's role in enhancing sustainability performance of the construction industry's demand side and supply side [e.g. contractors, subcontractors, and suppliers in the supply chain, as well as their construction project management processes, production and construction processes and outputs (e.g. built environment, materials)] has been investigated. This chapter covers the following topics: green marketing concept; green marketing and the construction industry's supply and demand sides; ways of enhancing effectiveness of the green marketing and integrating its principles into the construction project management phases; potential advantages of using green marketing in the construction industry.

BACKGROUND

Marketing enables the supply to meet the demand. "Marketing is a matching process, one that pairs the capabilities of a company and the wants of the customers. The creation and delivery of unique value to prospective customers and acquire a sustained competitive advantage is of prime importance in marketing" (Londhe, 2014, p. 335).

Green marketing concept is not new and its scope has been evolved throughout the years. It first emerged in the 1970s and it initially only targeted the socially and environmentally conscious customer segment focusing on the customers of the end product (Kicova & Kramarova, 2013; Majerova, 2015, p. 554;_Peattie, 1995; Rex and Baumann, 2007, p. 568; Sharma, Lyer, Mehrotra & Krishnan, 2010; Smirnova, Henneberg, Ashnai, Naude & Mouzas, 2011) and not on the customers in the supply chain (Liu, Kasturiratme & Moizer, 2012, p. 518). Following the 1980's environmental issues have been started to be given importance in the marketing strategy (Menon, 1997; Kumar, Rahman, Kazmi & Goyal, 2012, p. 485). The green marketing literature in the late 1980s and early 1990s (e.g. Margrath, 1992,

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

p. 31; Peattie, 1992; Peattie, 1995; Peattie, 2001; Simintiras, Schlegelmilch & Diamantopoulos, 1994, p. 415) focused mainly on the green market size and on the green consumer's profile revealing 'green market' potential (Rex & Baumann, 2007, p. 568). In the 1990s greening has been emphasised as a tool for enhancing competitiveness of the companies (e.g. Azzone & Bertele 1994; Elkington, 1994; Peattie & Charter 1992; Porter & van der Linde, 1995; Majerova, 2015, p. 554). Integrating sustainability criterion into marketing became an essential requirement in the business as the scope of the marketing concept has been expanded covering intra-personal, inter-personal and future generations' needs (Dam & Apeldoorn, 1996; Kumar et al., 2012, pp. 484-485) as well as various functions including but not limited to: supporting design of the product as well as service, selling, forecasting and communication (Cronin, Smith, Gleim, Ramirez & Martinez,, 2011; Siegel, Shim, & Walker, 2003; Smirnova, Henneberg, Ashnai, Naude, Mouzas, 2011; Liu et al., 2012, pp. 581-582). Furthermore, green marketing scope covers predicting and generating demand for environmentally-friendly products, as well as positioning them in the market to enhance competitive advantages of the companies (Sharma et al., 2010). Green marketing needs to be integrated with other business processes in the supply chain (Liu et al., 2012: 582). "Juwaheer, Pudaruth, and Noyaux (2012) recommended that effective green marketing strategy should be further developed on green branding, packaging, labelling and advertising to create demand for the green products" (Hasan & Ali, 2015, p. 465). For this reason, green marketing should not only target customers of the end product and but also the customers in the supply chain (customers of the production process).

Green marketing aims: to integrate environmental issues into the marketing efforts (Rex & Baumann, 2007, p. 568) and into strategic marketing processes (Chan, He, William & Wang, 2012, p. 558; Brindley & Oxborrow, 2014, p. 46); to contribute to the reduction of the environmental footprint (Chamorro & Bañegil, 2006; Hasan & Ali, 2015, p. 465); to create profit while fulfilling the social responsibility (Mourad & Ahmed, 2012; Hasan & Ali, 2015, p. 465); to create value for individuals and society, as well as for the environment (Polonsky, 2011, p. 1311); to facilitate the purchasing decision of the customer through providing them information about the green/sustainable properties of the products (Rex & Baumann, 2007, p.568). Furthermore, green marketing contributes to corporate image and to integrate environmentally-friendly activities with the business activities (Nadanyiova, Kicova, & Rypakova, 2015, p. 219). Green marketing can encourage the companies (i.e. suppliers, subcontractors etc.) in the construction supply chain to produce value for the nature and for the future generations. It can encourage the companies to develop their construction business enhancing their processes' and outputs' sustainability performance. Furthermore, green marketing can influence the customers' buying decision and it can encourage the customers to purchase environmentally-friendly products.

GREEN MARKETING AND THE SUPPLY SIDE OF THE CONSTRUCTION INDUSTRY

Supply side of the construction industry can be a change agent in the transformation of the construction industry into a more sustainable one and in the increasing of costumer awareness on environmental problems. Green marketing can be an effective tool for fulfilling construction companies' CSR (corporate social responsibility). CSR is "the responsibility of enterprises for their impacts on society (European Commission, 2011)" (Ubreziova et al., 2015, p. 543). "Building Responsible Competitiveness" project, which has been supported by the European Commission (2010), recommends contractors to follow the

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

4 main CSR fields, namely: health and safety, eco-compatibility, supply, and equal opportunities (Jiang & Wong, 2016, p. 850). Accordingly, following activities are among the CSRs: reducing environmental footprint of the construction industry, of the construction project management and of the outputs (e.g. materials, built environment) as well as enhancing environment and sustainability awareness of the customers and enabling them to make environment conscious choices facilitating their purchasing decision with the help of information provided on the sustainability performance of the product. This situation emphasises the importance of the green marketing and its potential role in the CSR and in reducing environmental footprint of the construction industry. Contractors and companies in the supply chain need to fulfil their CSR (Shen et al. 2010; Hill & Bowen, 1997) and reduce their adverse impacts to the environment. Enhancing sustainability performance of the supply chain requires the companies to establish a green supply chain management (GSCM). GSCM is integration of environmental thinking into supply chain management (SCM) (Srivastava, 2007, pp. 54-55). Green marketing and GSCM concepts cannot be considered separately (Cronin et al., 2011; Lamming & Hampson, 1996; Chan et al., 2012, pp. 558-559; Brindley & Oxborrow, 2014, p. 46) and they should be integrated with respect to product, promotion, planning, process, people, and project aspects so that green customers' needs are met and flows of resources (e.g. information, materials, and funds) are enabled (Liu et al. 2012; Liu et al., 2012, p. 581). In other words, green market intelligence, demand management, green product development and green supply chain processes need to be integrated (Sharma et al. 2010; Brindley & Oxborrow, 2014, p. 46). For this reason, companies need to understand the importance of integrating sustainability into their business practices (Kumar et al., 2012, p. 488) so that their green marketing strategies are aligned throughout their supply chain to enhance the supply chain's and companies' performances (Green, Whitten & Inman, 2012, p. 1008). Green marketing can foster green market development. Furthermore, contractors can request their supply chain partners to adhere to the international standards (e.g. ISO 26000: Guidance on Social Responsibility) and guidelines (e.g. Social Accountability 8000, Global Compact Initiative) (Jiang & Wong, 2016, p. 850) so that all partners in the supply chain comply with sustainability requirements to minimize their environmental footprint.

GREEN MARKETING AND THE DEMAND SIDE OF THE CONSTRUCTION INDUSTRY

Customers' purchasing decision influences the supply as companies need to consider characteristics of demand to survive in the competitive market. For this reason, the construction supply side needs to consider the factors influencing customers' purchasing decision when they define their green marketing strategy. Customers' decision on purchasing green products is influenced by: consumers' experiences in environment related problems (Ottman, 2003; Peattie, 2001; Rex & Baumann, 2007: 569; Soler 1995; Straughan, R.D. & Roberts, 1999) and consumers' concern for environmental degradation (Lin & Huang, 2012; Gonçalves, Lourenço & Silva 2016, p. 1485); the price and quality when they buy recycled products (Bei & Simpson, 1995; Gonçalves, et al. 2016, p. 1485); price (Finch, 2005; Gonçalves, et al. 2016, p. 1485); self-image improvement (Sweeney & Soutar, 2001; Finch, 2005; Gonçalves, et al. 2016, p. 1485) and perceived personal relevance (Majerova, 2015, p. 554); consumers' perception that they are preserving the environment when they buy recycled products (Bei & Simpson, 1995; Finch, 2005; Lin & Huang, 2012; Gonçalves, et al. 2016, p. 1485), the individual's belief that his or her efforts will make a difference (Ottman, 2003; Peattie, 2001; Soler, 1995; Rex & Baumann, 2007; Straughan

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

& Roberts, 1999) and the ability of the individual to make an effective contribution (Peattie & Charter, 1992; Majerova, 2015, p. 554). Factors influencing buying behaviour of the consumers for green products include: consumer values, demographic factors (Majerova, 2015, p. 554); preferences, dislikes, beliefs, attitudes and values, their position in the society, education and entourage; as well as their cognitive, affective and conative dimensions but in the same time, the psychographic characteristics (Stoica, Veghe & Orzan, 2015, pp. 923-924). Furthermore, functional, social, emotional, conditional, and epistemic values influence the buying behaviour of a customer (Sheth, Newman, & Gross, 1991) as well as of a green customer (Finch, 2005; Lin & Huang, 2012; Gonçalves, et al. 2016, p.1485).

Eco-information can influence consumers' green behaviour especially for frequently purchased, less-expensive goods (Siriwardena, Hunt, Teisl & Noblet, 2012, pp. 237-241) as customers' difficulty in identifying greener products (Tureac, Turtureanu, Bordean, Grigore, Modiga& Pripoie, 2010; Liu et al., 2012, p. 582) affects consumers' buying decision. Lai & Cheng (2016)'s research on the environmental attitudes and consumer behaviour of the undergraduate students in Hong Kong revealed effectiveness of eco-labelling and importance of emphasizing customers' contribution to the environment when they buy environmentally-friendly products. Customers' knowledge of environmental problems and alternative products can contribute to their purchasing decision (Majerova, 2015, p. 554). Furthermore, government can enhance customers' awareness of green consumption (Liu & Bai, 2014, p. 150) and environmental protection as well as their responsibilities for society (Deng & Huang, 2009; Liu et al., 2012: 582). Companies can influence customers buying decision through their ethical conduct (Mohanty, 2008; Ubreziova et al., 2015, p. 544) and corporate image (David, Kline & Dai, 2005; Kang & Yang, 2010; Keh & Xie, 2009; Lee, Hsu, Han & Kim, 2010; Miles & Covin, 2000; Ko, Hwang, & Kim, 2013, p.1711) as well as their green marketing strategy.

ENHANCING EFFECTIVENESS OF THE GREEN MARKETING

Companies operating in the construction industry need to design their marketing mix carefully to enhance the effectiveness of their green marketing strategy. "*Marketing mix … identifies the principal decision making managers make in configuring their offerings to suit consumers' needs*." (Londhe, 2014, p. 336). Marketing strategy's main aim is to enable the company to get competitive advantage (El-Ansary, 2006; Slater & Olson, 2001) and it is linked with the marketing mix of the company (Kumar et al., 2012, pp. 483-484). There are various marketing mix approaches, namely: 4P, 4C, 4V, 4S, and 5Ps+EE as briefly summarized below:

- **4P Approach:** It has been introduced by McCarty (1960). 4P stands for product, price, place, and promotion. It is known as the traditional marketing mix.
- **4C Approach:** It has been introduced by Peattie & Belz (2010) who have integrated 4P approach to the 4C approach to cover sustainability criterion in the marketing strategy (Kumar et al., 2012, p. 486).4C stands for customer solution, customer price, convenience, communication. 4C approach is known as sustainability marketing mix (Kumar et al., 2012, p. 487).
- **4V Approach:** 4V stands for 'value to customer', 'valued customer', 'value to the market', 'value to society' and it is based on the fact that all stakeholders in the marketing process are value focused (Londhe, 2014, p. 335) as quoted in the following sentences:

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The customer enters in the marketing process for better 'value' for his money through 'Value to Customer'. The marketers would like to concentrate on the 'valued customer'. The prime objective of any business is to sought value from the business 'value to the marketer'. The marketer and customer would like to keep society's interest intact through 'Value to society'. (Londhe, 2014, p. 335)

- **4S Approach:** 4S stands for scope, site, synergy and system and it is a web-marketing model describing web marketing strategy (Londhe, 2014, p. 336).
- **5Ps+EE Approach:** 5Ps+EE stand for planning, process, product, promotion, people, and eco-efficiency and this approach is called as the Green Strategy Mix and it has been introduced by Violeta & Gheorghe (2009) (Liu et al., 2012, p. 582).

Construction companies and suppliers can enhance their green marketing strategy benchmarking from the conventional marketing strategies. Based on their comparison of the green marketing to the conventional marketing, using Kotler et al. (2001)'s framework of the marketing strategy, Rex and Baumann (2007, pp. 573-574) recommend benchmarking from conventional marketing and rethinking green marketing so that companies' can gain competitive advantage (Rex & Baumann, 2007, pp. 573-574):

- Demand measurement should not focus on the market size only but also on the market needs and wants (Rex & Baumann, 2007, p. 573).
- Customer segmentation and targeting should not only focus on the green consumer but also on all consumers (Rex & Baumann, 2007, p. 574).
- Positioning should not only be carried out on product and eco-label but also on place, price, and promotion (Rex & Baumann, 2007, p. 574).

Companies in the construction industry can support their green marketing strategy with the help of the new technologies. For example, as Lee & Huang (2011, p. 9696) emphasised, recommender systems as an important technology for electronic commerce (Bose, 2009; Kauffman & Walden, 2001) can filter for online shoppers the information so that the customers do not encounter the information overload problem (Chen, Shang, & Kao, 2009). This technology can be useful especially in green marketing of environmentally-friendly construction materials. New technologies can be effective tools for green marketing in case the targeted customer segment is young. Jayaram, Manrai & Manrai, (2015, p. 119)'s research revealed that new technologies can enhance green marketing especially for the young customers' segment in emerging markets.

Organizational culture of the companies can enhance their green marketing strategy's performance. Construction companies and their partners in the supply chain as well as their employees need to share the same vision and culture with respect to their sustainability performance. In this way, all employees and workers can be conscious about their contribution to the sustainability performance of the construction project management and of the construction industry's outputs. They need to be aware of the fact that they do not only create value for the customer but also for the nature and for the future generations. Furthermore, they need to accept the nature and future generations as their stakeholders and consider their potential needs, and demands throughout their activities. They need to influence their customers' perception accordingly.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

POTENTIAL DRIVERS FOR AND ADVANTAGES OF USING GREEN MARKETING IN THE CONSTRUCTION INDUSTRY

Using green marketing as a tool for reducing environmental footprint of the construction industry can provide advantages to the companies. These advantages can act as potential drivers for widespread use of the green marketing in the construction industry. Contractors' competitiveness depends not only on achieving the construction projects' targets with respect to time, budget, and quality but also on aligning with societies' expectations and on enhancing their socially responsible image (Jiang & Wong, 2016, p. 851) which can be supported by green marketing. Companies' green marketing strategies and efforts for reducing environmental footprint can provide them various advantages, including: enhanced competitive advantage as well as corporate image and corporate brand image; increased profit margin; fostered green innovation; compliance with environmental legislations and regulations; fulfilled CSR; and enhanced customer awareness on environmental problems and their potential impact on reducing environmental footprint of the construction industry. These potential advantages can be briefly explained as follows:

- **Human Resources:** CSR can help the companies to attract and retain qualified employees (Luo & Bhattacharya, 2006; Pirsch et al., 2007; Piercy & Lane, 2009; Peloza & Shang, 2011; Lii & Lee, 2012). Human resources are key competitive advantage of a company as they cannot be imitated by its competitors. Furthermore, motivated and committed employees' productivity can be high.
- **Value to the Customer and Increased Profit Margin:** Green marketing can support companies' profitability (Lee & Huang, 2011, p. 9696). "Sustainability marketing strategy results in added value to customer…" (Kumar et al., 2012, p. 486). Green business strategy can enhance companies' sustainable growth (Dangelico & Pujari, 2010, Hasan & Ali, 2015, p. 464). Furthermore, as Gadeikiene and Banyte (2015, p. 703) state, CSR can provide long-term financial return due to benefits provided to the society (Sen & Bhattacharya, 2009, Piercy & Lane, 2009) as "…ethical conduct can influence customers' purchasing decisions (Mohanty, 2008)" (Ubreziova et al., 2015, p. 544). Green marketing can contribute to the customer's awareness of environmental problems and of their potential impact on reducing environmental footprint of the construction industry. Parsa, Lord, Putrevu & Kreeger, (2015)'s research provide a case study on the green marketing's effect on price premium. Parsa et al. (2015, p. 250)'s study on investigation into the relationship between consumer awareness of and response toward socially and environmentally responsible practices in the hospitality industry, revealed consumers' willingness to pay a little bit more for CSR (Parsa et al., 2015, p.250). Furthermore, increased profitability (Richey, Musgrove, Gillison & Gabler, 2014, p.1247) and enhanced financial performance (Menon, 1997) can be observed as green marketing strategies contribute to companies' performance (Richey et al., 2014, p. 1247) and as enhanced environmental performance and CSR can contribute to the Return on Assets and Return on Equity (Angelia & Suryaningsih, 2015, p. 348). Fuerst and Shimizu (2016)'s research provide a case study on the green marketing's effect on profitability. Fuerst and Shimizu (2016, p. 108)'s research on price premium impact of eco-labelled buildings in Tokyo revealed that eco-labelled buildings enable higher price premiums compared to non-labelled buildings and that the higher price premiums emerge due to capitalised utility bill savings and intangible benefits of living in a green building.
- **Compliance With Legislations and Regulations:** The public and governments' concerns about environmental problems are increasing (Lee & Huang, 2011, p. 9696). Legislation and EU targets

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

require the companies to enhance sustainability performance of their production processes and outputs. Compliance with the legislation and dealing with possible changes in the environmental laws and regulations as well as directives for reducing the environmental footprint and accounting system (i.e. environmental footprint taxes, calculating the nature's input's cost) can enhance sustainability of the construction companies. The possible changes in the future (i.e. green accounting system, environmental footprint taxes, calculating the nature's input's cost) can act as possible opportunities or threats for construction companies. These possible changes can also encourage the construction companies to transform their outputs and their construction processes into sustainable and regenerative ones for which they can get benefit from effective and efficient green marketing.

- **Getting Benefit From Potential Subsidies and Incentives:** Government can provide institutional incentives to companies (e.g. subsidies, tax, credits, and investments in research and development on green products) (Smirnova et al., 2011, Liu et al., 2012, p.582) to encourage them to enhance their sustainability performance. Furthermore, policy makers can establish regulations and incentives to encourage companies to contribute to the CE (circular economy)'s stricter regulatory market mechanism (Liu & Bai, 2014, p. 150) which supports closing-the-loop production patterns (Ghisellini, Cialani & Ulgiati, 2016, p. 11), and enables not wasting the waste (George, Lin & Chen, 2015, p. 63) as the waste from a factory can be input into other processes (Preston, 2012; Liu & Bai, 2014, p. 145) in other companies. Green marketing can enhance companies' and consumers' awareness of sustainability, CE's success and efficiency as CE requires the adoption of cleaner production patterns at company level, as well as increase in the responsibility and awareness of suppliers and consumers (Ghisellini, et al., 2016, p. 11).
- **Enhanced Corporate Image and Corporate Brand:** Green marketing can enhance corporate image and corporate's brand image as it can influence the way the customers perceive the construction company and its brand. Ko et al. (2013, p. 1710)'s research emphasises that "… socially responsible programs influence consumers' attributions of corporate image, and in turn corporate outcome (Berens, van Riel, & van Bruggen, 2005; Ellen, Webb, & Mohr, 2006)…" and that Environics International CSR Monitor identified CSR as the most important factor influencing consumer awareness of corporate image (Ko et al., 2013, p. 1710). CSR leads to enhanced corporate brand image (Gonzalez-Rodriguez, Diaz-Fernandez & Simonetti, 2015, p. 836) as well as to strong long-term relationships between company and consumer (Gadeikiene & Banyte, 2015, p. 702). Green marketing, as a socially responsible effort and as a CSR, can contribute to corporate image addressing societies' needs (Ko et al., 2013, p. 1710).
- **Fostered Green Innovation:** Sustainability in marketing strategy fosters innovation (Whiting, 2008; Kumar et al., 2012, p. 487). Green innovation can contribute to the companies' performance (Hasan & Ali, 2015, p. 463). Innovation can start based on the feedback from the customers. For this reason, innovation and green marketing are interrelated. Furthermore, green marketing strategy of an environmentally-friendly product (innovation) requires effective introduction of the new product to the market. While companies introduce new products to the market, companies need to decide whether to launch a new brand (considering the potential of the new green brand for becoming a benchmark for the market) or to launch the product under the existing brand (considering the potential limitation of using the existing brand for non-green products as it can remind the non-green version) (Aaker & Keller, 1990; Majid & Russell, 2015, p. 994).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

All drivers for and advantages of using green marketing as a tool for enhancing sustainability performance of the companies reveal green marketing's impact on the competitiveness of the companies. Green marketing can support companies' competitiveness (Lee & Huang, 2011, p. 9696) and enhance their sustainable competitive advantage (Nadanyiova et al., 2015, p. 226).

SOLUTIONS AND RECOMMENDATIONS

Construction companies and their partners in the supply chain need to integrate green marketing principles and adapt suitable combination of marketing mixes into their construction project management phases (e.g. pre-construction, construction, and post-construction phases) as suggested in the following paragraphs:

- **Pre-Construction Phase:** Pre-construction phase mainly consists of feasibility, design, and contract phases.
- **Feasibility Phase:** In the feasibility phase, the contractor needs to ensure that the project is feasible considering the 'product', 'people', 'place', 'planning', 'process', 'eco-efficiency', 'price' and 'customer price', 'value to customer', 'valued customer', 'value to the market', and 'value to society' constructs. The 'product' which fulfils the 'eco-efficiency' requirements and which can result in creation of 'value to customer', 'value to market' and 'value to society' needs to match with the 'customer price'.
- **Design Phase:** In the design phase, the interdisciplinary design team needs to consider and integrate the 'product', 'people', 'place', 'planning', 'process', 'eco-efficiency', 'value to customer', 'value to the market', 'value to society', 'price', 'customer price' and 'customer solution' constructs into the design. In the design phase, the design team needs to understand what the customer demands and concentrate on how to create 'value to customer', and 'value to society'. As society is stakeholder of the output (e.g. construction), as they will be effected by the construction in their vicinity, it is vital for the design team to consider expectations of the society and to create value for the society. Design team needs to understand what the customer values for and the 'customer solution' so that the design quality meets the customers' expectations. Furthermore, the design team need to concentrate on how to enhance 'eco-efficiency' of the output (e.g. construction) considering the production/construction phase covering 'planning', 'place', 'process', as well as 'value to the market'. They need to consider how to match the 'customer price', the 'value to customer' and the construction 'price' ensuring that the cost does not exceed the 'value created to customer'.
- **Contract Phase:** Construction contract acts like a marketing channel as it is how the contractor (the supply side) meets the customer (the demand side). Construction contract needs to cover the work scope, and contracting parties' rights and obligations. In other words, construction contracts needs to address the 'product', 'people', 'place', 'planning', 'process', 'eco-efficiency', 'value to customer', 'value to the market', 'value to society', 'price' and 'customer price' and 'customer solution' constructs of the marketing. They need to define the 'product' construct with the help of the specifications or Employer's requirements and 'customer solution'. They need to define the financial aspects (e.g. the 'price' construct) and the 'process' construct covering the 'planning' construct as well as contractors' obligations in the construction phase (e.g. site waste management

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

to enhance the 'eco-efficiency' construct). Contractor needs to ensure that all contracting-tiers are coherent and comply with each other so that suppliers and subcontractors in all contracting-tiers in the supply chain comply with the main contract's requirements.

- **Construction Phase:** Throughout the construction phase, companies in the supply chain need to perform in a lean and sustainable way. Adherence to the lean and sustainability principles in the construction phase (including mobilization, site management, and site waste management) can lead to focus on value creation (including 'value to customer', 'value to the market', 'value to society'), on directing the efforts and resources for the accomplishment of the 'product' with the help of efficient and effective 'processes' and to accomplish the construction on time and within the budget achieving profit at the contract 'price'/'customer price'. 'Eco-efficiency' of the construction process can be enhanced with the help of effective control to reduce/minimize the need for rework, and taking remedy actions upon deviation from the quality as determined in the contract. Site management influences the sustainability performance of the construction process. Site needs to be planned considering the construction process (the 'process' construct) enabling reduction or minimization of waste from lean and sustainability management point of views. Site waste management enables the debris to be sorted and sold to skip disposal companies. It contributes to the cleanness of the site and enhances sustainability performance (with the help of enabling the recycling or reuse of waste) as well as health and safety performance. Furthermore, it contributes to smooth flow of the construction process and to reduce the construction costs (through payment received from the debris). Site waste management is a tool for complying with 'eco-efficiency' construct.
- **Post-Construction Phase:** In the demobilization phase, the adverse impacts of the construction site to its vicinity need to be remedied complying with the 'create value to society' construct. In the post-construction phase, construction companies aiming to differentiate themselves from their competitors can provide repair and maintenance services. Efficiently operating constructions necessitate regular repair and maintenance. Efficiency in the operation phase of the constructions can contribute to the 'eco-efficiency' resulting in 'value to customer' and 'value to society' due to reduced environmental footprint. Furthermore, it can result in high customer satisfaction due to reduced operation costs complying with the 'customer price' construct. Customers' feedback need to be received upon completion of the construction. Furthermore, the companies in the supply chain need to analyse the lessons learned and problems emerged in the construction process. Customers' feedback and 'lessons learned' can contribute to the improvement of the 'process' which can lead to enhanced customer satisfaction, and enhanced 'eco-efficiency' due to reduced need for rework.

Construction material suppliers in the supply chain need to integrate green marketing into their manufacturing process and they need to adopt effective combination of marketing mixes into their pre-manufacturing, manufacturing, and post-manufacturing processes and activities to enhance the success of the green marketing. In the pre-manufacturing phase, the suppliers are recommended to carry out the design of the 'product' considering creation of value to customer, the market, and society. The design should be based on the production process requirement and availability of local materials suitable for the product (e.g. decrease in embodied CO_2 and costs). It should enable usage of recycled materials, reused materials or eco-labelled materials. In the manufacturing phase, process should rely on the lean

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

and sustainability principles. It should target zero waste both from lean and sustainability perspectives. Manufacturing process should support the CE. Companies/suppliers can try to collaborate with companies interested in their waste as they can use their wastes as input. Furthermore, companies/suppliers can try to collaborate with companies whose wastes can be input for their manufacturing process. In this way, manufacturing process can support closed loop material cycle creating value to society and enhancing 'eco-efficiency' of the 'process'. Innovation in design as well as in production techniques, and methods should be encouraged to enhance sustainability and lean performance of the product (e.g. dematerialization) and of the production process (e.g. accelerated production process, reduced waste, increased value). Innovation should be value focused and based on customer feedback wherever it is possible. In the post-manufacturing phase, as the product needs to meet the targeted customer segment, effective marketing channel needs to be considered. New technologies and 4S for the web-based marketing can be useful as well. Suppliers can provide post-manufacturing services (e.g. repair and maintenance) in order to differentiate themselves from their competitors. Customer feedback needs to be received as it can provide insights on 'customer solution', 'value', and changes needed in the product etc.

Construction companies, their subcontractors and suppliers in the supply chain need to consider the following items when they establish their green marketing strategy:

- Green marketing in the construction industry can be enhanced with the help of new technologies.
- Value to customer can be achieved with the help of integrating customer into the design process.
- Green marketing usage needs to be widespread to reduce construction industry's environmental footprint as construction industry is among the industries having adverse impact to the nature. For this reason, green marketing requirements need to be considered in establishing marketing strategies.
- Green marketing can be achieved through trainings and providing consultancy.
- Construction companies can establish a common platform where the companies can share their experiences in green marketing and where others can learn from them. The companies experiencing advantages of green marketing can be motivated in green marketing and can encourage other companies who can benchmark from them.
- Green marketing culture should be shaped and shared by all companies in the construction supply chain.
- Green marketing considerations and its requirements need to be integrated throughout the pre-construction, construction, and post-construction phases as well as throughout the pre-manufacturing, manufacturing, and post-manufacturing phases.
- Companies in the green/sustainable supply chain need to recognize the trend that green/sustainable building certificates as well as green/sustainable products increasingly act as a tool for green marketing.
- Communication with the customers and their feedback are valuable inputs into the innovation process. Innovation process needs to create value for customer, society, and future generations. Green marketing needs to support innovation in construction processes (e.g. specific labels/certificates for environmentally-friendly site management), construction materials and in design of construction (e.g. considering potential future needs of the customers throughout the construction's lifecycle (changing climate conditions; adaptable constructions to the customers' current and expected needs due to the changing climatic conditions).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- The customers need to be convinced with respect to the value created in a way that they perceive the price lower than the value created. In a free market, price is freely determined in the equilibrium point where the supply and demand curves intersect. Wishes need to be supported by purchasing power so that demand emerges. Reducing the cost through increased efficiency and effectiveness as well as dematerialization can lead to increased profit margin even if the price is kept constant. Elasticity of demand, availability of substitutes and need for complementary goods/products/outputs need to be considered in the pricing strategy. "Green marketing considerations will be low when cost considerations overwhelm green credentials (high competitive advantage, low sustainability advantage)" (Sharma & Iyer, 2012, p. 606). Furthermore, the companies need to consider the investment return rate of the customers' investment. For example, the customers consider the investment return rate of their investment in their decision on whether or not to replace their lighting equipments with sustainable ones. Similarly, they will consider the investment return rate for their investments in insulations or in sustainable buildings. The customers, if they think that they will not live in the building for 20 or 25 years, might tend not to invest in a sustainable building due to its high initial investment cost which can be returned in years. Targeted customer segment's position in the Maslow's hierarchy of needs can influence the price premium and the elasticity of demand for the product as well.
- Green marketing mottos and messages can attract current and potential green customers. Mottos need to be carefully determined considering companies' image, its outputs' green or sustainable properties as well as targeted customer segments, their priorities, characteristics, culture, and their interests. The 'people' construct requires determination of the customer segment accurately. The 'people' construct and the 'communication' construct are interrelated and they need to be covered in the promotion related marketing strategy decisions. 'People' construct will influence company's communication with their customers, the marketing mottos used and the marketing channels preferred. Especially the young customers segment can prefer to be communicated via new technologies such as web marketing strategy where the companies need to consider 4S approach and its requirements. 4S approach can be effective in the construction industry especially for suppliers and in case of purchasing from them. It has great potential to be used by material suppliers in the construction industry.

FUTURE RESEARCH DIRECTIONS

Green marketing is expected to widespread in the construction industry especially with the help of increased customer awareness on the importance of environmentally-friendly built environment. To foster the widespread use of green marketing, future researches are recommended to be carried out on case studies on the changes in the companies' performances (with respect to environmental footprint, financial performances, quality achievement, competitiveness, price premium, profit, corporate image, corporate social responsibility, innovation level, value created) compared to their performances before green marketing adaptation. Furthermore, future research is recommended to be carried out on how to increase the green market size in the construction industry.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

ANALYSIS

The world's living conditions deteriorate faster than the world can regenerate itself. Environmental footprint of the production and consumption need to be reduced. Effective green marketing plays an important role in transforming production and consumption patterns into sustainable ones. Among the industries construction industry has one of the biggest environmental footprints. Construction industry affects the deterioration of the world's habitat due to its production/construction processes and the built environment. For this reason, enhancing sustainability performance of the construction industry is a must for the sustainability of the world and regeneration of the nature. Green marketing's potential role in enhancing sustainability performance of the supply and demand sides of the construction industry can contribute to the recovery of the world's habitat. Effective green marketing can enhance customers' awareness of environmental problems and influence the characteristics of their demand side for more environmentally-friendly production/construction processes and outputs (e.g. sustainable building materials, sustainable built environment etc.). This change in the demand side can influence and motivate the supply side for enhancing the sustainability performance of their production/construction processes and their outputs. In other words, the demand side can influence the supply side. Similarly, the supply side can influence the demand side with the help of green marketing as the demand side can be equipped with the eco-information of the outputs/products and their potential contribution to the solution of the environmental problems with the help of their environmentally-friendly purchasing decisions. Furthermore, green marketing can help the customers to understand CSR actions of the companies in the construction industry and to take their purchasing decision accordingly.

Companies can be motivated for enhancing their sustainability performance and green marketing upon their experience of potential advantages of green marketing. Green marketing is not only a potential way of fulfilling their CSR and enhancing their corporates' images and brands, it can also contribute to the survival of the companies in the highly competitive construction industry. Their competitiveness depends on achieving project targets, and sustainability targets as well as on increasing their profit margin while creating value to the customer. Green marketing should be part of the strategic management as sustainable built environment and sustainable building material markets have the potential for growing further with the help of green marketing. Companies need to keep scanning the sustainable business environment for potential opportunities and threats so that they can adapt themselves to the changes in the business conditions, and in the green market as opportunities do not last forever, and as the threats might have potentials for being converted into opportunities. Potential failure of the companies in adapting green marketing strategy can act as a thread and it can lead to the shrinkage of their market. For this reason, they need to pay attention to the establishment of the effective green marketing strategy through benchmarking from the conventional marketing strategies as well as through adaptation of new technologies (e.g. recommender system) and effective green marketing mix (considering 4P, 4C, 4V, 4S, 5Ps+EE approaches). Integration of green marketing, environmentally-friendly working culture and organizational culture into the construction/production processes and into the entire supply chain can support the effectiveness and success of the green marketing. Green marketing concept and sustainability principles should be adapted to the entire supply chain, as companies in the supply chain are customers in the production/construction process and as they can affect the sustainability performance of the production/construction process and of the output.

Political, economic, and educational supports are important for enhancing effectiveness of the green marketing and reducing environmental footprint of the construction industry. Political and educational

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

supports can enhance potential customers' awareness of and consciousness of environmental issues. Policies need to support formal and informal education (e.g. festivals, university education, courses, fairs etc.) on environmental problems, and potential role of the customers in transforming consumption and production patterns into sustainable ones. Policies can also encourage companies in the construction industry for transforming their production/construction processes and outputs into sustainable ones and for investing in research and development for green innovation via economic supports such as incentives and subsidies. Furthermore, as there is need for enhancing sustainability performance of the construction industry throughout the world, policies can encourage international collaboration.

CONCLUSION

This chapter aimed to introduce green marketing as a tool for reducing environmental footprint of the construction industry for establishment of the sustainable built environment. Green marketing can encourage customers to act as change agents for sustainability. Green marketing can influence customers' perception and understanding of the climate change as well as of the importance of the sustainable consumption and production. Furthermore, it can influence customers' understanding of their potential contribution to the sustainability of the nature by purchasing environmentally-friendly products. Green marketing can foster sustainable production as increase in the demand for environmentally-friendly products can encourage the companies in the supply chain to reduce their environmental footprint throughout their production/construction process as well as in their output (e.g. construction materials, constructions).

Construction companies and suppliers can get following potential advantages of integrating green marketing into the construction supply chain: enhanced competitiveness, increased profit margin, attracting competent employees; fostered green innovation; compliance with environmental laws and regulations; enhanced corporate image and corporate brand; creation of more value for customers, and nature.

Companies in the construction supply chain can encounter potential barriers while transforming their business into a more environmentally-friendly one and while adopting the green marketing into their marketing strategy and integrating it throughout their production/construction process. These barriers might be related with the need for increasing customers' awareness of the possibility that they can contribute to the sustainability of the environment in case they purchase environmentally-friendly products/constructions. Furthermore, customers might be reluctant in replacing their equipments with environmentally-friendly ones, or in investing in sustainable constructions/construction materials due to their relatively high initial investment cost. Companies can also encounter difficulties in establishing environmentally-friendly working culture in their supply chain.

Companies in the construction industry can enhance their green marketing's effectiveness through:

- Establishment of the green marketing mix effectively.
- Establishment of the green marketing strategy benchmarking from the conventional marketing strategies.
- Adaptation of new technologies which can support the effectiveness of green marketing.
- Integration of green marketing into the construction as well as into the manufacturing processes and outputs.
- Establishment of environmentally-friendly working culture throughout the supply chain.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

REFERENCES

Angelia, D., & Suryaningsih, R. (2015). The Effect of Environmental Performance And Corporate Social Responsibility Disclosure Towards Financial Performance (Case Study to Manufacture, Infrastructure, And Service Companies That Listed At Indonesia Stock Exchange). *Procedia: Social and Behavioral Sciences*, *211*, 348–355. doi:10.1016/j.sbspro.2015.11.045

Azzone, G., & Bertele, U. (1994). Exploiting Green Strategies for Competitive Advantage. *Long Range Planning*, *27*(6), 69–81. doi:10.1016/0024-6301(94)90165-1

Barber, J. (2007). Mapping the movement to achieve sustainable production and consumption in North America. *Journal of Cleaner Production*, *15*(6), 499–512. doi:10.1016/j.jclepro.2006.05.010

Bei, L., & Simpson, E. (1995). The determinants of consumers purchase decisions for recycled products: An application of acquisition-transaction utility theory. *Advances in Consumer Research. Association for Consumer Research (U. S.)*, *22*(1), 257–261.

Berens, G., van Riel, C. B. M., & van Bruggen, G. H. (2005). Corporate associations and consumer product responses: The moderating role of corporate brand dominance. *Journal of Marketing*, *69*(3), 35–48. doi:10.1509/jmkg.69.3.35.66357

Bose, R. (2009). Advanced analytics: Opportunities and challenges. *Industrial Management & Data Systems*, *109*(2), 155–172. doi:10.1108/02635570910930073

Bribian, I. Z., Uson, A. A., & Scarpellini, S. (2009). Life cycle assessment in buildings: State-of- the-art and simplified LCA methodology as a complement for building certification. *Building and Environment*, *44*(12), 2510–2520. doi:10.1016/j.buildenv.2009.05.001

Brindley, C., & Oxborrow, L. (2014). Aligning the sustainable supply chain to green marketing needs: A case study. *Industrial Marketing Management*, *43*(1), 45–55. doi:10.1016/j.indmarman.2013.08.003

Chamorro, A., & Bañegil, T. M. (2006). Green Marketing Philosophy: A Study of Spanish Firms with Ecolabels. *Corporate Social Responsibility and Environmental Management*, *13*(1), 11–24. doi:10.1002/csr.83

Chan, H. K., He, H., William, Y. C., & Wang, W. Y. C. (2012). Green marketing and its impact on supply chain management in industrial markets. *Industrial Marketing Management*, *41*(4), 557–562. doi:10.1016/j.indmarman.2012.04.002

Chen, Y. C., Shang, R. A., & Kao, C. Y. (2009). The effects of information overload on consumers subjective state towards buying decision in the internet shopping environment. *Electronic Commerce Research and Applications*, *8*(1), 48–58. doi:10.1016/j.elerap.2008.09.001

Cronin, J. J., Smith, J. S., Gleim, M. R., Ramirez, E., & Martinez, J. D. (2011). Green marketing strategies: An examination of stakeholders and the opportunities they present. *Journal of the Academy of Marketing Science*, *39*(1), 158–174. doi:10.100711747-010-0227-0

Dam, K. Y., & Apeldoorn, P. A. C. (1996). Sustainable Marketing. *Journal of Macromarketing*, *16*(2), 45–56. doi:10.1177/027614679601600204

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Dangelico, R. M., & Pujari, D. (2010). Mainstreaming Green Product Innovation: Why and How Companies Integrate Environmental Sustainability. *Journal of Business Ethics*, *95*(3), 471–486. doi:10.100710551-010-0434-0

David, P., Kline, S., & Dai, Y. (2005). Corporate social responsibility practices, corporate identity, and purchase intention: A dual-process model. *Journal of Public Relations Research*, *17*(3), 291–313. doi:10.12071532754xjprr1703_4

Deng, D., & Huang, Q. (2009). On the leading role of government based on the externality of green marketing. *Proceedings of the 2009 International Conference on Public Economics and Management*, 110–115.

Dixon, W. (2010). *The Impacts of Construction and the Built Environment*. Retrieved on May 29, 2016 from www. willmottdixon.co.uk/asset/download/9462

El-Ansary, A. I. (2006). Marketing strategy: Taxonomy and frameworks. *European Business Review*, *18*(4), 266–293. doi:10.1108/09555340610677499

Elkington, J. (1994). Toward the sustainable corporation: Win-win-win business strategies for sustainable development. *California Management Review*, *36*(2), 90–100. doi:10.2307/41165746

Ellen, P. S., Webb, D. J., & Mohr, L. A. (2006). Building corporate associations: Consumer attributions for corporate socially responsible programs. *Journal of the Academy of Marketing Science*, *34*(2), 147–157. doi:10.1177/0092070305284976

Environics International CSR Monitor. (n.d.). *Corporate Social Responsibility Monitor* Retrieved on May 29, 2016 from https://www.iisd.org/business/issues/sr_csrm.aspx

Finch, J. E. (2005). The impact of personal consumption values and beliefs on organic food purchase behavior. *Journal of Food Products Marketing*, *11*(4), 63–76. doi:10.1300/J038v11n04_05

Fuerst, F., & Shimizu, C. (2016). Green luxury goods? The economics of eco-labels in the Japanese housing market. *Journal of the Japanese and International Economies*, *39*, 108–122. doi:10.1016/j.jjie.2016.01.003

Gadeikiene, A., & Banyte, J. (2015). Discourse on corporate social responsibility in the context of marketing scientific research. 20th International Scientific Conference Economics and Management - 2015 (ICEM-2015). *Procedia: Social and Behavioral Sciences*, *213*, 702–708.

Gardezi, S. S. S., Shafiq, N., Zawawi, N. A. W. A., Khamidi, M. F., & Farhan, S. A. (2016). A multivariable regression tool for embodied carbon footprint prediction in housing habitat. *Habitat International*, *53*, 292–300. doi:10.1016/j.habitatint.2015.11.005

George, D. A. R., Lin, B. C., & Chen, Y. (2015). A circular economy model of economic growth. *Environmental Modelling & Software*, *73*, 60–63. doi:10.1016/j.envsoft.2015.06.014

Ghisellini, P., Cialani, C., & Ulgiati, S. (2016). A review on circular economy: The expected transition to a balanced interplay of environmental and economic systems. *Journal of Cleaner Production*, *114*, 11–32. doi:10.1016/j.jclepro.2015.09.007

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Gonçalves, H. M., Lourenço, T. F., & Silva, G. M. (2016). Green buying behavior and the theory of consumption values: A fuzzy-set approach. *Journal of Business Research*, *69*(4), 1484–1491. doi:10.1016/j.jbusres.2015.10.129

Gonzalez-Rodriguez, M. R., Diaz-Fernandez, M. C., & Simonetti, B. (2015). The social, economic and environmental dimensions of corporate social responsibility: The role played by consumers and potential entrepreneurs. *International Business Review*, *24*(5), 836–848. doi:10.1016/j.ibusrev.2015.03.002

Green, K. W. Jr, Whitten, D., & Inman, R. A. (2012). Aligning marketing strategies throughout the supply chain to enhance performance. *Industrial Marketing Management*, *41*(6), 1008–1018. doi:10.1016/j.indmarman.2012.02.003

Hasan, Z., & Ali, N. A. (2015). The impact of green marketing strategy on the firms performance in Malaysia. Global Conference on Business & Social Science-2014, GCBSS-2014, 15th & 16th December Kuala Lumpur. *Procedia: Social and Behavioral Sciences*, *172*, 463–470. doi:10.1016/j.sbspro.2015.01.382

Hawken, P., Lovins, E., & Lovins, H. (1999). *Natural, Capitalism - Creating the Next Industrial Revolution*. Snowmass, CO: Rocky Mountain Institute.

Hill, R. C., & Bowen, P. A. (1997). Sustainable construction: Principles and a framework for attainment. *Construction Management and Economics*, *15*(3), 223–239. doi:10.1080/014461997372971

Jayaram, D., Manrai, A. K., & Manrai, L. A. (2015). Effective use of marketing technology in Eastern Europe: Web analytics, social media, customer analytics, digital campaigns and mobile applications. *Journal of Economics. Finance and Administrative Science*, *20*(39), 118–132. doi:10.1016/j.jefas.2015.07.001

Jiang, W., & Wong, J. K. W. (2016). Key activity areas of corporate social responsibility (CSR) in the construction industry: A study of China. *Journal of Cleaner Production*, *113*, 850–860. doi:10.1016/j.jclepro.2015.10.093

Juwaheer, T. D., Pudaruth, S., & Noyaux, M. M. E. (2012). Analysing the impact of green marketing strategies on consumer purchasing patterns in Mauritius. *World Journal of Entrepreneurship. Management and Sustainable Development*, *8*(1), 36–59.

Kang, M., & Yang, S. U. (2010). Comparing effects of country reputation and the overall corporate reputations of a country on international consumers product attitudes and purchase intentions. *Corporate Reputation Review*, *13*(1), 52–62. doi:10.1057/crr.2010.1

Kauffman, R. J., & Walden, E. A. (2001). Economics and electronic commerce: Survey and directions for research. *International Journal of Electronic Commerce*, *5*(4), 5–116.

Keh, H. T., & Xie, Y. (2009). Corporate reputation and customer behavioral intentions: The roles of trust, identification and commitment. *Industrial Marketing Management*, *38*(7), 732–742. doi:10.1016/j.indmarman.2008.02.005

Kicova, E. & Kramarova, K. (2013). The significance and importance of the brand for the enterprise. *Grant Journal, 2*, 29-34.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Ko, E., Hwang, Y. K., & Kim, E. Y. (2013). Green marketing functions in building corporate image in the retail setting. *Journal of Business Research*, *66*(10), 1709–1715. doi:10.1016/j.jbusres.2012.11.007

Kotler, P., Armstrong, G., Saunders, J., & Wong, V. (2001). *Principles of marketing* (3rd European ed.). Harlow, UK: Prentice Hall.

Kumar, V., Rahman, Z., Kazmi, A. A., & Goyal, P. (2012). Evolution of sustainability as marketing strategy: Beginning of new era. International Conference on Emerging Economies - Prospects and Challenges (ICEE-2012). *Procedia: Social and Behavioral Sciences*, *37*, 482–489. doi:10.1016/j.sbspro.2012.03.313

Lai, C. K. M., & Cheng, E. W. L. (2016). Green purchase behavior of undergraduate students in Hong Kong. *The Social Science Journal*, *53*(1), 67–76. doi:10.1016/j.soscij.2015.11.003

Lamming, R., & Hampson, J. (1996). The Environment as a Supply Chain Management Issue. *British Journal of Management*, *7*(s1), S45–S62. doi:10.1111/j.1467-8551.1996.tb00147.x

Lee, J. S., Hsu, L. T., Han, H., & Kim, Y. (2010). Understanding how consumers view green hotels: How a hotels green image can influence behavioral intentions. *Journal of Sustainable Tourism*, *18*(7), 901–914. doi:10.1080/09669581003777747

Lee, Y. L., & Huang, F. H. (2011). Recommender system architecture for adaptive green marketing. *Expert Systems with Applications*, *38*(8), 9696–9703. doi:10.1016/j.eswa.2011.01.164

Lii, Y. S., & Lee, M. (2012). Doing Right Leads to Doing Well: When the Type of CSR and Reputation Interact to Affect Consumer Evaluations of the Firm. *Journal of Business Ethics*, *105*(1), 69–81. doi:10.100710551-011-0948-0

Lin, P., & Huang, Y. (2012). The influence factors on choice behavior regarding green products based on the theory of consumption values. *Journal of Cleaner Production*, *22*(1), 11–18. doi:10.1016/j.jclepro.2011.10.002

Liu, S., Kasturiratme, D., & Moizer, J. (2012). A hub-and-spoke model for multi-dimensional integration of green marketing and sustainable supply chain management. *Industrial Marketing Management*, *41*(4), 581–588. doi:10.1016/j.indmarman.2012.04.005

Liu, Y., & Bai, Y. (2014). An exploration of firms awareness and behavior of developing circular economy: An empirical research in China. *Resources, Conservation and Recycling*, *87*, 145–152. doi:10.1016/j.resconrec.2014.04.002

Londhe, B. R. (2014). Marketing Mix for Next Generation Marketing. Symbiosis Institute of Management Studies Annual Research Conference (SIMSARC13). *Procedia Economics and Finance,* 11, 335–340. 10.1016/S2212-5671(14)00201-9

Luo, X., & Bhattacharya, C. B. (2006). Corporate Social Responsibility, Customer Satisfaction, and Market Value. *Journal of Marketing*, *70*(4), 1–18. doi:10.1509/jmkg.70.4.1

Majerova, J. (2015). Analysis of Slovak Consumer's Perception of the Green Marketing Activities. *Procedia Economics and Finance,* 553-560.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Majid, K. A., & Russell, C. A. (2015). Giving green a second thought: Modeling the value retention of green products in the secondary market. *Journal of Business Research*, *68*(5), 994–1002. doi:10.1016/j.jbusres.2014.10.001

McCarthy, J. E. (1960). *Basic marketing: A managerial approach*. Homewood, IL: Richard D. Irwin Publishing.

Menon, A., & Menon, A. (1997). Enviropreneurial marketing strategy: The emergence of corporate environmentalism as market strategy. *Journal of Marketing*, *61*(1), 51–67. doi:10.2307/1252189

Miles, M. P., & Covin, J. G. (2000). Environmental marketing: A source of reputational, competitive, and financial advantage. *Journal of Business Ethics*, *23*(3), 299–311. doi:10.1023/A:1006214509281

Mohanty, R. P. (2008). Quality Management Practices. In *Proceedings of the International Conference on Quality Management Practices for Organizational Excellence*. New Delhi: Excel Books.

Mourad, M., & Ahmed, Y. S. E. (2012). Perception of green brand in an emerging innovative market. *European Journal of Innovation Management*, *15*(4), 514–537. doi:10.1108/14601061211272402

Nadanyiova, M., Kicova, E., & Rypakova, M. (2015). Green marketing and its exploitation in Slovak companies. *Procedia Economics and Finance,* 26, 219 – 226.

Ottman, J. A. (2003). Empowering the people. *Business*, *25*(6), 32.

Parsa, H. G., Lord, K. R., Putrevu, S., & Kreeger, J. (2015). Corporate social and environmental responsibility in services: Will consumers pay for it? *Journal of Retailing and Consumer Services*, *22*, 250–260. doi:10.1016/j.jretconser.2014.08.006

Peattie, K. (1992). *Green marketing*. London: Pitman Publishing.

Peattie, K. (1995). *Environmental marketing management: meeting the green challenge*. London: Pitman Publishing.

Peattie, K. (2001). Golden goose or wild goose? The hunt for the green consumer. *Business Strategy and the Environment*, *10*(4), 187–199. doi:10.1002/bse.292

Peattie, K., & Charter, M. (1992). Green Marketing. In M. Baker & S. Hart (Eds.), *The Marketing Book* (pp. 726–757). Burlington, MA: Elsevier.

Peattie, K., & Crane, A. (2005). Green marketing: Legend, myth, farce of prophesy? *Qualitative Market Research: An International Journal*, *8*(4), 357–370. doi:10.1108/13522750510619733

Peloza, J., & Shang, J. (2011). How Can Corporate Social Responsibility Activities Create Value for Stakeholders? A Systematic Review. *Journal of the Academy of Marketing Science*, *39*(1), 117–135. doi:10.100711747-010-0213-6

Piercy, N. F., & Lane, N. (2009). Corporate Social Responsibility: Impacts on Strategic Marketing and Customer Value. *The Marketing Review*, *9*(4), 335–360. doi:10.1362/146934709X479917

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Polonsky, M. J. (2011). Transformative green marketing: Impediments and opportunities. *Journal of Business Research*, *64*(12), 1311–1319. doi:10.1016/j.jbusres.2011.01.016

Porter, M., & van der Linde, C. (1995). Green and Competitive: Ending the stalemate. *Harvard Business Review*, *73*(5), 120–151.

Preston, FA. (2012). Global redesign? Shaping the circular economy. *Energy, Environment and Resource Governance.* EERG BP 2012/02.

Rex, E., & Baumann, H. (2007). Beyond ecolabels: What green marketing can learn from conventional marketing. *Journal of Cleaner Production*, *15*(6), 567–576. doi:10.1016/j.jclepro.2006.05.013

Richey, R. G. Jr, Musgrove, C. F., Gillison, S. T., & Gabler, C. B. (2014). The effects of environmental focus and program timing on green marketing performance and the moderating role of resource commitment. *Industrial Marketing Management*, *43*(7), 1246–1257. doi:10.1016/j.indmarman.2014.06.014

Rincon, L. (2011). *Material flow analysis of the building sector in Lleida* (PhD thesis). University of Lleida, Lleida, Spain.

Sen, S., & Bhattacharya, C. B. (2001, May). Does doing good always lead to doing better? Consumer reactions to corporate social responsibility. *JMR, Journal of Marketing Research*, *38*(2), 225–243. doi:10.1509/jmkr.38.2.225.18838

Sharma, A., & Iyer, G. R. (2012). Resource-constrained product development: Implications for green marketing and green supply chains. *Industrial Marketing Management*, *41*(4), 599–608. doi:10.1016/j.indmarman.2012.04.007

Sharma, A., Lyer, G. R., Mehrotra, A., & Krishnan, R. (2010). Sustainability and businessto-business marketing: A framework and implications. *Industrial Marketing Management*, *39*(2), 330–341. doi:10.1016/j.indmarman.2008.11.005

Shen, L. Y., Tam, V. W. Y., Tam, L., & Ji, Y. B. (2010). Project feasibility study: The key to successful implementation of sustainable and socially responsible construction management practice. *Journal of Cleaner Production*, *18*(3), 254–259. doi:10.1016/j.jclepro.2009.10.014

Sheth, J. N., Newman, B. I., & Gross, B. L. (1991). Why we buywhat we buy: A theory of consumption values. *Journal of Business Research*, *22*(2), 159–170. doi:10.1016/0148-2963(91)90050-8

Siegel, J. G., Shim, J. K., & Walker, J. P. (2003). *The Artificial Intelligence Handbook: Business Applications in Accounting, Banking, Finance, Management and Marketing*. Thomson South-Western.

Sim, J., & Sim, J. (2017). The atmospheric environmental impact of a Korean traditional buildings life cycle, along with carbon footprint analysis. *Sustainable Cities and Society*, *28*, 172–186. doi:10.1016/j.scs.2016.09.008

Simintiras, A. C., Schlegelmilch, B. B., & Diamantopoulos, A. (1994). 'Greening' the marketing mix: a review of the literature and an agenda for future research. In P. McDonagh & A. Prothero (Eds.), *Green management a reader* (pp. 413–434). London: The Dryden Press.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Sinha, R., Lennartsson, M., & Frostell, B. (2016). Environmental footprint assessment of building structures: A comparative study. *Building and Environment*, *104*, 162–171. doi:10.1016/j.buildenv.2016.05.012

Siriwardena, S., Hunt, G., Teisl, M. F., & Noblet, C. L. (2012). Effective environmental marketing of green cars: A nested-logit approach. *Transportation Research Part D, Transport and Environment*, *17*(3), 237–242. doi:10.1016/j.trd.2011.11.004

Slater, S. F., & Olson, E. M. (2001). Marketings contribution to the implementation of strategy: An empirical analysis. *Strategic Management Journal*, *22*(11), 1055–1067. doi:10.1002mj.198

Smirnova, M., Henneberg, S. C., Ashnai, B., Naude, P., & Mouzas, S. (2011). Understanding the role of marketing-purchasing collaboration in industrial markets: The case of Russia. *Industrial Marketing Management*, *40*(1), 54–64. doi:10.1016/j.indmarman.2010.09.010

Soler, C. (1995). Ecologically-friendly buying. In Environmental management - Where do we stand? Cappelen Akademisk Forlag.

Srivastava, S. K. (2007). Green supply chain management: A state of the art literature review. *International Journal of Management Reviews*, *9*(10), 53–80. doi:10.1111/j.1468-2370.2007.00202.x

Stoica, I., Veghe, C., & Orzan, M. (2015). Statistical exploratory marketing research on Romanian consumers behavior regarding smartphones. *Procedia Economics and Finance*, *32*, 923–931. doi:10.1016/S2212-5671(15)01549-X

Straughan, R. D., & Roberts, J. A. (1999). Environmental segmentation alternatives: A look at green consumer behaviour in the new millennium. *Journal of Consumer Marketing*, *16*(6), 558–575. doi:10.1108/07363769910297506

Sweeney, J. C., & Soutar, G. N. (2001). Consumer perceived value: The development of a multiple item scale. *Journal of Retailing*, *77*(2), 203–220. doi:10.1016/S0022-4359(01)00041-0

The European Commission. (2010). *Building Responsible Competitiveness - Guidelines to Enhance CSR in the Construction Sector*. Retrieved on May 29, 2016 http://www.improntaetica.org/file/docs/BRC_guideline_ENG_web.pdf

Tureac, C. E., Turtureanu, A. G., Bordean, I., Grigore, A., Modiga, G., & Pripoie, R. (2010). Ecological food products – general considerations on green marketing. *Proceedings of the 10th International Multi-disciplinary Scientific Geo-Conference (SGEM2010)*, *2*, 529–536.

UNEP. (2009a). *Buildings and Climate Change: Summary for Decision-makers*. United Nations Environment Programme.

UNEP. (2009b). *Common Carbon Metric for Measuring Energy Use and Reporting Greenhouse Gas Emissions from Building Operations*. United Nations Environment Programme.

United Nation. (2014). *Sustainable Future.* Retrieved on May 29, 2016 from http://www.un.org/en/sustainablefuture/cities.shtml#facts

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Violeta, S., & Gheorghe, I. G. (2009). The green strategy mix – a new marketing approach. *Knowledge Management and Innovation in Advancing Economics–Analysis and Solutions*, *1–3*, 1344–1347.

Whiting, D. (2008). *Why is marketing missing from the sustainability agenda?* Retrieved on May 29, 2016 from https://www.marketingsociety.com/the-library/why-marketing-missingsustainability-agenda

Yeo, Z., Ng, R., & Song, B. (2016). Technique for quantification of embodied carbon footprint of construction projects using probabilistic emission factor estimators. *Journal of Cleaner Production*, *119*, 135–151. doi:10.1016/j.jclepro.2016.01.076

Yu, L. (2009). Study on the policy and barrier of development circular economy. *Journal of Resource Industry*, *11*(1), 126–128.

KEY TERMS AND DEFINITIONS

Circular Economy: Environmentally-friendly economy enabled by closed loop material cycle and zero waste principles based on tangible and intangible resource exchanges among companies.

Construction Supply Chain: Production chain in construction consisting of suppliers and subcontractors taking part in different stages of the production [starting from the raw material extraction to the production of the end product (e.g. buildings etc.)].

Corporate Social Responsibility: Corporate's support and contribution to the societies' needs. Companies do not charge for their CSR activities.

Environmental Footprint: Embodied impact of the product on the environment.

Green Marketing: Marketing processes and activities emphasizing: value for the nature and next generations; importance of sustainability as well as products' and their production processes' characteristics/properties with respect to sustainability. Green marketing can be used as a tool for enhancing customers' awareness of the importance of sustainability and influencing their demand for environmentally-friendly products and production processes.

Marketing: Processes and activities enabling the supply side to meet the demand side. It is an important ingredient/input for design and production as well as for post-production as customers' feedback can provide insights on what the customers value for.

Marketing Mix: Strategic factors to be concentrated on throughout the marketing activities to address the correct customer segment, to promote the product, and to increase the market share.

Value: Value is what the demand side is looking for in the supply side and what the supply side needs to create to meet the needs and expectations of the demand side.

This research was previously published in Green Marketing and Environmental Responsibility in Modern Corporations edited by Thangasamy Esakki, pages 1-29, copyright year 2017 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 26
Green Marketing Initiatives and Sustainable Issues in Hotel Industry

Neeti Kasliwal
Banasthali University, India

Srishti Agarwal
IIS University, India

ABSTRACT

With the fast degradation of the environment and changing lifestyle of the consumers, the companies have started moving towards the concept of green marketing. Although green marketing has been able to address concerns of green consumers but as anticipated has not shown much expected results from companies as well as from mainstream consumers' acceptance level. This chapter is an attempt to draw attention towards sustainable issues in hotel industry, what are the opportunities' and challenges' the hotels are facing with respect to green initiatives and how successful the present companies are in incorporating the green practices. The authors conclude the chapter giving the focus on future research directions in green marketing and green practices to be followed by hotel industry.

INTRODUCTION

Green Marketing concept is emerged in the late 1980s. The term describes an organization's efforts at designing, promoting, pricing and distributing products that will not harm the environment. It has been defined as the management process that is responsible for identifying, anticipating and satisfying the requirements of customers and society in a profitable and sustainable way (Chan E.S.W 2013). Green marketing means the marketing of products and services which are environment friendly. The green marketing has originated under three phases according to Peattie (2001), first phase was termed as "Ecological" green marketing, and during this period all marketing activities were concerned to help environment problems and provide remedies for environmental problems. Second phase was "Environmental" green marketing and the focus shifted on clean technology that involved designing of innovative new products,

DOI: 10.4018/978-1-5225-7915-1.ch026

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

which take care of pollution and waste issues. Third phase was "Sustainable" green marketing. It came into prominence in the late 1990s and early 2000. The concept is not restricted to only products but also services. The emergence of green hotels has taken a prominent step and has become major issue in today's scenario because of the increasing concern of environment in the eyes of consumers.

BACKGROUND

Why Green Marketing?

In today's scenario, with the fast degradation of the environment it has become the important part in everyone's life to accept those products and services which can save environment. The fast changing of lifestyle of people also compels them to adapt to those products which will not harm the environment. So marketing of green products and services has become important so that it can be positioned in consumer's mind. Further marketing can also help consumers to make them aware about the green products and services. With the changing time, the concept of green marketing is taking place rapidly. Different rules of green marketing have been identified by Jacquelyn A. Ottman (2010) in his book "The New rules of Green Marketing". The 20 new rules of green marketing are as follows:

1. **Green is Mainstream:** Today, 83% of consumers – representing every generation, from Baby Boomers to Millennials and Gen Ys – are some shade of green. Moreover, there are now finely defined segments of green consumers.
2. **Green is Cool:** In fact, green consumers are early adopters and leaders who influence purchasing behaviour. Celebrities and other cool types generally are espousing green causes.
3. Greener products work equally or better – and are often worth a premium price.
4. Green inspires innovative products and services that can result in better consumer value, enhanced brands, and a stronger company.
5. **Values Guide Consumer Purchasing:** Historically, consumers bought solely on price, performance, and convenience
6. **A Life-Cycle Approach is Necessary:** Single attributes such as recyclable, organic, or energy-efficient matter greatly,
7. **Manufacturer and Retailer Reputation Count Now More than Ever:** In addition to looking for trusted brand names on supermarket shelves, consumers are now flipping over packages, saying, "Who makes this brand? Did they produce this product with high environmental and social standards?"
8. **Save me!:** Today's consumers buy greener brands to help protect their health, save money, or because they simply work better.
9. Businesses are their philosophies: It used to be that companies were what they made. Now, businesses and brands are what they stand for.
10. Sustainability represents an important consumer need, and is now an integral aspect of product quality.
11. The greenest products represent new concepts with business models with significantly less impact.
12. Consumers don't necessarily need to own products; services can meet their needs, perhaps even better.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

13. The brands consumers buy and trust today educate and engage them in meaningful conversation through a variety of media, especially via websites and online social networks.
14. Green consumers are strongly influenced by the recommendations of friends and family, and trusted third parties.
15. Green consumers trust brands that tell all
16. **Green Consumers Don't Expect Perfection:** Keep improving, and report on progress.
17. Environmentalists are no longer the enemy.
18. **Nearly Everyone is a Corporate Stakeholder:** No longer confined to just customers, employees, and investors, publics of all stripes are now corporate stakeholders: environmentalists, educators, and children – even the unborn.
19. **Authenticity:** It's not enough to slap on a recycling logo or make a biodegradability claim. Brands viewed as the most genuine integrate relevant sustainability benefits into their products.
20. **Keep it Simple:** Plato was an environmentalist: "Simplicity is elegance." Today's consumers are cutting out the needless purchases, and getting rid of the gadgets and gizmos that don't add value to their lives.

Green Products and Green Consumers

The term "green" refers to actions that reduce the impact on the environment, such as eco processing or recycling (Han et al., 2011). By Saini (2013), A product may be considered green if it:

- Conserves water and energy;
- Prevents contributions to air, water, and land pollution;
- Protects indoor air quality;
- Uses renewable, responsibly sourced materials;
- Produces little environmental impact;
- Is manufactured in an environmentally conscious way;
- Using one's own bag, rather than a plastic carrier provided by a shop.

In general, Ottman (1999) classifies green products as durable, non-toxic, made from recycled materials and with minimal packaging. It means that green products cannot be visualised only from the viewpoint of the final results of the production process, but also in light of the entire production chain.

According to Ottman (1994) an environmentally friendly or green product, should have the following characteristics: a) be manufactured with a minimum amount of raw materials and with recyclable raw material, b) be manufactured with the utmost energy efficiency and with the least use of water; c) be packed in lighter packaging; d) provide a higher durability and serve multiple purposes; e) be reusable; f) be biodegradable. So here green products refer to those which are eco-friendly and usage of the green products does not harm the environment.

When it comes to know about the green consumers, first thing comes in mind is that consumers who consumes the eco-friendly products and services but consumption of green products does not make them a green person. Green consumers should also be aware and concerned about the environment. There were various concepts of green consumers given by different authors such as, According to Ottman (1999), it is the one that seeks to consume products that cause little impact to the environment – which is called as environment friendly products. It is the individual who makes their buying decisions not only by

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

checking price and quality, but also the fact that products should be environmentally friendly. According to Portilho (2004) study, green consumers are the one who in addition to the variable quality/price, includes in their "power of choice", the environmental variable preferring products that do not harm the environment, whereas Dias (2007) identified, It is the one who is concerned with the environment and adopts a behaviour consistent with these values.

Today, the green consumers are increasing throughout the world and growing concern of consumers towards the environment has shown drastic increase in the usage of green products and services. Bhattacharya et al., (2009) showed that consumers expressed their preference for products from those companies which invest in social issues and environmental responsibility issues. That means consumers wants companies to accept the green products and services which saves environment. In McKinsey research article by Dan & Aline (n.d.), para.2 showed that 66% of the global consumers prefer to buy products and services from companies that give back to society; according to a recent Nielsen survey of 28,000 online respondents in 56 countries, it has been seen that many consumers are aware and they know about the green products and services but consumers hardly make their buying decisions. People generally think as eco-friendly consumers, our actions often fail to match the standards of our intentions. The simple reason can be that people don't really care about the environment. Although social pressures and companies initiatives force people to accept eco-friendly products but they don't actually have genuine environmental beliefs'. According to the McKinsey finding consumers do care about the environment, but there is no alignment in behaviours with intentions. Because consumers tend to focus on the present goals only and future goals treated to be less important. The consequences of consumer's behaviour are uncertain, and their collective effects on the environment would be disastrous. There is one way to overcome it, is to appeal for emotions to the people rather than giving logical reasons for a particular course of action. So this article brought a major issue that consumers are aware and concern towards the environment but problem arises when the consumer behaviour is not aligned with their intentions. Green consumers are increasing and accepting the green products and services to save environment.

Benefits of Green Marketing

In very general terms, the marketing of those products which can save environment is the primary benefit of the green marketing. Many companies want to put their efforts to be Green and they are also coming out of the green products. Some of the advantages of green marketing are:

- It ensures sustained long term growth along with profitability.
- Initially the cost is more but in the long run it saves money.
- With keeping the environment aspects in mind, it helps the companies to market their products and services.
- It helps in accessing the new markets and also companies enjoy the competitive advantage.

Various examples of Green Marketing have being identified from many sources. According to Singh (2013) study various examples are being quoted such as:

- Suzlon Energy manufactures and markets wind turbines, which provide an alternative source of energy based on wind power. This green initiative taken by the company is extremely important for reducing the carbon footprint.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- Tamil Nadu Newsprint and Papers Limited (TNPL) was awarded the green Business Leadership Award in the pulp and paper sector for the year 2009-10, based on the EVI Green Business Survey conducted by financial Express and Emergent Ventures India. This was given in recognition of two clean development mechanism projects implemented by the company generating biogas from bagasse wash water, and using the same as a substitute for furnace oil.
- Tata Metalikes Ltd (TML) has initiated the use of only sunlight during in its offices.
- ITC has introduced Paperkraft, a premium range of eco- friendly business paper. The company's social and farm forestry initiative has greened over 80000 hectares of arid land.
- Wipro's computers division has launched energy star compliant products in the market.
- HCL Technologies is moving towards phasing out hazardous vinyl plastic and brominated flame retardants from its products.
- Oil and Natural Gas Corporation Ltd (ONGC), India's largest oil company, has introduced energy-efficient Mokshada Green Crematorium, which saves 60 to 70% of wood and fourth of the burning time per cremation.
- IndusInd Bank installed the country's first solar-powered ATM and thus brought about an eco-savvy change in the Indian Banking sector.
- Idea Cellular implemented its national campaign 'Use Mobile Save Paper'. The company organized Green Pledge campaigns to save paper and trees. Idea decorated bus shelters with potted plants and tendil climbers to communicate the green massage.
- Samsung offers a host of eco-friendly products. It was the first to launch eco-friendly mobile handsets (made of renewable materials)- W510 and F268- in India.
- Nokia's policy is to reduce the environment impact of its products. It has taken the initiative to take back, recover useful materials and dispose of waste in a manner that causes least harm to the environment.
- Hero Honda Motor's philosophy of continuous innovation in green products and solutions has enabled it to strike a balance between business, consumers and nature.
- Honda India introduced its civic Hybrid car. However, initially it was unable to sell the same due to the high price. The price was reduced by 8 lakh, and within a day, 98 civic Hybrids were sold, which was more than what Honda had been able to sell during the previous five months since its launch.
- Maruti and Hyundai have come up with LPG and CNG based variants for WagonR and Santro respectively.
- Reva, India's very-own Banglore-based company (now a part of Mahindra Group) was the first in the world to commercially release an electric car. Reva is being sold in countries like UK, Ireland, Belgium, Spain, Cyprus, Greece and Norway.
- Mahindra Group had launched project Mahindra Hariyali in which 1 million trees would be planted nation-wide by Mahindra employees and other stakeholders including customers, vendors and dealers.
- McDonald's restaurants use napkins and bags made of recycled paper.
- Apple has adopted the philosophy that going green streams. It recycles e-waste and also generates revenues.
- IBM is selling green solutions to corporate data centres where energy constraints and costs are limiting their ability to grow, with the promise that the energy costs would be reduced by half.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Green marketing is rising quickly and consumers are willing to pay a lot for green product. There has been little analysis of the impact of this new market on the consumers and the environment so far. Green marketing affects all areas of our economy, it does not just lead to environmental safety but it also generates new market and job opportunities. Hotels are trying to attract green consumers but it is quite difficult to satisfy consumers if they are paying higher prices for hotels. So hoteliers need to convince their green consumers that green services will pay off without sacrificing their comforts. Das et.al.,(2012) has identified various reasons for the companies to adopt green marketing. These are:

- To explore Opportunities or Competitive Advantage
- For Corporate Social Responsibilities (CSR)
- Due to Government Pressure
- Due to Competitive Pressure
- For Cost or Profit Issues
- Due to Increased Customer Consciousness
- Deterioration of Climatic Conditions

The above reasons have compelled many companies to come up with the green products and services to attract and retain their customers for a longer period of time. Also at the same time reduce their costs and increase their profits.

Challenges of Green Marketing

There are various challenges ahead in this sector which companies need to address and so that they are able to adapt cope up for future. One of the main challenge identified with green issues is that firms using green marketing must ensure that their activities are not misleading to consumers or industry, and do not breach any of the regulations or laws dealing with environmental marketing. Other challenges are as follows:

- Green products require recyclable products, which are found to be costly.
- Green products and services needs latest technology, which requires huge investment.
- Most of the people are not very much aware about the green products & services and its uses. Even if they are aware then they do not have much knowledge about its applicability.
- As the green products & services are costly, so most of the consumers are not willing to pay premium price for the green products & services.
- Green Marketing concept is new to the consumers which hinders their decision making process.
- Consumers do not have trust on the companies who are offering them green products. Consumers have perception that they are being cheated by the companies by charging high prices for the green products.

The knowledge gap towards the usage of green products& services will prevent consumers in making buying decisions. Today, consumers want more reliable and credible information about the ecological effect of products rather than only that products are eco-friendly. The above challenges or problems are generally faced by the consumers as well as hoteliers who prevent them in making their purchase decisions regarding green products and services. With the above focus on the challenges, companies need

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

to identify that what exactly the consumer wants from the hotels in terms of the green services? What are their perceptions towards the green services? How will they behave while using the green services? And will they be able to pay higher price for the green services or not? What another steps a hotel can take to convince consumers for using green services? Hoteliers have to find out the answers and have to identify consumers' needs and their preference and accordingly have to apply the strategies to sustain in the market. Those hotels which have revised their policies are coming forward with the innovative services to satisfy their green consumers are true winners.

Despite the fact that green marketing has several challenges but with the changing scenario the opportunities can be seen today for the green marketing such as to achieve competitive advantage, increasing the consumer market segment, meeting with government legislation and corporate social responsibility. Today every industry is heading towards these opportunities to stand out in the market and adopting eco-friendly practices in their organisation. When it comes to India, the implementation of green practices has created problems such as high cost; consumers are price sensitive, lack of awareness among the consumers towards the green products & services, lack of authentication in information and companies making false environment claims (Yadav et.al., 2013). These challenges are majorly faced by the companies to attract consumers in India. Consumers still feel awkward to accept the green products and services in India so it has become important for the companies as well as the hotel sectors to explore more details in green market segment. Also, they need to find out the solution to cope up with these challenges. Consumers face some barriers while making their purchase decisions. Shove and Warde, (2002) and Mont, (2004) in their research discussed that internal barrier is one of the barriers which stop consumers from purchasing eco- friendly products that come from individuals' lack of knowledge and ability to understand the consequences of their acts, and habits. Demeritt (2005), and Yan *et al.*, (2006) also identified that individual purchase decisions are also determined by external barriers that relate to the availability of good products & services, the convenience in accessing them, and to the belief that one person cannot make a difference. External barriers are much stronger than internal knowledge and motivations in obstructing tourist environmental behaviour (Kaiser *et al.*, 1999; Tanner *et al.*2004).

Present Trends in Green Marketing in India

- Green marketing is being considered as an opportunity for the companies in this competitive era.
- Companies believe that green marketing is a social obligation for them which can also save their society from any harmful effects.
- Governmental Bodies are also forcing companies to become more responsible towards the society as well as the environment.
- Companies are shifting towards the green products and services to compete with their competitors so that they can survive in the market.
- Through using green products, one can control their costs and can come out with the new technology for saving water and energy.

Green Marketing Mix

According to Mishra et.al, (2011) every company has its own marketing mix. Some have 4 P's and some have 7 P's of marketing mix. The 4 P's of green marketing are same as compared with the conventional marketing but the challenge before marketers is to use 4 P's in an innovative manner.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- **Product:** The objective of product is to identify those products which are eco-friendly and can be used to save environment.
- **Price:** Price is a critical factor of green marketing mix. Most of the consumers are still not ready to pay the premium price of the green products, so before fixing price it is important to consider the consumers' mentality and thoughts.
- **Promotion:** There are three types of green advertising: - first, ads that address a relationship between a product/service and the biophysical environment, second, those that promote a green lifestyle and third, ads that present a corporate image of environmental responsibility.
- **Place:** place of a product decides that where the products can be available so that maximum number of consumers can reach there to avail the green products.

Strategies of Green Marketing

The marketing strategies for green marketing includes:

- Develop marketing plan and Marketing Audit while making strategy towards the green marketing.
- The key to successful green marketing communications is credibility. Never overstate environmental claims or establish unrealistic expectations, and communicate simply through sources that people trust.
- Always explore the market before making strategy.
- Identify consumer needs and demands.
- Give value of money to the consumers in terms of green products.
- As the consumers are price sensitive, so it needs to identify their willingness to pay before making strategy.

Future Trends of Green Marketing

There are various lessons that to be learned to avoid certain misconceptions of green marketing. The best and effective marketing of green products requires applying good marketing principles to make green products more attractive and desirable in the eyes of consumers. However there is still a question arise that what is the future of green marketing? Various scholars and researchers has viewed that there are maximum number of consumers who still are not aware and educated about the green products and services. The companies today are not able to match the demand of consumers with the eco-friendly products. Traditionally, marketing of products included only selling products as much as u can but the time has change, companies need to identify consumers' needs to retain their customers. So the future trends of the green marketing are:

- To deliver consumers green products which gives them value of their money
- Target relevant consumer segment
- Educate consumers about the eco-friendly product.
- Make environmental product attributes as "solutions" for consumer needs.
- Make green products trustworthy to the consumers
- Make certified and eco labelled products.

So the above trend has shown that green marketing will help when the above trends could be followed.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

MAIN FOCUS OF THE CHAPTER

The present chapter focuses on the initiatives towards the green marketing and sustainability issues taken by the hotel industry. Knowing the consumer preference for green services, hotel industry is focusing their attention towards green consumers and green practices. This practice not only gives an edge over competitors and but also fulfils their responsibility towards environment.

Sustainability and Tourism

"Going green" has becoming a trend in all over the world. Various ideas of green marketing have emerged not only in the tangible sectors but also in the service sectors in large. Green marketing has emerged to focus on the environmental issues and putting emphasis on reducing the environmental damages. Sustainable marketing has become the most important step to be taken by the service industry. The need for green products and services among the consumers has drastically increased. It is gradually being realised the degradation of environment and it can only be prevented by using environment friendly products and services. Tourism sector is the largest service sectors in the world, where sustainable marketing has become prominent to save the environment and to sustain in the competitive market (World Travel & Tourism Council [WTTC], 2007). In terms of sustainability issues and goals, various businesses (TOI, 2003), governmental and intergovernmental organizations (OECD, 2002, UNEP, 2005, and European Environmental Agency, 2006) make excellent efforts to minimise negative effects and also making and improving benefits from tourism. The result of the various initiatives by the government and individuals has showed the encouraging signs that tourist provision can be improved in terms of resource consumption, waste management and transport management (Upham, 2001, Götz *et al.*, 2002, and VISIT, 2005). The above efforts can be analysed and it can be seen that the corporate and government sectors have adapted various green practices but today tourists are much less interested to adopt sustainable lifestyles. Different Tools and strategies are being adopted by various institutions such as eco-labels, awards and certification schemes, communicating and spreading awareness among others, educational campaigns are designed and implemented to encourage tourists 'behaviour towards the responsible tourism.

Tourism, being a major source of income and employment for many countries depends heavily on environmental resources which causes more degradation of the natural resources. Among the various components of tourism, the hotel industry is one of the major sectors of the tourism that creates a major threat to the environment due to its high consumption of energy, water and less durable goods. The hotel industry is the key of tourism business which may not be the first sector that creates environmental pollution and also consumes significant amount of global resources. But the major aim of hotel is to provide comfortable services such as supplying of hot water, food, drinks, linens, towels, lighting, air conditioning, water, swimming pools etc, which compels hotels to consume large amounts of water, energy, non-recyclable, goods, and natural resources which directly or indirectly harming the environment. A conference which was held in Canada on "Global opportunities for business and the environment" concluded that sustainable development acts as a vehicle or a catalyst for identifying the problems of modern tourism (Tourism Canada, 1990). Sustainable tourism development must meet the need of the present tourists and protecting and improving opportunities for the future regions and future needs.

Sustainability, according to Moore, also involves total integration with the community in which the tourism organisation is located. Total integration here is referred to as involving health and safety is-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

sues, conservation of natural resources, renewable energy supplies, and other environmental friendly manifestations.

Mowforth and Munt, (1998) go a step further in defining sustainable tourism by stating that the concept is not just about the environmental and social dimensions. In fact, sustainability in tourism incorporates dimensions such as (a) environmental sustainability, i.e., avoiding or minimizing the environmental impact of tourist activities via the utilization of tools such as carrying capacity; (b) social sustainability, i.e., the ability of the community to absorb inputs and to continue function without or with minimum social disharmony; (c) cultural sustainability, i.e., the ability of people to retain or adapt elements in their culture which distinguish them from other people; (d) economic sustainability, i.e., sufficient economic return of tourism activity either to cover the cost of any special measures taken to cater for the tourist and to mitigate the effects of the tourist's presence, or to offer an income appropriate to the inconvenience caused to the local community visited–without violating any of the other conditions–or both; (e) having an educational element, i.e., providing greater understanding of how our natural and human environment works as the goal of the activity; and (f) having local participation, i.e., inclusion of the local population. As a key sector of tourism industry, hotel business, needs to play a role which have several key environmental and social impacts in the society i.e., (1) energy consumption; (2) water consumption; (3)waste production; (4)waste water management; (5) chemical use and atmospheric contamination; (6) purchasing/procurement and (7) local community initiatives (International Hotel Environmental Initiative, 1995; Kirk, 1995).

Green Hotels and Green Practices Adopted by Hotel Industry

According to Green Hotel Association,(2008) Green hotels, also known as environmentally friendly hotels, is defined as an eco-friendly hotel operation that performs various environmentally friendly practices such as saving water and energy, using eco-friendly products and reducing emission and waste disposals to protect the natural environment and reduce operational costs. Consumers appreciate the contribution green hotel practices make to improving the environment, they do not want to compromise on service quality or living comfort.

Hotel industry is one of the major contributors in economic activity of tourism sectors. The potential growth of this sector has an impact on environmental issues like climate change, increasing pollution, wastage of energy and water etc. Much attention towards the negative impact on the environment such as over-consuming of energy and water, using of detergents in laundry that hotels do on a daily basis, using of plastic bags, using of non-recyclable products and other materials while operating business have been caused by hotel industry. This increasing degradation of the environment, hotels are becoming more responsive towards their obligation and over the years, efforts have been made to improve environmental conditions as well as social responsibility in the hotel industry. There are many reasons that have been seen for going green such as government pressures, increasing competition, quality services, social responsibility, self-regulation, brand building and many others which have forced hotel industry to show initiatives for sustainable practices.

With the increasing awareness towards the environment, hotels are taking green initiatives and also coming out with the more green products and services. Various green attributes are being incorporated in the hotels such as participation in environmental partnership or certification program, using recycling programs, having energy saving light bulbs in the rooms, towel reuse program, recycle bins in the guest room, sheets changed on requests etc. According to Watkins, (1994) study, eco-friendly attributes

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

of hotels like recycle bins, energy efficient lights, changing sheets when requested that may influence consumers' decision making these attributes are being widely used in the hotels today which are being adopted by the consumers as well. Today green hotels are using these eco-friendly attributes which helps them to stand out in the market as compared to the conventional hotels. Hotel industry can also reduce their operating costs and expenses by incorporating green techniques in their hotels. Hotel industries can also create a competitive advantage and make profits for themselves by offering green services to their consumers. The awareness level is not limited to the hotel industry. The growing population and changing lifestyle of people, green products and services has taken major place in consumers' day to day life. Consumers has positive attitude and behaviour towards green products and services so it is crucial for the hotel industry to explore more on concept of green hotels in more detail.

More consumers are expressing a preference for environmental products and services (Schubert et al., 2010). Consumers' concern towards the environmental can influence their decision when selecting a hotel. Although consumers have their own preference while selecting a hotel which is focusing on green practices but not all consumers are willing to pay extra amount for the green hotels. Some studies reported that most of the respondents were willing to pay extra for staying in a green hotel. For instance, 67% of the consumers in Kenya have a strong willingness to pay a higher rate for an environmentally friendly hotel (Masau& Prideaux, 2003). (Choi, Parsa, Sigala, & Putrevu, 2009) got similar results in their study of consumers in Greece and the United States. Other studies pointed to the opposite conclusion. One study by Ogbeide,(2012) revealed that the majority of the consumers thought that a green hotel room should cost the same or even less than one in a hotel that does not have green practices. In a study of Indian hotel guests, only 15%of the respondents would like to pay more for the hotel's environmental initiatives. The remaining 85% of the respondents felt that the costs should either be paid for by the hotel or shared (Manaktola & Jauhari, 2007). American hotel guests also had a similar attitude, with only 30% of the respondents expressing willingness to pay more to stay at a green hotel (Kang et al., 2012).

Inquiries over tourists willingness to pay for environmental protection and the well-being of local communities show Dutch tourists to be uninterested (CREM, 2000), over 81% of British tourists being willing to pay up to 3% of the value of their holiday (Martin, 2001), while international tourists in Thailand show there is no desire to pay for environmental quality, but they are willing to do so for raising the quality of service (Baddeley, 2004). Certain research indicates that 70–80% of tourists state their high concerns for eco-social components of holidays, only about 10% convert this concern to purchasing decisions (Chafe, 2005) and, in reality, the majority are reluctant to change their own behaviour in support of sustainability goals (CREM, 2000; Grankvist, 2002; Yan *et al.*, 2006).

Both marketers and consumers are showing their concern towards the need for green products and services. This shift of consumers as well as marketers towards "green" may be expensive in the short term, but will be advantageous in the long run. Consumers have shown their interest in green products and services due to increasing awareness towards the environment and also ready to pay extra amount for the green services. Consumers' demand for green hotels is increasing with changing lifestyle and they are ready to pay even higher prices for the green services but without sacrificing their comforts. Tourist choice of travel depends on flexibility, comfort, convenience, relaxation, a sense of freedom and 'no stress' (Anable & Gatersleben, 2005).

In the tourism sectors, the most important thing for the consumers are comforts and convenience, so keeping this in mind hoteliers have to come out with those green attributes and services which will be attractive for the consumers without making any compromise in their comforts. Awareness and knowledge of the consumers plays an important role in accepting green products and services which helps consum-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

ers in committing themselves to make purchase decisions. So it has become crucial for the marketers to make consumers aware towards the environment friendly products and services. The consumers are heterogeneous with different tastes and preferences and this has compelled the marketers to come out with those green products and services that can easily suits to consumer's tastes. The hotel industry has developed a standardized and systematized method for measuring the environmental friendliness of hotels. There are international hotel certification programs in place such as Green Globe and Energy Star, and accreditation schemes such as ISO 14001, LEED (Leadership in Energy and Environmental Design), and GSTC (Global Sustainable Tourism Criteria).

Previous studies have identified that younger people and women are found to be more sensitive to environmental issues and more likely to buy green products as compared to men (Mainieri et al., 1997). Consumers' concerns for the environment affect their decision while buying green products and services. A study showed that because of the environmental image of the hotel, consumers were interested in staying at green hotels (Lee et al., 2010). Green practices that hotels are initiating were well accepted by consumers who are environmentally conscious (Millar & Baloglu, 2008). According to Kasliwal and Agarwal,(2014), the result showed that green practices like train employees for better environment performance, use savers to save electricity, recycling programs, having energy saving bulb lights as very important attributes considered by the hotels as well as consumers.

Consumers are showing their interests and expectation for hotels to implement more environmentally friendly practices. The willing to pay (WTP) however is not a universal phenomenon as Indian customers are reluctant to pay a premium for green hotel rooms (Manaktola & Jauhari, 2007) which poses challenges for the industry to meet the expectations of the consumers, because Indian consumers are more price sensitive. According to Kasliwal and Agarwal, (2015) with the analysis of women consumers it was found that the women consumers prefer attribute key cards used to turn power on and off as very important green attribute while choosing a hotel

Hence it is important for hotel industry to understand the attitude and expectations of consumers from a green hotel. Hoteliers also have to identify what green services can attract their consumers and can act as differentiating tool to grab their attention.

By concluding the above, we can say that green products and services have taken major place in consumers mind and hotel industry is also putting efforts to satisfy this latent need of the consumers. There are so many things which excite consumers to buy green products and services but, more awareness needs to be created. Also consumers who are not ready to buy green products and services at premium price needs to be convinced that actual services will be matched with their expectations.

There are various green attributes that hotels have incorporated and various green marketing strategies that a hotel should apply for attaining competitive advantage. Chan, (2013) mentioned various strategies of green marketing for hotels. These are as follows:

- Designing green products and services;
- Contributing to green-conscious customers;
- Saving water and energy resources, reducing wastes, and conserving ecosystem;
- Launching green-certification programs;
- Product-differentiation by green products and services;
- Cooperation with environmentally-friend groups;
- Adoption of environmentally-friendly distribution channels;
- Influencing consumers through green marketing;

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- Green pricing leads to lower costs of green products and services;
- Adoption of environmental labelling as a marketing tool;
- Trying to create innovative green products and services;
- Using eco-labels on packages and in websites;
- Effect of efficiency of green products and marketing on customers' decision to stay again;
- Launching special program to assure success of green products and services;
- Willingness of customers to pay higher prices for green products and services;
- Contradiction of rivals on environmental claims.

The above mentioned are the major marketing strategies for the hotel industries towards the launching of green products and services. These green marketing strategies will help hotel industry to sustain in the competitive market and also to attract more consumers who are concerned towards the environment.

SOLUTIONS AND RECOMMENDATIONS

The above discussion towards the green marketing and sustainable issues in hotel industry, it can be analysed that various problems has been seen that consumers are still not ready to accept green products and services. This problem can be solved by bringing more awareness of green products and services in the mind of consumers make availability of green products in every hook and corner and also give value for money to the green products and services. These solutions can be useful for both companies and hoteliers to retain their customers for a longer period of time. The lifestyle of consumers is changing and they want to buy innovative products. They are aware of the fact that environment is degrading day by day so companies as well as hoteliers are coming out of the green products and services but consumers are not ready to accept these green products and services. So it has become important to identify the needs and desire of the consumers before proceeding further. It is recommended to the hoteliers to provide green services without making any hindrances in consumer's comforts, hoteliers should know their preferences of the consumers while they choose the hotels and also give best green services which gives them value for money.

FUTURE RESEARCH

Going green is becoming the new trend in the changing lifestyle. Not only in the field of hotel industry but also in the field of tangible things which force have people to change their buying decisioned. Various future studies can be done with respect from consumer's point of view and from management point of view. The managerial implications of the future studies will help to formulate the strategies that should be adopted by the hotel industry to survive in the market. This study has lot of scope when it comes to green services. Generally companies are putting efforts in green marketing to position the green products in the mind of consumers but hospitality sectors has a tough competition and a difficult task to identify green consumers and give them the best green services without compromising their comforts and convenience. Hence it has a future scope to research on analysing employee's behaviour, consumer perceptions, management initiatives, government role towards green products and services and many more.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

CONCLUSION

It is crystal clear and a fact that hotel managers have to develop and implement new strategies to attract and enhance their customers' satisfaction more than their competitors. Development of delightful customers for products and services by upgrading customer satisfaction always help to achieved competitive edge in the market. In the strategic management perspective to achieve greater level of customer satisfaction hotels can use combination of environment product strategy and environment place strategy. Green marketing is a very new term in the hotel industry. It simply means using environmentally-friendly products and services in hotels and accommodations. However, hotel managers are expected to launch quick activities in order to make use of principles of green marketing properly in their hotels. As green marketing is a key factor in the hospitality industries because major portion of the harmful chemicals are found in the hotel industry which harms the environment most. So the green marketing has played a prominent role to market those services which do not harm the environment.

In the current era of globalization and privatisation, we cannot ignore competitions. Competitors are rising and to survive in the market, it is crucial to bring innovative products like green products and services. This chapter has come out with the fact that green marketing is becoming the burning topic for the companies as well as for the service industries. To survive in the market, and further to attract consumers with a motive to save environment, hotel industry needs to come out with the creative strategies.

REFERENCES

Anable, J. & Gatersleben, B. (2005) All work and no play? The role of instrumental and affective factors in work and leisure journeys by different travel modes. *Transportation Research Part A: Policy and Practice*, *39*, 163–181.

Ariely, & Grüneisen. (n.d.). *How to turn consumers green*. Retrieved from http://voices.mckinseyonsociety.com/how-to-turn-consumers-green/

Baddeley, M. C. (2004). Are tourists willing to pay for aesthetic quality? An empirical assessment from Krabi Province, Thailand. *Tourism Economics*, *10*(1), 45–61. doi:10.5367/000000004773166583

Bhattacharya, S. (2011). Consumer attitude towards green marketing in India. *IUP Journal of Marketing Management*, *10*(4), 62.

Budeanu, A. (2007). Sustainable tourist behaviour–a discussion of opportunities for change. *International Journal of Consumer Studies*, *31*(5), 499–508. doi:10.1111/j.1470-6431.2007.00606.x

Chafe, Z., & Honey, M. (2005). *Consumer demand and operator support for socially and environmentally responsible tourism*. Center on Ecotourism and Sustainable Development.

Chan, E. S. (2013). Managing green marketing: Hong Kong hotel managers' perspective. *International Journal of Hospitality Management*, *34*, 442–461. doi:10.1016/j.ijhm.2012.12.007

Choi, G., Parsa, H. G., Sigala, M., & Putrevu, S. (2009). Consumers' environmental concerns and behaviors in the lodging industry: A comparison between Greece and the United States. *Journal of Quality Assurance in Hospitality & Tourism*, *10*(2), 93–112. doi:10.1080/15280080902946335

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Das, S. M., Dash, B. M., & Padhy, P. C. (2012). Green Marketing Strategies for Sustainable Business Growth. *Journal of Business Management & Social Sciences Research*, *1*(1), 82–87.

Demeritt, L. (2005). *What makes a Green Consumer*. Environmental Outlook.

Dias, R. (2007). *Environmental Marketing: ethics, social responsibility and competitiveness in business*. São Paulo: Atlas.

Götz, K., Loose, W., Schmied, M., & Schubert, S. (2002). *Mobility Styles in Leisure Time: Reducing the environmental impacts of leisure and tourism travel.* Freiburg, Germany: Oko-Institut eV.

Grankvist, G. (2002). *Determinants of choice of Eco-labeled Products*. Academic Press.

Han, H., Hsu, L. T. J., Lee, J. S., & Sheu, C. (2011). Are lodging customers ready to go green? An examination of attitudes, demographics, and eco-friendly intentions. *International Journal of Hospitality Management*, *30*(2), 345–355. doi:10.1016/j.ijhm.2010.07.008

Initiative, T. O. (2003). *Sustainable Tourism: The Tour Operators' Contribution*. Paris: TOI.

International Hotels Environmental Initiatives. (1995). *Environmental management for hotels: The industry's guide to best practice.* Author.

International Tourism Partnership. (n.d.). *Going green: Minimum standards towards a sustainable hotel.* Retrieved from International Tourism Partnership website:http://www.tourismpartnership.org/images/content/downloads/pdf/going_green_english_final.pdf

Kaiser, F. G., Wolfing, S., & Fuhrer, U. (1999). Environmental attitude and ecological behaviour. *Journal of Environmental Psychology*, *19*(1), 1–19. doi:10.1006/jevp.1998.0107

Kang, K. H., Stein, L., Heo, C. Y., & Lee, S. (2012). Consumers' willingness to pay for green initiatives of the hotel industry. *International Journal of Hospitality Management*, *31*(2), 564–572. doi:10.1016/j.ijhm.2011.08.001

Kasliwal, N. & Agarwal, S. (2014). A Study on Indian consumers' Attitude and choice of preferences for green attributes of the hotel industry. *Prabandhan: Indian Journal of Management, 8*(1), 21-33

Kasliwal, N., & Agarwal, S. (2015). An Exploratory Study on Women's Perception and Choice of Preference towards the Green Attributes of Hotel Industry. *International Journal of Engineering Technology Management and Applied Sciences*, *3*, 304–312.

Kirk, D. (1995). Environmental management in hotels. *International Journal of Contemporary Hospitality Management*, *7*(6), 3–8. doi:10.1108/09596119510095325

Lee, J. S., Hsu, L. T., Han, H., & Kim, Y. (2010). Understanding How Consumers View Green Hotels: How A Hotel's Green Image Can Influence Behavioural Intentions. *Journal of Sustainable Tourism*, *18*(7), 901–914. doi:10.1080/09669581003777747

Mainieri, T., Barnett, E., Valdero, T., Unipan, J., & Oskamp, S. (1997). Green buying: The influence of environmental concern on consumer buying. *The Journal of Social Psychology*, *137*(2), 189–204. doi:10.1080/00224549709595430

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Manaktola, K., & Jauhari, V. (2007). Exploring Consumer Attitude and Behaviour towards Green Practices in the Lodging Industry in India. *International Journal of Contemporary Hospitality Management*, *19*(5), 364–377. doi:10.1108/09596110710757534

Martin, A. (2001). *Attitudes Towards Package Holidays and ABTA–2000*. London: Association of British Travel Agents.

Masau, P., & Prideaux, B. (2003). Sustainable tourism: A role for Kenya's hotel industry. *Current Issues in Tourism*, *6*(3), 197–208. doi:10.1080/13683500308667953

Millar, M., & Baloglu, S. (2008). *Hotel Guests' Preferences for Green Hotel Attributes*. Academic Press.

Mishra, P., & Sharma, M. P. (2011). *Green Marketing In India: Future Opportunity for Business*. Academic Press.

Mont, O. (2004). Institutionalisation of sustainable consumption patterns based on shared use. *Ecological Economics*, *50*(1-2), 135–153. doi:10.1016/j.ecolecon.2004.03.030

Mowforth, M., & Munt, I. (1998). *Tourism and sustainability: New tourism in the third world*. London: Routledge.

OECD. (2002). *Household Tourism Travel: Trends, Environmental Impacts and Policy Response.* Retrieved from http://www.oecd.org/

Ogbeide, G. C. (2012). Perception of green hotels in the 21st century. *Journal of Tourism Insights, 3*(1), Retrieved from http://scholarworks.gvsu.edu/jti/vol3/iss1/1

Ottman, J.A. (1994). *Green marketing Verde: challenges and opportunities to a new marketing era*. Academic Press.

Ottman, J. A. (1999). Green marketing: Will the consumer pay a premium for green? Business, 21(4), 36.

Peattie, K. (2001). Towards sustainability: The third age of green marketing. *The Marketing Review*, *2*(2), 129–146. doi:10.1362/1469347012569869

Saini, B. (2013). Green Marketing and its impact on consumer buying behavior. *International Journal of Engineering Science Invention*.

Schubert, F., Kandampully, J., Solnet, D., & Kralj, A. (2010). Exploring consumer perceptions of green restaurants in the US. *Tourism and Hospitality Research*, *10*(4), 286–300. doi:10.1057/thr.2010.17

Shove, E., & Warde, A. (2002). Inconspicuous consumption: the sociology of consumption, lifestyles and the environment. *Sociological Theory and the Environment: Classical Foundations, Contemporary Insights, 230*, 51.

Singh, G. (2013). A study of evolution and practice of green marketing by various companies in India. *International Journal of Management and Social Sciences Research*, *2*, 49–56.

Tanner, C., Kaiser, F. G., & WÖfing Kast, S. (2004). Contextual conditions of ecological consumerism. *Environment and Behavior*, *36*(1), 94–111. doi:10.1177/0013916503251437

UNEP. (2005). Making tourism more sustainable. In *A guide for policy makers.* Paris: UNEP and WTO.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

UNEP-EEA. (2006). *Priority issues in the Mediterranean environment*. Author.

Upham, P. (2001). A comparison of sustainability theory with UK and European airports policy and practice. *Journal of Environmental Management*, *63*(3), 237–248. doi:10.1006/jema.2001.0469 PMID:11775497

VISIT. (2005). *The Tourism Market: Potential Demand for Products.* Retrieved from http://www.your-visit.info/brochure/en/070.htm#nachfrage

Watkins, E. (1994). Do guests want green hotels? *Lodging Hospitality,* 70-72.

World Travel and Tourism Council. (2007). *United States: The 2007 travel & tourism economic research*. Retrieved from http://www.wttc.travel/bin/pdf/original_pdf_file/1unitedstates.pdf

Yadav, & Swaroop. (2013, Oct.). Green Marketing: Initiatives in the Indian Context. *Indian Journal of Marketing, 43*(10), 25-32.

Yan, J., Barkmann, J., et al. (2006). *Sustainable Production and Consumption in the Domestic Chinese Tourism Market: The Sceptics' Challenge for Sustainable Tourism in the Southwestern China Biodiversity Hotspot*. Academic Press.

ADDITIONAL READING

Ali, A., & Adil, M. (2014). Determining the Predictors of Green Consumer Behavior in India: An Empirical Study. *Journal of Marketing Communications*, *9*(3).

Barr, S., & Gilg, A. W. (2007). A conceptual framework for understanding and analyzing attitudes towards environmental behaviour. *Geografiska Annaler. Series B, Human Geography*, *89*(4), 361–379. doi:10.1111/j.1468-0467.2007.00266.x

Chen, T. B., & Chai, L. T. (2010). Attitude towards the environment and green products: consumers' perspective. *Management science and engineering, 4*(2), 27-39.

Da Silva Tamashiro, H. R., Da Silveira, J. A. G., Merlo, E. M., & Ghisi, M. (2013). The relationship between ecological knowledge, ecological concern, ecological affection, subjective norms and the green purchase behavior in Brazil. *African Journal of Business Management*, *7*(34), 3297–3314.

Dash, B. M., & Das, S. M. (2012). Green Marketing Strategies for Sustainable Business Growth. *Journal Of Business Management & Social Sciences Research*, *1*(1), 82–87.

Faulk, E. S. (2000). A survey of environmental management by hotels and related tourism businesses. *OIKOS PhD Summer Academy*, 1-22.

Ginsberg, J. M., & Bloom, P. N. (2004). Choosing the right green-marketing strategy. *MIT Sloan Management Review*, *46*(1), 79.

Kotler, P. (2012). *Marketing Management: South Asian perspective* (14th ed.). Pearson Publishers.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Mostafa, M. M. (2007). Gender differences in Egyptian consumers' green purchase behaviour: The effects of environmental knowledge, concern and attitude. *International Journal of Consumer Studies*, *31*(3), 220–229. doi:10.1111/j.1470-6431.2006.00523.x

Mowforth, M., & Munt, I. (2008). *Tourism and sustainability: Development, globalisation and new tourism in the third world*. Routledge. doi:10.4324/9780203891056

Ottman, J. (2011). *The new rules of green marketing: Strategies, tools, and inspiration for sustainable branding*. Berrett-Koehler Publishers.

Peattie, K., & Charter, M. (2003).Green marketing. *The marketing book, 5*, 726-755.

Perera, H. L. N., & Pushpanathan, A. (2015). Green Marketing Practices and Customer Satisfaction: A Study of Hotels Industry in Wennappuwa Divisional Secretariat. *Tourism. Leisure and Global Change*, *2*(1), 13–29.

Polonsky, M. J. (1994). An introduction to green marketing. *Electronic Green Journal, 1*(2).

Poupineau, S., & Pouzadoux, C. (2013). Internal and External factors that influence the ecotourists: A study on green consumer behavior, applied to ecotourism.

Punitha, S., & Rasdi, R. M. (2013). Corporate Social Responsibility: Adoption of Green Marketing by Hotel Industry. *Asian Social Science*, *9*(17), 79. doi:10.5539/ass.v9n17p79

Saxena, R. P., & Khandelwal, P. K. (2008). Consumer attitude towards green marketing: an exploratory study.

Zabkar, V., & Hosta, M. (2013). Willingness to act and environmentally conscious consumer behaviour: Can prosocial status perceptions help overcome the gap? *International Journal of Consumer Studies*, *37*(3), 257–264. doi:10.1111/j.1470-6431.2012.01134.x

KEY TERMS AND DEFINITIONS

Green Consumers: Those consumers who are concern towards the environment and buy the green products which are eco-friendly.

Green Hotels: Those hotels which perform environment friendly operations.

Green Marketing: Marketing of those products which are environment friendly.

Green Products: Those products which are environment friendly.

Green Services: Those services which are environment friendly.

Sustainability: The quality of not being harmful to the environment.

This research was previously published in the Handbook of Research on Promotional Strategies and Consumer Influence in the Service Sector edited by Upendra Singh Panwar, Raj Kumar, and Nilanjan Ray, pages 197-214, copyright year 2016 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 27
Building Theory of Green Procurement Using Fuzzy TISM and Fuzzy DEMATEL Methods

Surajit Bag
Tega Industries South Africa Pty. Ltd., South Africa

ABSTRACT

Green procurement is the set of procurement policies held, action taken and relationships formed in response to concerns linked with the natural environment. Green procurement has drawn major attention of supply chain practitioners' and has become the theme of most of the seminars and workshops. Green procurement is gaining popularity due to its positive association with the triple bottom line. Firms implement green procurement to achieve sustainability in this dynamic business environment. There are several published papers that have adopted either qualitative or quantitative methodology to build and test theories in the discipline of green procurement. However multiple elements influencing green procurement creates decision making problem among supply chain practitioners. This has motivated to pursue the current study and further extend the theory of green procurement. The main purpose of the current study is to investigate the inter-relationships between elements of green procurement using advanced multi criteria decision making techniques. First systematic review of literature is done to identify the leading drivers. Secondly these drivers were refined through expert interview from manufacturing sector. Thirdly Fuzzy TISM and Fuzzy DEMATEL method were applied to find the intensity of influence of green procurement drivers and make a comparative study of elements. Finally, the conclusions of research are drawn and also present the managerial implications and directions of future research.

1. INTRODUCTION

Globally researchers and industry associations are seeking innovative eco-friendly approaches to conserve the natural resources and curb greenhouse gas emissions. The level of popularity of green procurement can be estimated from the high research output in leading journals such as IJPE, IJPR, IJPM, Resources, Conservation and Recycling Journals. Research output on green procurement has increased over the

DOI: 10.4018/978-1-5225-7915-1.ch027

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

years and reached its peak in 2013 and out of which 43 were survey papers, 14 case studies and only 5 were theoretical and conceptual papers (Appolloni et al., 2014). Environmental aspects have been an important consideration in Europe since the treaty of Rome in 1957. However, more importance was given since the United Nations conference on Environment and Development in the year 1992. In the European Union, the Sustainable Development Strategy was launched by the heads of state and government in 2001. Sustainable development strategy did not clearly refer to green procurement. However, at the world summit in 2002 which was organized in Johannesburg called for green public procurement.

In June 2003, the policy paper on integrated product policy has triggered to green public procurement in EU member states by 2006. Therefore, the epicenter of green purchasing, and sustainable development is Europe. The Government procurement agreement developed seeks to protect and preserve environment. Environmental criteria awarding for supplier selection and awarding orders, technology selection, methods and production process are all considered under EU government procurement agreement. It is mandatory for all member states to comply with the directives and allow for the integration of environmental considerations in supply and service contracts. Because of the purchasing power of the public sector the potential for green public procurement is enormous. Outside the European Union green public procurement initiatives has been developed in Japan, Philippines, Canada and USA.

European commission is proud to publish their handbook on Green Public Procurement. This handbook aims to encourage public authorities to buy eco-friendly goods. EU commission helps member states in establishing the plans and targets for green public procurement. Major barrier is the lack of environmental knowledge on the right criteria to include in tender documents, budgetary constraints due to up-front prices that are higher than prices of conventional goods and services. The handbook seeks to help overcome these barriers (Day, 2005). The member countries of EU practice green public procurement and has also influenced private sector to convert into green procurement practices. The EU handbook on Green Public Procurement promotes the idea of defining technical specifications in terms of performance or functional requirements. This allows tender participants to come up with innovative solutions.

Legal frameworks such as international legal framework for government procurement (GPA) are important to be implemented in developing countries like India. There is scope in converting to green electricity, renewable energy, use energy efficient computers and home appliances, water saving toilets and taps, buy organic foods and convert kitchen waste to compost for gardening, recycle waste water for gardening. Government should not only ask citizens to be environmentally conscious but demonstrate the eco-friendly buying process and also the process of recycling, reuse waste.

The main objectives of this paper are:

1. To identify the drivers that influence green procurement programs
2. To determine the interactions among the identified drivers
3. To understand the managerial implications of this study

This paper is structured into seven additional sections. The next section presents the systematic literature review which helps to identify the green procurement drivers. The third section introduces research methods. Forth section presents Fuzzy TISM and fifth section presents Fuzzy DEMATEL. Finally, conclusions, managerial implications, limitations and directions of future research are presented.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

2. LITERATURE REVIEW

Literature review is an important part of the any research study. Traditional review approach mostly lacks thoroughness, quality and information which ultimately do not make sense to practitioners. Here author attempts to use the process of systematic review for exploring and understanding the links. The systematic literature review (SLR) process creates transparency and assist in developing the research question which will further enhance the knowledge base. Earlier SLR was mainly used by researchers in the area of medical sciences but recently SLR has gained popularity in the area of management sciences. Some of the recent published papers which adopted SLR techniques are (Chakrabarty& Dubey, 2014; Bag & Anand, 2014a; Dubey and Ali, 2014; Srivastava & Dubey, 2014). The steps of systematic review of literature followed in the present study have been adopted based on the guidelines of Tranfield et al. (2003).

Stage 1: Planning the review

In this stage researcher conduct studies to assess the relevance and size of the literature and to draw up the boundaries of the topic. Our review basically focuses on articles published in reputed peer review journals. To set up a time span, a starting position was set at 2000. Library database (EBSCO) was used through a keyword search using keywords "Green Procurement," "Eco friendly practices" and "Environmental Purchasing." Since the literature is interlinked when we picked up one thread, we could easily identify the rest. Finally, we selected only the important papers relevant for the present study. The list of cited references is presented at the end of the study.

Phase 0: Identification the need for a review

The objective of conducting the review is to identify the research gaps in existing published literature and further develop the problem statement, research questions and research objective for the present research.

Phase 1: Preparation of a proposal for review

Researchers have carried out detailed review of research articles published in *IJPE, IJPR, IJPM,* and other reputed journals to understand the links for the present study and present a review proposal for the present study.

Phase 2: Development of a research protocol

In this step the conceptual discussion of the research problem and a statement of the problems' significance are presented.

New and innovative eco friendly methods of production are required to develop sustainable products which generally attract customers and enhance market share (Bag, 2014). Green procurement promotes sustainable production and consumption (Liu et al., 2012; Tenner and Kast, 2003). Environmental problem

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

not only occur during production but also from consumption of products. Dawson and Rober (2010), argued that sustainable consumption necessitates a sustainable procurement commitment. Therefore, right purchasing is linked to impact of society on the environment. Every purchase decision has ethical, resource, waste and community impact implications (Young et al., 2010). Green procurement reduces negative environment impact related to product production and consumption (Ho et al., 2010; Green et al., 2000). However, the success stories of green procurement implementation in developing countries are few. The underlying reasons are numerous. Firstly, it is due to the environmentally oriented products which are not effective in terms of their market place performance. It is necessary that the products are effective both internally versus competitors (Pujari et al., 2003). Secondly there are numerous barriers to implement green procurement practices and managers lack knowledge of critical success factors (Zhu and Sarkis, 2004). Addressing these critical success factors may provide firms new opportunities for competition (Zhu and Sarkis, 2006).

Firms in developing countries cannot improve on the triple bottom line until they understand the inter-relationships between the antecedents/drivers of green procurement. The present research shows the road map to firms in developing countries to dig out the benefits by implementing green procurement.

Stage 2: Conducting a review

Green Procurement has thrown up unique challenges in areas such as design of eco-friendly products, inventory management, collaboration with suppliers, reverse logistics and life cycle thinking. In this study, we focus at an important area of green procurement which has not received attention so far. The present study is motivated by recent green movement in South Africa and noted developments which can be set as a benchmark for other developing countries such as India.

Hassini et al., (2012) conducted a review considering the published papers during the last decade (2000-2010) which gives us important insights.

Tsai et al., (2012) found that green economy has a positive influence on customer perceived value on green products and motivates manufacturers in new eco innovation for product development.

Liu et al., (2012) found that environmental attitudes, perception of self responsibility greatly influence green procurement behavior.

Arslan et al., (2012) showed that environmental attitudes, environmental behavior and green product awareness have a positive effect on environmentally conscious purchasing behavior. Environmental attitude include action which contribute towards environment preservation and conservation. The environmental problems are present in human behavior, therefore it is essential to change the behavior and culture of organizations. Companies failing to implement environmental responsible operation will encounter a loss of competitiveness. We must note that both producers and customers have important role in environmental conservation.

There are existing studies which have identified green procurement drivers such as the study by El-Tayeb et al., (2010) where they examined the effect of four drivers (i.e., regulations, customer pressures, social responsibility and expected business benefits) on green purchasing.

Another study by Large and Thompson, (2011) also identified five potential drivers of green procurement such as green supply management capabilities, the strategic level of the purchasing department, the level of environmental commitment, the degree of green supplier assessment, and the degree of green collaboration with suppliers. The results suggest that the degree of green supplier assessment and the level of green collaboration exert direct influence on environmental performance.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Lee (2008) finds that buyer environmental requirements and support were positively linked to their suppliers' willingness to participate in green supply chain initiatives. The government can play an important role in motivating these suppliers.

Govindan et al., (2015) used ISM approach to identify inter-relationships among lean, green and resilient practices and supply chain performance. It is found that just in time (lean), flexible transportation (resilient) and green packaging (green) are the key drivers.

Green procurement can be used as a tool in managing environmental risk management (Caniels et al., 2013). They also identified the drivers for participation of suppliers in green initiatives and are supplier readiness and customer requirements.

Other studies on green procurement give us information on supplier development and collaboration. Firms monitoring their suppliers and focusing on supplier development can help to achieve supply materials that are less polluting and generate low wastage (Gimenez et al., 2012).

Gimenez (2012) studied the impact of sustainable operation on triple bottom line and concluded that supply chain collaboration has a statistically significant impact on the triple bottom line.

Vachon& Klassen (2008, 2013) argued that benefits of collaborative green practices were broadest with suppliers rather than collaboration with customers. However environmental information is essential for all collaborative efforts aiming at sustainable competitive advantage (Soler, 2010). The participation of suppliers in the eco-design stage is emphasized in the study by (Fu et al., 2012). Ji et al., (2014) found that top management commitment is the key factor for both green procurement and green supplier development. We have already discussed in the previous section about the importance given to green public procurement in European Union. There is an increasing recognition of the potential of green public procurement as a policy instrument (Burja, 2009). European Unions' "Europe 2020" strategy and 'Sustainable development' strategy portray green public procurement as an essential market based instrument to achieve the EUs' economic, environmental and energy goals (Kunzlik, 2013). In other respected work such as Attri et al., (2010) did a further analysis of environmental criteria in public procurement contracts. Further Azevedo et al., (2011) explored the relationships between green practices and supply chain performance. The findings suggest that there is a positive relationship between green practice implementation and operational performance. There is also a positive relationship between green practices and environmental performance. Researchers such as Kaiser el al., (2001) talked about the importance of life cycle thinking and green procurement practices in context to health care industry. Green Procurement can provide an easy solution to waste generation and disposal issues. In a recent article Kunzlik (2013) talked about sustainable and eco-innovative purchases precisely to stimulate firms to innovate and attain high environmental standards, maintaining its international advantage in environmental technologies.

Green Procurement supports other environmental standards (ISO 14000, Eco labeling). It can also be used as a tool to advance corporate social responsibility (Ho et al., 2010).

The benefits of green procurement are numerous but still many firms in developing countries fear to implement green purchasing thinking of the high costs. But we should bear in mind that the initial costs may be high but they save money during their life cycle. Therefore, it offsets the initial costs incurred in buying. It is essential to take into account the entire life cycle cost of the item.

The research gaps which evolved from the review of literature are presented to further develop the research objectives for the present study.

There are studies which report the drivers of green procurement. However, those studies have either not considered all major drivers or the developed models are not robust. Secondly there is dearth of stud-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

ies where earlier researchers have demonstrated application of advanced MCDM methods such as Fuzzy TISM or Fuzzy DEMATEL to investigate the inter-relationships between green procurement drivers.

The present research is motivated based on the recommendations of Azevedo et al., (2011) where they have shown potential research area in exploring the enablers and barriers which influence companies in taking green procurement decisions. Although Appolloni et al., (2014) conducted a review on green procurement considering the time frame between 1996 and 2013 but does not highlight the inter-relationships between the antecedents/drivers of green procurement practices and they have also kept it as one of the future research direction. They have also mentioned the need for strong qualitative and quantitative research to support the progress of green procurement.

3. RESEARCH METHODS

Good research is grounded in theory. Theory is necessary for scientific understanding of the underlying phenomenon. Numerous calls have been issued describing the need for greater use of theory in operations management. More theory driven empirical research has occurred as a result of these calls. However, the potential of qualitative research in theory building have been largely underestimated, specifically in the area of project and operations management. The objective of this research is to address this gap in the body of knowledge.

The main objective of this paper is to explore the inter-relationships between the enablers influencing successful green procurement practices. The boundaries of green procurement are still relatively vague. Therefore, at this initial stage of research it is better to select qualitative approach to gain deep insights. The current study intends to develop green procurement theory based on Fuzzy total interpretive structural modeling (Fuzzy TISM) approach and Fuzzy DEMATEL approach.

Fuzzy TISM is an extension of TISM which has its base from ISM. ISM methodology, transforms unclear, poorly articulated models of systems into clear, well-defined models. ISM uses experts to judge the variables, and the relations among the variables are interpreted. ISM depends on the experts' knowledge and familiarity with the firm, its operations, and its industry. Therefore, ISM generates deep knowledge of the subject and is greatly helpful for supply chain practitioners. The evolution of ISM dates back in the year 1974 by Warfield. The use of ISM gradually increased in the last decade where we have seminal works (e.g.: Bag and Anand (2015); Bag (in press); Agarwal & Vrat (2015); Jayalakshmi & Pramod (2015); Khatwani et al., (2015); Dubey& Ali, (2014); Dubey et al., (2015c), Dubey et al., (2014), Attri et al., (2013); Sushil, (2012); Sushil, (2009); Sushil, (2005a); Sushil, (2005b). ISM technique has been explored in depth by (Dubey et al., 2015a) where researchers have demonstrated that ISM is an effective methodology for theory building in Operations and Supply Chain Management. ISM has taken a major leap recently in one of the latest published research by (Dubey et al., 2015 b) where authors argued the use of mixed methods for theory building using ISM, MICMAC analysis and confirmatory factor analysis. Total Interpretive Structural Modeling (TISM) is an extension of ISM methodology and has been used in this study to overcome the limitations of ISM methodology. TISM is an advanced method and designed in a manner to capture both the statements of respondents as well as logic and interpretation. TISM model is a powerful tool and can be employed in complex situations where the number of elements is more since ISM fails in that kind of situation. TISM has greater explanatory power than other established inductive approaches. The merits of TISM have encouraged applying the interpretive logic-knowledge base for the green procurement drivers and developing the green procurement theory.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Fuzzy DEMATEL is an extension of DEMATEL technique. It is basically an extended method for building and analyzing a structural model for analyzing the influence relation among multiple criteria. Some of the seminal work on application of Fuzzy DEMATEL are Lin (2013); Mavi et al., (2013); Hsu et al., (2013); Shen et al., (2013); Kannan et al., (2013); Chang et al., (2013); Wu et al., (2013); Tseng & Chiu, (2013); Chang et al., (2011); Lin (2008).

Based on the above research objectives in mind authors has applied Fuzzy TISM and Fuzzy DEMATEL to develop theory on green procurement.

4. FUZZY TISM

The steps of Fuzzy TISM have been followed as per Khatwani et al., (2015). The Data analysis is segregated into following sub-sections:

4.1. Start the Decision Making Process

In the current study, the responses of five experts from manufacturing sector have been gathered. The input has been utilized to refine the criteria's and further used in modeling.

4.2. Selection of Criteria and Sub Criteria of Green Procurement

This is the second step in Fuzzy TISM modeling approach. For the purpose of this study, twenty-five drivers are identified from literature (Table 1) which influences green procurement practices and finally refined through experts' opinion. The final twenty sub criteria are presented in Table 1.

4.3. Gathering Responses and Calculation of Aggregated SSIM

The responses of five experts has been collected separately and further calculated the aggregated SSIM matrix by applying mode. The aggregated SSIM matrix is shown in Table 2.

4.4. Calculation of Fuzzy Reachability Matrix

The fuzzy reachibility matrix is generated from aggregated fuzzy SSIM matrix in step 4.3 above. The fuzzy reachibility matrix is shown in Table 3.

4.5. Calculation of Final Fuzzy Reachability Matrix

The final fuzzy reachibility matrix is derived from step 4.4 above Table 3. From the final fuzzy reachibility matrix (Table 4) the dependence power (X) and driving power (Y) is calculated based on summing of columns and rows and calculating the crisp value. The crisp value of each element is used as an input to develop fuzzy MICMAC analysis.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 1. Final set of criteria identified for Fuzzy TISM modeling

Purpose	Dimension	Criteria	References
Green Procurement Drivers	Discipline	Government policy and Regulations	Min & Galle, 1997; Diabat & Govindan, 2011; Hassini et al., 2012; Bag, 2014; Appolloni et al., 2014
		Total Quality Environmental management	Diabat& Govindan, 2011; Ageron et al., 2012; Bag, 2014; Bag & Anand, 2014; Dubey et al., 2014
	Management Commitment	Management Support	Min & Galle, 1997; Zhu et al., 2008; Arslan, 2012; Bag, 2014
		Management Review	Experts Opinion
		Continuous education of employees	Experts Opinion
		Cross functional team building	Experts Opinion
		Organization Culture	Experts Opinion
	Green Engineering	Green process and Technology	Green et al., 2000; Hassini et al., 2012; Bag, 2014
		Information System Infrastructure	Green et al., 1998; Hervani et al., 2005; Bag, 2014
		Green Design	Mavi et al., 2013
		Re-use, Re-engineering and Recycling of products and materials	Mavi et al., 2013
	Supplier Relationship	Supplier Flexibility	Ageron et al., 2012; Bag, 2014; Bag & Anand, 2014; Dubey et al., 2014
		Suppliers' capability to Innovate	Min & Galle, 2001; Chiou et al., 2011; Ageron et al., 2012
		Supply risk management	Ageron et al., 2012; Bag, 2014; Bag & Anand, 2014; Dubey et al., 2014
		Trust building in suppliers	Ageron et al., 2012; Ji et al., 2014
		Low supplier lead time	Ageron et al., 2012; Bag, 2014; Bag & Anand, 2014; Dubey et al., 2014
	Supply chain performance	Customer Satisfaction	Diabat& Govindan, 2011; Ageron et al., 2012; Bag, 2014; Bag & Anand, 2014; Dubey et al., 2014
		Annual Savings from green procurement practices	Experts Opinion
		Annual Saving of natural resources	Experts Opinion
		Procurement Excellence	Experts Opinion

4.6. Driving Power and Dependence Power Matrix (MICMAC) Based on Fuzzy Reachibility Matrix of Table 4

Driving Power and Dependence Power Matrix (MICMAC) based on Fuzzy Reachibility Matrix of Table 4 is shown in Figure 1.

Cluster 1. Autonomous Variables: These variables have a weak drive power and weak dependence power. In this cluster we have six variables. Total Quality Environmental management (E2), Management Support (E3), Management Review (E4), Cross functional team building (E6), Organization Culture (E7) and Information System Infrastructure (E9).

Cluster 2. Dependence Variables: These variables have a weak drive power but strong dependence power. In this cluster we have twelve variables. Green process and Technology (E8), Green Design (E10), Re-use, Re-engineering and Recycling of products and materials (E11), Supplier Flexibility (E12), Suppliers' capability to Innovate (E13), Supply risk management (E14), Trust building in suppliers (E15), Low supplier lead time (E16), Customer Satisfaction (E17), Annual Savings from

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 2. Aggregated SSIM Matrix

	E 20	E 19	E 18	E 17	E 16	E 15	E 14	E 13	E 12	E 11	E 10	E 9	E 8	E 7	E 6	E 5	E 4	E 3	E 2	E 1
E 1	O(No)	V(VH)	V(VH)	O(No)	O(No)	O(No)	O(No)	O(No)	O(No)	V(VH)	V(VH)	V(L)	V(VH)	O(No)	O(No)	O(No)	O(No)	O(No)	V(VH)	
E 2	V(VH)	V(VH)	V(VH)	V(VH)	V(L)	V(H)	V(VH)	V(H)	V(H)	V(VH)	V(VH)	V(H)	V(VH)	O(No)	V(VH)	V(H)	O(No)	O(No)		
E 3	V(VH)	V(VH)	V(VH)	V(H)	V(L)	V(H)	V(H)	V(H)	V(H)	V(VH)	V(VH)	V(VH)	V(VH)	V(H)	V(VH)	V(VH)	V(H)			
E 4	V(VH)	V(VH)	V(VH)	V(H)	V(H)	V(L)	V(H)	V(L)	V(L)	V(H)	V(H)	V(L)	V(H)	V(L)	V(H)	V(H)				
E 5	V(VH)	V(H)	V(H)	V(L)	O(No)	O(No)	O(No)	O(No)	O(No)	V(H)	V(H)	O(No)	V(H)	O(No)	V(L)					
E 6	V(VH)	V(VH)	V(VH)	V(L)	V(L)	V(L)	V(H)	V(L)	V(H)	V(VH)	V(VH)	V(L)	V(VH)	O(No)						
E 7	V(VH)	V(VH)	V(VH)	V(VH)	V(L)	V(VH)	V(VH)	V(VH)	V(VH)	V(VH)	V(VH)	V(VH)	V(VH)							
E 8	V(VH)	V(VH)	V(VH)	V(VH)	V(VH)	V(VH)	V(VH)	V(H)	V(H)	V(VH)	V(VH)	V(H)								
E 9	V(H)	V(L)	V(L)	V(L)	V(L)	O(No)	V(H)	O(No)	O(No)	V(L)	V(L)									
E 10	V(H)	V(VH)	V(VH)	V(VH)	V(H)	V(H)	V(H)	V(H)	V(H)	V(VH)										
E 11	V(VH)	V(VH)	V(VH)	V(VH)	V(H)	V(H)	V(H)	V(H)	V(H)											
E 12	V(H)	V(H)	V(L)	O(No)	V(VH)	V(H)	V(VH)	V(VH)												
E 13	V(VH)	V(VH)	V(VH)	V(H)	V(H)	V(L)	V(VH)													
E 14	V(VH)	O(No)	O(No)	V(H)	A(VH)	A(VH)														
E 15	V(VH)	V(H)	V(H)	O(No)	V(VH)															
E 16	V(H)	V(L)	V(L)	V(L)																
E 17	A(VH)	A(H)	A(H)																	
E 18	X(VH)	X(VH)																		
E 19	X(VH)																			
E 20																				

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 3. Fuzzy Reachability Matrix

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	E12	E13	E14	E15	E16	E17	E18	E19	E20
E 1	1	VH	No	No	No	No	No	VH	L	VH	VH	No	No	No	No	No	No	VH	VH	No
E 2	No	1	No	No	H	VH	No	VH	H	VH	VH	H	H	VH	H	L	VH	VH	VH	VH
E 3	No	No	1	H	VH	VH	H	VH	VH	VH	VH	H	H	H	H	L	H	VH	VH	VH
E 4	No	No	No	1	H	H	L	H	L	H	H	L	L	H	L	H	H	VH	VH	VH
E 5	No	No	No	No	1	L	No	H	No	H	H	No	No	No	No	No	L	H	H	VH
E 6	No	No	No	No	No	1	No	VH	L	VH	VH	H	L	H	L	L	L	VH	VH	VH
E 7	No	No	No	No	No	No	1	VH	VH	VH	VH	VH	VH	VH	VH	L	VH	VH	VH	VH
E 8	No	No	No	No	No	No	No	1	H	VH	VH	H	H	VH	VH	VH	VH	VH	VH	VH
E 9	No	No	No	No	No	No	No	No	1	L	L	No	No	H	No	L	L	L	L	H
E 10	No	No	No	No	No	No	No	No	No	1	VH	H	H	H	H	H	VH	VH	VH	H
E 11	No	No	No	No	No	No	No	No	No	No	1	H	H	H	H	H	VH	VH	VH	VH
E 12	No	No	No	No	No	No	No	No	No	No	No	1	VH	VH	H	VH	No	L	H	H
E 13	No	No	No	No	No	No	No	No	No	No	No	No	1	VH	L	H	H	VH	VH	VH
E 14	No	No	No	No	No	No	No	No	No	No	No	No	No	1	No	No	H	No	No	VH
E 15	No	No	No	No	No	No	No	No	No	No	No	No	No	VH	1	VH	No	H	H	VH
E 16	No	No	No	No	No	No	No	No	No	No	No	No	No	VH	No	1	L	L	L	H
E 17	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	1	No	No	No
E 18	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	H	1	VH	VH
E 19	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	H	VH	1	VH
E 20	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	VH	VH	VH	1

green procurement practices (E18), Annual Saving of natural resources (E19) and Procurement Excellence (E20).

Cluster 3. Linkage Variables: These variables have a strong drive power as well as strong dependence power. Linkage variables are very sensitive and unstable. Any action on these variables will trigger an effect on other variables and also a feedback on themselves. In this cluster we have no variables.

Cluster 4. Driving Variables: These variables have a strong drive power but weak dependence power. In this cluster we have two variables. Government policy and Regulations (E1) and Continuous education of employees (E5).

4.7. Defuzzified Reachibility Matrix

The Defuzzified reachibility matrix with fuzzy linguistic terms VH, H as 1 and rest as 0 is shown in Table 5.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 4. Final Fuzzy Reachibility matrix

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	E12	E13	E14	E15	E16	E17	E18	E19	E20	Driving Power	Crisp Value
E 1	(1,1,1)	(0.75,1.0,1.0)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0.75,1.0,1.0)	(0.25,0.5,0.75)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0,0,0.25)	(5.75,7.50,10.75)	1.71
E 2	(0,0,0.25)	(1,1,1)	(0,0,0.25)	(0,0,0.25)	(0.5,0.75,1.0)	(0.75,1.0,1.0)	(0,0,0.25)	(0.75,1.0,1.0)	(0.5,0.75,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.5,0.75,1.0)	(0.5,0.75,1.0)	(0.75,1.0,1.0)	(0.5,0.75,1.0)	(0.25,0.5,0.75)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(10.50,14.25,16.75)	0.70
E 3	(0,0,0.25)	(0,0,0.25)	(1,1,1)	(0,0,0.25)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.5,0.75,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.5,0.75,1.0)	(0.5,0.75,1.0)	(0.5,0.75,1.0)	(0.5,0.75,1.0)	(0.25,0.5,0.75)	(0.5,0.75,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(11.5,15.75,19.25)	0.76
E 4	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(1,1,1)	(0.5,0.75,1.0)	(0.5,0.75,1.0)	(0.25,0.5,0.75)	(0.5,0.75,1.0)	(0.25,0.5,0.75)	(0.5,0.75,1.0)	(0.5,0.75,1.0)	(0.25,0.5,0.75)	(0.25,0.5,0.75)	(0.5,0.75,1.0)	(0.25,0.5,0.75)	(0.5,0.75,1.0)	(0.5,0.75,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(8.50,12.50,16.50)	0.69
E 5	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(1,1,1)	(0.25,0.5,0.75)	(0,0,0.25)	(0.5,0.75,1.0)	(0,0,0.25)	(0.5,0.75,1.0)	(0.5,0.75,1.0)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0.25,0.5,0.75)	(0.5,0.75,1.0)	(0.5,0.75,1.0)	(0.75,1.0,1.0)	(4.75,6.75,11.25)	0.92
E 6	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(1,1,1)	(0,0,0.25)	(0.75,1.0,1.0)	(0.25,0.5,0.75)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.5,0.75,1.0)	(0.25,0.5,0.75)	(0.5,0.75,1.0)	(0.25,0.5,0.75)	(0.25,0.5,0.75)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(7.75,11,14.25)	0.53
E 7	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(1,1,1)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.25,0.5,0.75)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(10.25,13.5,15.25)	0.63
E 8	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(1,1,1)	(0.5,0.75,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.5,0.75,1.0)	(0.5,0.75,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(9.25,12.25,14.75)	0.59
E 9	(0.25,0.5,0.75)	(0.5,0.75,1.0)	(0.75,1.0,1.0)	(0.25,0.5,0.75)	(0.5,0.75,1.0)	(0.5,0.75,1.0)	(0.25,0.5,0.75)	(0.5,0.75,1.0)	(1,1,1)	(0.5,0.75,1.0)	(0.5,0.75,1.0)	(0.5,0.75,1.0)	(0.5,0.75,1.0)	(0.5,0.75,1.0)	(0.5,0.75,1.0)	(0.5,0.75,1.0)	(0.5,0.75,1.0)	(0.5,0.75,1.0)	(0.5,0.75,1.0)	(0.5,0.75,1.0)	(3.50,5.50,9.50)	0.26
E 10	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(1,1,1)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(7,9.50,13.25)	0.46
E 11	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(1,1,1)	(0.5,0.75,1.0)	(0.5,0.75,1.0)	(0.5,0.75,1.0)	(0.5,0.75,1.0)	(0.5,0.75,1.0)	(0.5,0.75,1.0)	(0.5,0.75,1.0)	(0.5,0.75,1.0)	(0.5,0.75,1.0)	(6.50,8.75,12.50)	0.43
E 12	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(1,1,1)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0,0,0.25)	(0,0,0.25)	(0.25,0.5,0.75)	(0,0,0.25)	(0,0,0.25)	(5,6.75,12.50)	0.35

continued on following page

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 4. Continued

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	E12	E13	E14	E15	E16	E17	E18	E19	E20	Driving Power	Crisp Value
E 13	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(1,1,1)	(0.75,1.0,1.0)	(0.25,0.5,0.75)	(0.5,0.75,1.0)	(0.5,0.75,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(5.25,7,10.75)	0.33
E 14	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(1,1,1)	(0,0,0.25)	(0,0,0.25)	(0.5,0.75,1.0)	(0,0,0.25)	(0,0,0.25)	(0.75,1.0,1.0)	(2.25,2.75,7.25)	0.11
E 15	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0.75,1.0,1.0)	(1,1,1)	(0.75,1.0,1.0)	(0,0,0.25)	(0.5,0.75,1.0)	(0.5,0.75,1.0)	(0.75,1.0,1.0)	(4.25,5.5,9.5)	0.26
E 16	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0.75,1.0,1.0)	(0,0,0.25)	(1,1,1)	(0.25,0.5,0.75)	(0.25,0.5,0.75)	(0.25,0.5,0.75)	(0.5,0.75,1.0)	(3.4,25,8.75)	0.19
E 17	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(1,1,1)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(1,1,5.75)	0.20
E 18	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0.5,0.75,1.0)	(1,1,1)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(3,3.75,8)	0.18
E 19	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0.5,0.75,1.0)	(0.75,1.0,1.0)	(1,1,1)	(0.75,1.0,1.0)	(3,3.75,8)	0.18
E 20	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0,0,0.25)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(0.75,1.0,1.0)	(1,1,1)	(3.25,4,8)	0.18
Dependence Power	(1,1,5.75)	(1.75,2,6.5)	(1,1,5.75)	(1.5,1.75,6.50)	(2.75,3,50.8)	(3.25,4.25,8.5)	(1.75,2.25,7)	(5.75,7,5.11)	(4.25,6,10.25)	(6.75,9,12.25)	(7.5,10,13)	(5,7,11.50)	(5.5,7.75,12)	(9.25,12.5,15.50)	(6.25,8.25,12.50)	(6.5,9.5,13.50)	(9.5,13.5,16.75)	(11.75,16,17.75)	(12,16.25,18)	(12.75,17,18.5)		
Crisp Value	0.03	0.07	0.03	0.07	0.17	0.20	0.09	0.38	0.29	0.44	0.50	0.36	0.40	0.63	0.43	0.48	0.67	0.79	0.82	0.85		

4.8. Defuzzified Reachability Matrix and Transitivity Check

The paired comparisons are translated in the form of reachability Matrix. The matrix has been also checked for transitivity rule. A final reachability matrix, post transitivity check is presented in Table 6.

4.9. Driving Power and Dependence Power Matrix (MICMAC) Based on Defuzzified Reachibility Matrix of Table 6

Driving Power and Dependence Power Matrix (MICMAC) based on Defuzzified Reachibility Matrix of Table 6 is shown in Figure 2.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 1. MICMAC analysis based on crisp values

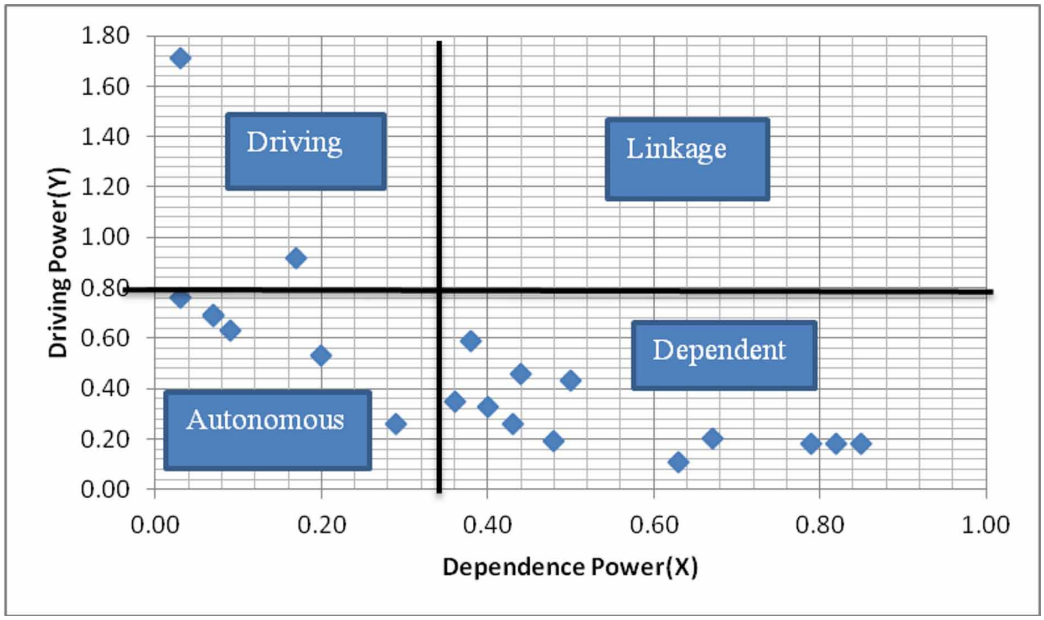


Table 5. Defuzzified Reachability Matrix

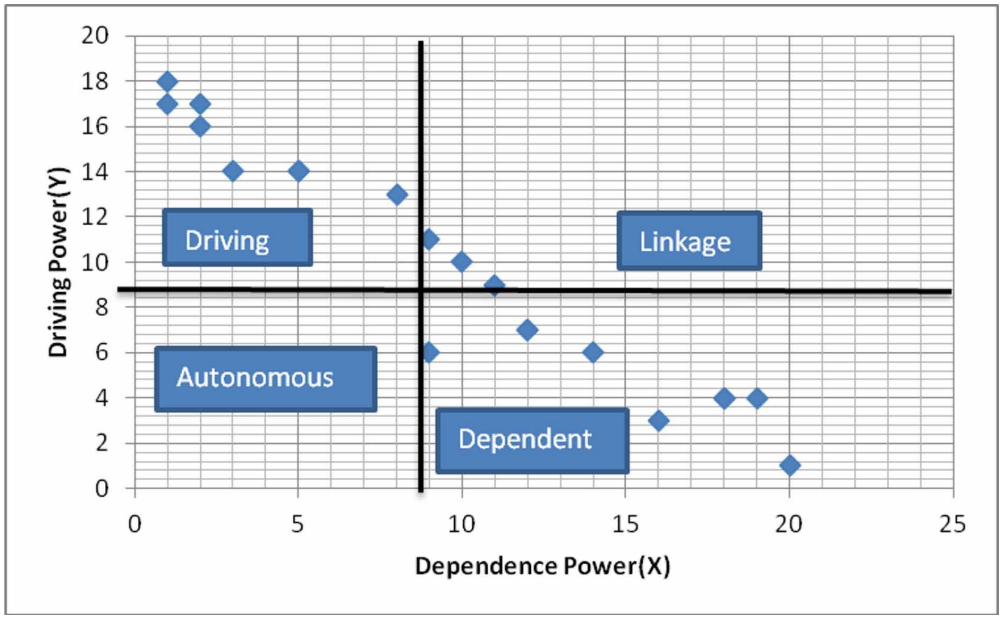
	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	E12	E13	E14	E15	E16	E17	E18	E19	E20
E 1	1	1	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	1	1	0
E 2	0	1	0	0	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1
E 3	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1
E 4	0	0	0	1	1	1	0	1	0	1	1	0	0	1	0	1	1	1	1	1
E 5	0	0	0	0	1	0	0	1	0	1	1	0	0	0	0	0	0	1	1	1
E 6	0	0	0	0	0	1	0	1	0	1	1	1	0	1	0	0	0	1	1	1
E 7	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1
E 8	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1
E 9	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	1
E 10	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1
E 11	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
E 12	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	0	1	1
E 13	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	1	1	1
E 14	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1
E 15	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	1	1
E 16	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	1
E 17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
E 18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
E 19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
E 20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 6. Defuzzified Reachability Matrix and Transitivity Check

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	E12	E13	E14	E15	E16	E17	E18	E19	E20
E1	1	1	0	0	1*	1*	0	1	1*	1	1	1*	1*	1*	1*	1*	1*	1	1	1*
E2	0	1	0	0	1	1	1*	1	1	1	1	1	1	1	1	1*	1	1	1	1
E3	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1*	1	1	1	1
E4	0	0	0	1	1	1	0	1	1*	1	1	1*	1*	1	1*	1	1	1	1	1
E5	0	0	0	0	1	0	0	1	1*	1	1	1*	1*	1*	1*	1*	1*	1	1	1
E6	0	0	0	0	0	1	0	1	1*	1	1	1	1*	1	1*	1*	1*	1	1	1
E7	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1*	1	1	1	1
E8	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1
E9	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1*	1*	1*	1
E10	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1
E11	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
E12	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1*	1*	1	1
E13	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	1	1	1
E14	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1
E15	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1*	1	1	1
E16	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1*	1*	1
E17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
E18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
E19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
E20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1

Figure 2. MICMAC analysis based on Table 6



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Cluster 1. Autonomous Variables: These variables have a weak drive power and weak dependence power. In this cluster we have no variables.

Cluster 2. Dependent Variables: These variables have a weak drive power but strong dependence power. In this cluster we have nine variables. Information System Infrastructure (E9), Suppliers' capability to Innovate (E13), Supply risk management (E14), Trust building in suppliers (E15), Low supplier lead time (E16), Customer Satisfaction (E17), Annual Savings from green procurement practices (E18), Annual Saving of natural resources (E19), Procurement Excellence (E20).

Cluster 3. Linkage Variables: These variables have a strong drive power as well as strong dependence power. Linkage variables are very sensitive and unstable. Any action on these variables will trigger an effect on other variables and also a feedback on themselves. In this cluster we have three variables. Green Design (E10), Re-use, Re-engineering and Recycling of products and materials (E11) and Supplier Flexibility (E12).

Cluster 4. Driving Variables: These variables have a strong drive power but weak dependence power. In this cluster we have eight variables. Government policy and Regulations (E1), Total Quality Environmental management (E2), Management Support (E3), Management Review (E4), Continuous education of employees (E5), Cross functional team building (E6), Organization Culture (E7), and Green process and Technology (E8).

4.10. Level Partition on Reachability Matrix

The final reachability matrix obtained above in Table 6 is now partitioned into different levels (Table 7). After the first iteration, the driver classified to level 1 is discarded and the partitioning procedure is repeated on the remaining drivers to determine the level 2. These iterations are continued until the level of each driver has been determined.

4.11. TISM Diagraph

The connective and interpretive information contained in the interpretive direct interaction matrix and diagraph is used to derive the TISM. The nodes in the diagraph are replaced by the interpretation of elements placed in boxes. The interpretation of the cells of interpretive direct interaction matrix is depicted by the side of the respective links in the structural model. The final TISM model is presented in Figure 3.

4.12. Discussion on Fuzzy TISM Analysis

In the current study first author proposes a Fuzzy TISM method for identifying the interrelationships among elements influencing green procurement. Due to incorporation of fuzziness in TISM the decision makers have the flexibility in assigning the level of influence of pair wise elements. Apart from wider flexibility Fuzzy TISM also enhance the quality of decision making. The findings from the TISM model show that Customer Satisfaction is in level 1, Annual Savings from green procurement practices, Annual Saving of natural resources and Procurement Excellence are in level 2, Supply risk management is in level 3, Information System Infrastructure and Low supplier lead time is in level 4, Suppliers' capability to Innovate and Trust building in suppliers is in level 5, Supplier Flexibility is in level 6, Re-use, Re-engineering and Recycling of products and materials is in level 7, Green Design is in level 8, Green process and Technology is in level 9, Continuous education of employees, Cross functional

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 7. Partitioning of the reachibility matrix

Iterations	Elements	RS	AS	IS	Level
	E1	1,2,5,6,8,9,10,11,12,13,14,15,16,17,18,19,20	1	1	
	E2	2,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20	1,2	2	
	E3	3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20	3	3	
	E4	4,5,6,8,9,10,11,12,13,14,15,16,17,18,19,20	3,4	4	
	E5	5,8,9,10,11,12,13,14,15,16,17,18,19,20	1,2,3,4,5	5	
	E6	6,8,9,10,11,12,13,14,15,16,17,18,19,20	1,2,3,4,6	6	
	E7	7,8,9,10,11,12,13,14,15,16,17,18,19,20	2,3,7	7	
Iteration 1	E8	8,9,10,11,12,13,14,15,16,17,18,19,20	1,2,3,4,5,6,7,8	8	
	E9	9,14,17,18,19,20	1,2,3,4,5,6,7,8,9	9	
	E10	10,11,12,13,14,15,16,17,18,19,20	1,2,3,4,5,6,7,8,10	10	
	E11	11,12,13,14,15,16,17,18,19,20	1,2,3,4,5,6,7,8,10,11	11	
	E12	12,13,14,15,16,17,18,19,20	1,2,3,4,5,6,7,8,10,11,12	12	
	E13	13,14,16,17,18,19,20	1,2,3,4,5,6,7,8,10,11,12,13	13	
	E14	14,17,20	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16	14	
	E15	14,15,16,17,18,19,20	1,2,3,4,5,6,7,8,10,11,12,15	15	
	E16	14,16,17,18,19,20	1,2,3,4,5,6,7,8,10,11,12,13,15,16	16	
	E17	17	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20	17	I
	E18	17,18,19,20	1,2,3,4,5,6,7,8,9,10,11,12,13,15,16,18,19,20	18,19,20	
	E19	17,18,19,20	1,2,3,4,5,6,7,8,9,10,11,12,13,15,16,18,19,20	18,19,20	
	E20	17,18,19,20	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,18,19,20	18,19,20	
	E1	1,2,5,6,8,9,10,11,12,13,14,15,16,18,19,20	1	1	
	E2	2,5,6,7,8,9,10,11,12,13,14,15,16,18,19,20	1,2	2	
	E3	3,4,5,6,7,8,9,10,11,12,13,14,15,16,18,19,20	3	3	
	E4	4,5,6,8,9,10,11,12,13,14,15,16,18,19,20	3,4	4	
	E5	5,8,9,10,11,12,13,14,15,16,18,19,20	1,2,3,4,5	5	
	E6	6,8,9,10,11,12,13,14,15,16,18,19,20	1,2,3,4,6	6	
	E7	7,8,9,10,11,12,13,14,15,16,18,19,20	2,3,7	7	
Iteration 2	E8	8,9,10,11,12,13,14,15,16,18,19,20	1,2,3,4,5,6,7,8	8	
	E9	9,14,18,19,20	1,2,3,4,5,6,7,8,9	9	
	E10	10,11,12,13,14,15,16,18,19,20	1,2,3,4,5,6,7,8,10	10	
	E11	11,12,13,14,15,16,18,19,20	1,2,3,4,5,6,7,8,10,11	11	
	E12	12,13,14,15,16,18,19,20	1,2,3,4,5,6,7,8,10,11,12	12	
	E13	13,14,16,18,19,20	1,2,3,4,5,6,7,8,10,11,12,13	13	
	E14	14,20	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16	14	
	E15	14,15,16,18,19,20	1,2,3,4,5,6,7,8,10,11,12,15	15	
	E16	14,16,17,18,19,20	1,2,3,4,5,6,7,8,10,11,12,13,15,16	16	
	E18	18,19,20	1,2,3,4,5,6,7,8,9,10,11,12,13,15,16,18,19,20	18,19,20	II
	E19	18,19,20	1,2,3,4,5,6,7,8,9,10,11,12,13,15,16,18,19,20	18,19,20	II

continued on following page

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 7. Continued

Iterations	Elements	RS	AS	IS	Level
	E20	18,19,20	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,18,19,20	18,19,20	II
	E1	1,2,5,6,8,9,10,11,12,13,14,15,16	1	1	
	E2	2,5,6,7,8,9,10,11,12,13,14,15,16	1,2	2	
	E3	3,4,5,6,7,8,9,10,11,12,13,14,15,16	3	3	
	E4	4,5,6,8,9,10,11,12,13,14,15,16	3,4	4	
	E5	5,8,9,10,11,12,13,14,15,16	1,2,3,4,5	5	
Iteration 3	E6	6,8,9,10,11,12,13,14,15,16	1,2,3,4,6	6	
	E7	7,8,9,10,11,12,13,14,15,16	2,3,7	7	
	E8	8,9,10,11,12,13,14,15,16	1,2,3,4,5,6,7,8	8	
	E9	9,14	1,2,3,4,5,6,7,8,9	9	
	E10	10,11,12,13,14,15,16	1,2,3,4,5,6,7,8,10	10	
	E11	11,12,13,14,15,16	1,2,3,4,5,6,7,8,10,11	11	
	E12	12,13,14,15,16	1,2,3,4,5,6,7,8,10,11,12	12	
	E13	13,14,16	1,2,3,4,5,6,7,8,10,11,12,13	13	
	E14	14	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16	14	III
	E15	14,15,16	1,2,3,4,5,6,7,8,10,11,12,15	15	
	E16	14,16	1,2,3,4,5,6,7,8,10,11,12,13,15,16	16	
	E1	1,2,5,6,8,9,10,11,12,13,15,16	1	1	
	E2	2,5,6,7,8,9,10,11,12,13,15,16	1,2	2	
	E3	3,4,5,6,7,8,9,10,11,12,13,15,16	3	3	
	E4	4,5,6,8,9,10,11,12,13,15,16	3,4	4	
	E5	5,8,9,10,11,12,13,15,16	1,2,3,4,5	5	
	E6	6,8,9,10,11,12,13,15,16	1,2,3,4,6	6	
Iteration 4	E7	7,8,9,10,11,12,13,15,16	2,3,7	7	
	E8	8,9,10,11,12,13,15,16	1,2,3,4,5,6,7,8	8	
	E9	9	1,2,3,4,5,6,7,8,9	9	IV
	E10	10,11,12,13,15,16	1,2,3,4,5,6,7,8,10	10	
	E11	11,12,13,15,16	1,2,3,4,5,6,7,8,10,11	11	
	E12	12,13,15,16	1,2,3,4,5,6,7,8,10,11,12	12	
	E13	13,16	1,2,3,4,5,6,7,8,10,11,12,13	13	
	E15	15,16	1,2,3,4,5,6,7,8,10,11,12,15	15	
	E16	16	1,2,3,4,5,6,7,8,10,11,12,13,15,16	16	IV
	E1	1,2,5,6,8,10,11,12,13,15	1	1	
	E2	2,5,6,7,8,10,11,12,13,15	1,2	2	
	E3	3,4,5,6,7,8,10,11,12,13,15	3	3	
	E4	4,5,6,8,10,11,12,13,15	3,4	4	
	E5	5,8,10,11,12,13,15	1,2,3,4,5	5	
Iteration 5	E6	6,8,10,11,12,13,15	1,2,3,4,6	6	

continued on following page

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 7. Continued

Iterations	Elements	RS	AS	IS	Level
	E7	7,8,10,11,12,13,15	2,3,7	7	
	E8	8,10,11,12,13,15	1,2,3,4,5,6,7,8	8	
	E10	10,11,12,13,15	1,2,3,4,5,6,7,8,10	10	
	E11	11,12,13,15	1,2,3,4,5,6,7,8,10,11	11	
	E12	12,13,15	1,2,3,4,5,6,7,8,10,11,12	12	
	E13	13	1,2,3,4,5,6,7,8,10,11,12,13	13	V
	E15	15	1,2,3,4,5,6,7,8,10,11,12,15	15	V
	E1	1,2,5,6,8,10,11,12	1	1	
	E2	2,5,6,7,8,10,11,12	1,2	2	
	E3	3,4,5,6,7,8,10,11,12	3	3	
	E4	4,5,6,8,10,11,12	3,4	4	
Iteration 6	E5	5,8,10,11,12	1,2,3,4,5	5	
	E6	6,8,10,11,12	1,2,3,4,6	6	
	E7	7,8,10,11,12	2,3,7	7	
	E8	8,10,11,12	1,2,3,4,5,6,7,8	8	
	E10	10,11,12	1,2,3,4,5,6,7,8,10	10	
	E11	11,12	1,2,3,4,5,6,7,8,10,11	11	
	E12	12	1,2,3,4,5,6,7,8,10,11,12	12	VI
	E1	1,2,5,6,8,10,11	1	1	
	E2	2,5,6,7,8,10,11	1,2	2	
	E3	3,4,5,6,7,8,10,11	3	3	
	E4	4,5,6,8,10,11	3,4	4	
Iteration 7	E5	5,8,10,11	1,2,3,4,5	5	
	E6	6,8,10,11	1,2,3,4,6	6	
	E7	7,8,10,11	2,3,7	7	
	E8	8,10,11	1,2,3,4,5,6,7,8	8	
	E10	10,11	1,2,3,4,5,6,7,8,10	10	
	E11	11	1,2,3,4,5,6,7,8,10,11	11	VII
	E1	1,2,5,6,8,10	1	1	
	E2	2,5,6,7,8,10	1,2	2	
	E3	3,4,5,6,7,8,10	3	3	
Iteration 8	E4	4,5,6,8,10	3,4	4	
	E5	5,8,10	1,2,3,4,5	5	
	E6	6,8,10	1,2,3,4,6	6	
	E7	7,8,10	2,3,7	7	
	E8	8,10	1,2,3,4,5,6,7,8	8	
	E10	10	1,2,3,4,5,6,7,8,10	10	VIII
	E1	1,2,5,6,8	1	1	

continued on following page

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 7. Continued

Iterations	Elements	RS	AS	IS	Level
	E2	2,5,6,7,8	1,2	2	
	E3	3,4,5,6,7,8	3	3	
Iteration 9	E4	4,5,6,8	3,4	4	
	E5	5,8	1,2,3,4,5	5	
	E6	6,8	1,2,3,4,6	6	
	E7	7,8	2,3,7	7	
	E8	8	1,2,3,4,5,6,7,8	8	IX
	E1	1,2,5,6	1	1	
	E2	2,5,6,7	1,2	2	
Iteration 10	E3	3,4,5,6,7	3	3	
	E4	4,5,6	3,4	4	
	E5	5	1,2,3,4,5	5	X
	E6	6	1,2,3,4,6	6	X
	E7	7	2,3,7	7	X
	E1	1,2	1	1	
Iteration 11	E2	2	1,2	2	XI
	E3	3,4	3	3	
	E4	4	3,4	4	XI
	E1	1	1	1	XII
Iteration 12	E3	3	3	3	XII

team building and Organization Culture is in level 10, Total Quality Environmental management and Management Review is in level 11 and Government policy and Regulations and Management Support are in the bottom level.

The fuzzy TISM model gives a clear picture on the inter-relationships between green procurement drivers. The proposed method is a novel attempt in the direction of green procurement theory building. The incorporation of fuzzy allows the decision maker to judge degree of relationship between criteria. Instead of only selecting {0, 1} i.e. binary here respondent can select influence level such as {Very High, High, Low, Very Low, No} of selected criteria. The final fuzzy model consists of fuzzy relationships between one to one criteria. The interpretation of model can assist supply chain practitioners in better decision making.

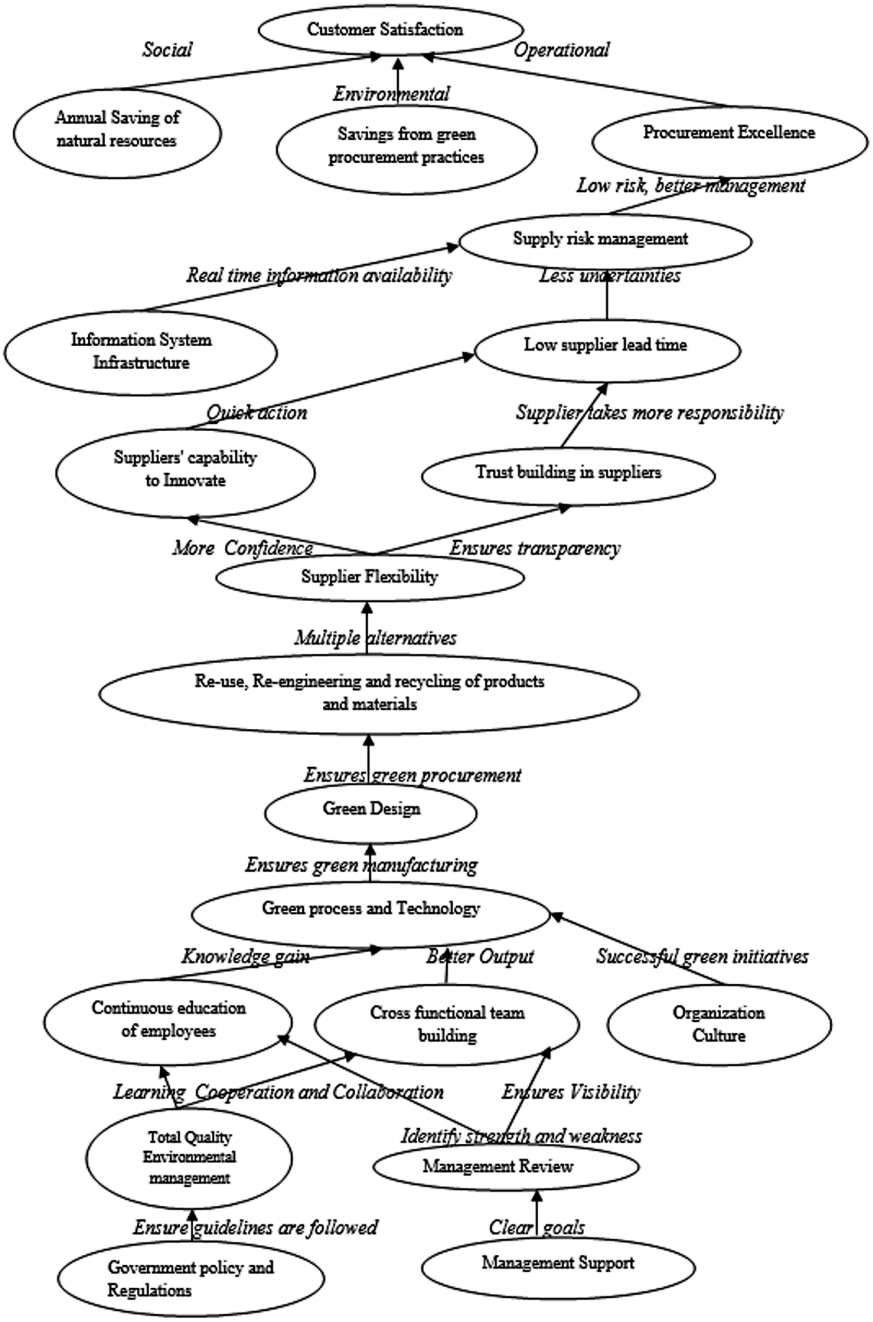
5. FUZZY DEMATEL

The steps of Fuzzy DEMATEL have been followed as per (Gharakhani, 2012 and Mavi et al., 2013). The Data analysis is segregated into following sub-sections:

Here expert from manufacturing sector has been interviewed to capture the data for further Fuzzy DEMATEL application. The questionnaire has been prepared keeping in mind the pair wise comparison

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 3. TISM diagraph



to evaluate the influence of each score. The evaluation criteria symbols are as follows: Government policy and Regulations (E1), Total Quality Environmental management (E2), Management Support (E3), Management Review (E4), Continuous education of employees (E5), Cross functional team building (E6), Organization Culture (E7), Green process and Technology (E8), Information System Infrastructure (E9), Green Design (E10), Re-use, Re-engineering and Recycling of products and materials (E11), Supplier

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Flexibility (E12), Suppliers' capability to Innovate (E13), Supply risk management (E14), Trust building in suppliers (E15), Low supplier lead time (E16), Customer Satisfaction (E17), Annual Savings from green procurement practices (E18), Annual Saving of natural resources (E19), Procurement Excellence (E20).

5.1. Design the Fuzzy Linguistic Variables

The study addresses response to the human logic variable as Table 8.

5.2. Direct Relation Matrix (T)

The below Table 9 presents a completed direct-relation matrix for first expert within a linguistic scale assessment among the green procurement drivers.

5.3. Transform Triangular Fuzzy Numbers Into Initial Direct Relation Matrix (F)

Here author applied modified CFCS method to develop a crisp value direct-relation matrix for each evaluator. Final results are shown in Table 10.

5.4. Setup the Generalized Direct –Relation Matrix (S)

The generalized direct-relation matrix is presented in Table 11.

5.5. Set Up the Total Relation Matrix (M)

The total relation matrix is obtained from the generalized direct-relation matrix. The total relation matrix is presented in Table 12.

5.6. Sum of Rows and Columns

The sum of rows and sum of columns are separately denoted as D and R within the total relation matrix as below:

Table 8. The Fuzzy linguistic scale

Linguistic Terms	Influence Score	Triangular Fuzzy Numbers
No Influence	0	(0, 0, 0.25)
Very Low Influence	1	(0, 0.25, 0.50)
Low Influence	2	(0.25, 0.50, 0.75)
High Influence	3	(0.50, 0.75, 1.00)
Very High Influence	4	(0.75, 1.00, 1.00)

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 9. The Linguistic scale direct relation matrix

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	E12	E13	E14	E15	E16	E17	E18	E19	E20
E1	0	0.75, 1.00, 1.00	0.75, 1.00, 1.00	0.75, 1.00, 1.00	0, 0, 0.25	0, 0, 0.25	0, 0, 0.25	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0, 0, 0.25	0, 0, 0.25	0, 0, 0.25	0, 0, 0.25	0, 0, 0.25	0, 0, 0.25	0, 0, 0.25	0, 0, 0.25	0, 0, 0.25
E2	0, 0, 0.25	0	0, 0.25, 0.50	0, 0.25, 0.50	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0, 0.25, 0.50	0.25, 0.50, 0.75	0.25, 0.50, 0.75	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.25, 0.50, 0.75	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.75, 1.00, 1.00	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.75, 1.00, 1.00
E3	0, 0, 0.25	0.75, 1.00, 1.00	0	0.75, 1.00, 1.00	0.75, 1.00, 1.00	0.75, 1.00, 1.00	0.75, 1.00, 1.00	0.75, 1.00, 1.00	0.75, 1.00, 1.00	0.75, 1.00, 1.00	0.75, 1.00, 1.00	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.75, 1.00, 1.00	0.50, 0.75, 1.00	0.75, 1.00, 1.00	0.25, 0.50, 0.75	0.25, 0.50, 0.75	0.75, 1.00, 1.00
E4	0, 0, 0.25	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0	0.50, 0.75, 1.00	0.25, 0.50, 0.75	0.25, 0.50, 0.75	0.50, 0.75, 1.00	0.25, 0.50, 0.75	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.75, 1.00, 1.00	0.25, 0.50, 0.75	0.25, 0.50, 0.75	0.50, 0.75, 1.00	0.75, 1.00, 1.00	0.75, 1.00, 1.00	0.75, 1.00, 1.00
E5	0, 0, 0.25	0.50, 0.75, 1.00	0.25, 0.50, 0.75	0, 0.25, 0.50	0	0, 0.25, 0.50	0.25, 0.50, 0.75	0.50, 0.75, 1.00	0.25, 0.50, 0.75	0.75, 1.00, 1.00	0.75, 1.00, 1.00	0.25, 0.50, 0.75	0.25, 0.50, 0.75	0.25, 0.50, 0.75	0, 0, 0.25	0, 0, 0.25	0.25, 0.50, 0.75	0.25, 0.50, 0.75	0.25, 0.50, 0.75	0.75, 1.00, 1.00
E6	0, 0, 0.25	0.50, 0.75, 1.00	0, 0, 0.25	0, 0, 0.25	0, 0, 0.25	0	0, 0, 0.25	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.75, 1.00, 1.00	0.75, 1.00, 1.00	0.50, 0.75, 1.00	0.25, 0.50, 0.75	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.25, 0.50, 0.75	0.50, 0.75, 1.00	0.25, 0.50, 0.75	0.50, 0.75, 1.00	0.75, 1.00, 1.00
E7	0, 0, 0.25	0.75, 1.00, 1.00	0.75, 1.00, 1.00	0.75, 1.00, 1.00	0.75, 1.00, 1.00	0.75, 1.00, 1.00	0	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.75, 1.00, 1.00	0.50, 0.75, 1.00	0.75, 1.00, 1.00	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.75, 1.00, 1.00	0.25, 0.50, 0.75	0.25, 0.50, 0.75	0.75, 1.00, 1.00
E8	0, 0, 0.25	0.50, 0.75, 1.00	0, 0.25, 0.50	0, 0.25, 0.50	0.25, 0.50, 0.75	0.50, 0.75, 1.00	0.25, 0.50, 0.75	0	0.50, 0.75, 1.00	0.75, 1.00, 1.00	0.75, 1.00, 1.00	0.25, 0.50, 0.75	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.25, 0.50, 0.75	0.75, 1.00, 1.00	0.75, 1.00, 1.00	0.75, 1.00, 1.00	0.75, 1.00, 1.00
E9	0, 0, 0.25	0.50, 0.75, 1.00	0.25, 0.50, 0.75	0.25, 0.50, 0.75	0.25, 0.50, 0.75	0, 0.25, 0.50	0, 0, 0.25	0, 0.25, 0.50	0	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.25, 0.50, 0.75	0.50, 0.75, 1.00	0.25, 0.50, 0.75	0.25, 0.50, 0.75	0.75, 1.00, 1.00	0.75, 1.00, 1.00	0.75, 1.00, 1.00	0.75, 1.00, 1.00
E10	0, 0, 0.25	0.50, 0.75, 1.00	0.25, 0.50, 0.75	0.25, 0.50, 0.75	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.25, 0.50, 0.75	0.75, 1.00, 1.00	0.50, 0.75, 1.00	0	0.75, 1.00, 1.00	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.25, 0.50, 0.75	0.50, 0.75, 1.00	0.75, 1.00, 1.00	0.50, 0.75, 1.00	0.75, 1.00, 1.00	0.75, 1.00, 1.00
E11	0, 0, 0.25	0.50, 0.75, 1.00	0.25, 0.50, 0.75	0.25, 0.50, 0.75	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0, 0.25, 0.50	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.75, 1.00, 1.00	0	0.50, 0.75, 1.00	0.75, 1.00, 1.00	0.50, 0.75, 1.00	0.25, 0.50, 0.75	0.25, 0.50, 0.75	0.75, 1.00, 1.00	0.75, 1.00, 1.00	0.75, 1.00, 1.00	0.75, 1.00, 1.00
E12	0, 0, 0.25	0.25, 0.50, 0.75	0.50, 0.75, 1.00	0.25, 0.50, 0.75	0, 0.25, 0.50	0, 0.25, 0.50	0, 0.25, 0.50	0.25, 0.50, 0.75	0, 0, 0.25	0.50, 0.75, 1.00	0.75, 1.00, 1.00	0	0.75, 1.00, 1.00	0.75, 1.00, 1.00	0.75, 1.00, 1.00	0.75, 1.00, 1.00	0.25, 0.50, 0.75	0.25, 0.50, 0.75	0.25, 0.50, 0.75	0.50, 0.75, 1.00
E13	0, 0, 0.25	0.25, 0.50, 0.75	0.50, 0.75, 1.00	0.25, 0.50, 0.75	0, 0, 0.25	0.25, 0.50, 0.75	0, 0, 0.25	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.75, 1.00, 1.00	0.50, 0.75, 1.00	0	0.50, 0.75, 1.00	0.25, 0.50, 0.75	0.25, 0.50, 0.75	0.25, 0.50, 0.75	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.50, 0.75, 1.00
E14	0, 0, 0.25	0, 0.25, 0.50	0.25, 0.50, 0.75	0.50, 0.75, 1.00	0.25, 0.50, 0.75	0.50, 0.75, 1.00	0, 0, 0.25	0.25, 0.50, 0.75	0.25, 0.50, 0.75	0.25, 0.50, 0.75	0.25, 0.50, 0.75	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0	0.25, 0.50, 0.75	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0, 0.25, 0.50	0, 0.25, 0.50	0.25, 0.50, 0.75
E15	0, 0, 0.25	0.25, 0.50, 0.75	0, 0, 0.25	0, 0, 0.25	0, 0, 0.25	0, 0, 0.25	0, 0, 0.25	0, 0, 0.25	0, 0, 0.25	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.75, 1.00, 1.00	0.75, 1.00, 1.00	0.75, 1.00, 1.00	0	0.75, 1.00, 1.00	0, 0.25, 0.50	0, 0.25, 0.50	0, 0.25, 0.50	0.50, 0.75, 1.00
E16	0, 0, 0.25	0, 0, 0.25	0, 0, 0.25	0, 0, 0.25	0, 0, 0.25	0, 0, 0.25	0, 0, 0.25	0, 0, 0.25	0, 0, 0.25	0, 0, 0.25	0.25, 0.50, 0.75	0.25, 0.50, 0.75	0, 0, 0.25	0.75, 1.00, 1.00	0, 0, 0.25	0	0, 0.25, 0.50	0.50, 0.75, 1.00	0.25, 0.50, 0.75	0.50, 0.75, 1.00
E17	0, 0, 0.25	0.25, 0.50, 0.75	0.50, 0.75, 1.00	0.75, 1.00, 1.00	0.50, 0.75, 1.00	0.25, 0.50, 0.75	0.25, 0.50, 0.75	0.75, 1.00, 1.00	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0, 0.25, 0.50	0, 0.25, 0.50	0.25, 0.50, 0.75	0, 0, 0.25	0, 0.25, 0.50	0	0, 0, 0.25	0, 0, 0.25	0, 0, 0.25
E18	0, 0, 0.25	0, 0, 0.25	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.25, 0.50, 0.75	0.25, 0.50, 0.75	0, 0.25, 0.50	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.25, 0.50, 0.75	0.25, 0.50, 0.75	0, 0.25, 0.50	0	0.75, 1.00, 1.00	0.50, 0.75, 1.00
E19	0, 0, 0.25	0, 0, 0.25	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0, 0.25, 0.50	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.25, 0.50, 0.75	0.50, 0.75, 1.00	0, 0, 0.25	0, 0, 0.25	0, 0, 0.25	0, 0, 0.25	0.50, 0.75, 1.00	0	0.75, 1.00, 1.00
E20	0, 0.25, 0.50	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.50, 0.75, 1.00	0.25, 0.50, 0.75	0.25, 0.50, 0.75	0, 0, 0.25	0, 0, 0.25	0, 0, 0.25	0, 0, 0.25	0, 0, 0.25	0, 0, 0.25	0, 0, 0.25	0, 0, 0.25	0.75, 1.00, 1.00	0.50, 0.75, 1.00	0, 0, 0.25	0.75, 1.00, 1.00	0.50, 0.75, 1.00	0

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 10. The initial direct relation matrix (F)

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	E12	E13	E14	E15	E16	E17	E18	E19	E20
E1	0	0.966	0.966	0.966	0.033	0.033	0.033	0.800	0.800	0.800	0.800	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033
E2	0.033	0	0.260	0.260	0.800	0.800	0.260	0.500	0.500	0.800	0.800	0.800	0.800	0.500	0.800	0.800	0.966	0.800	0.800	0.966
E3	0.033	0.966	0	0.966	0.966	0.966	0.966	0.966	0.966	0.966	0.966	0.800	0.800	0.800	0.966	0.800	0.966	0.500	0.500	0.966
E4	0.033	0.800	0.800	0	0.800	0.500	0.500	0.800	0.500	0.800	0.800	0.800	0.800	0.966	0.500	0.500	0.800	0.966	0.966	0.966
E5	0.033	0.800	0.500	0.260	0	0.260	0.500	0.800	0.500	0.966	0.966	0.500	0.500	0.500	0.033	0.033	0.500	0.500	0.500	0.966
E6	0.033	0.800	0.033	0.033	0.033	0	0.033	0.800	0.800	0.966	0.966	0.800	0.500	0.800	0.800	0.500	0.800	0.500	0.800	0.966
E7	0.033	0.966	0.966	0.966	0.966	0.966	0	0.800	0.800	0.800	0.966	0.800	0.966	0.800	0.800	0.800	0.966	0.500	0.500	0.966
E8	0.033	0.800	0.260	0.260	0.500	0.800	0.500	0	0.800	0.966	0.966	0.500	0.800	0.800	0.800	0.500	0.966	0.966	0.966	0.966
E9	0.033	0.800	0.500	0.500	0.500	0.260	0.033	0.260	0	0.800	0.800	0.800	0.500	0.800	0.500	0.500	0.966	0.966	0.966	0.966
E10	0.033	0.800	0.500	0.500	0.800	0.800	0.500	0.966	0.800	0	0.966	0.800	0.800	0.800	0.500	0.800	0.966	0.800	0.966	0.966
E11	0.033	0.800	0.500	0.500	0.800	0.800	0.260	0.800	0.800	0.966	0	0.800	0.966	0.800	0.500	0.500	0.966	0.966	0.966	0.966
E12	0.033	0.500	0.800	0.500	0.260	0.260	0.260	0.500	0.033	0.800	0.966	0	0.966	0.966	0.966	0.966	0.500	0.500	0.500	0.800
E13	0.033	0.500	0.800	0.500	0.033	0.500	0.033	0.800	0.800	0.800	0.966	0.800	0	0.800	0.500	0.500	0.500	0.800	0.800	0.800
E14	0.033	0.260	0.500	0.800	0.500	0.800	0.033	0.500	0.500	0.500	0.500	0.800	0.800	0	0.500	0.800	0.800	0.260	0.260	0.500
E15	0.033	0.500	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.800	0.800	0.966	0.966	0.966	0	0.966	0.260	0.260	0.260	0.800
E16	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.500	0.500	0.033	0.966	0.033	0	0.260	0.800	0.500	0.800
E17	0.033	0.500	0.800	0.966	0.800	0.500	0.500	0.966	0.800	0.800	0.800	0.260	0.260	0.500	0.033	0.260	0	0.033	0.033	0.033
E18	0.033	0.033	0.800	0.800	0.500	0.500	0.260	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.500	0.500	0.260	0	0.966	0.800
E19	0.033	0.033	0.800	0.800	0.800	0.800	0.260	0.800	0.800	0.800	0.800	0.500	0.800	0.800	0.033	0.033	0.033	0.800	0	0.966
E20	0.260	0.800	0.800	0.800	0.500	0.500	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.966	0.800	0.033	0.966	0.800	0

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 11. The generalized direct-relation matrix

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	E12	E13	E14	E15	E16	E17	E18	E19	E20
E1	0	0.060	0.060	0.060	0.002	0.002	0.002	0.050	0.050	0.050	0.050	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
E2	0.002	0	0.016	0.016	0.050	0.050	0.016	0.031	0.031	0.050	0.050	0.050	0.050	0.031	0.050	0.050	0.060	0.050	0.050	0.060
E3	0.002	0.060	0	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.050	0.050	0.050	0.060	0.050	0.060	0.031	0.031	0.060
E4	0.002	0.050	0.050	0	0.050	0.031	0.031	0.050	0.031	0.050	0.050	0.050	0.050	0.060	0.031	0.031	0.050	0.060	0.060	0.060
E5	0.002	0.050	0.031	0.016	0	0.016	0.031	0.050	0.031	0.060	0.060	0.031	0.031	0.031	0.002	0.002	0.031	0.031	0.031	0.060
E6	0.002	0.050	0.002	0.002	0.002	0	0.002	0.050	0.050	0.060	0.060	0.050	0.031	0.050	0.050	0.031	0.050	0.031	0.050	0.060
E7	0.002	0.060	0.060	0.060	0.060	0.060	0	0.050	0.050	0.050	0.060	0.050	0.060	0.050	0.050	0.050	0.060	0.031	0.031	0.060
E8	0.002	0.050	0.016	0.016	0.031	0.050	0.031	0	0.050	0.060	0.060	0.031	0.050	0.050	0.050	0.031	0.060	0.060	0.060	0.060
E9	0.002	0.050	0.031	0.031	0.031	0.016	0.002	0.016	0	0.050	0.050	0.050	0.031	0.050	0.031	0.031	0.060	0.060	0.060	0.060
E10	0.002	0.050	0.031	0.031	0.050	0.050	0.031	0.060	0.050	0	0.060	0.050	0.050	0.050	0.031	0.050	0.060	0.050	0.060	0.060
E11	0.002	0.050	0.031	0.031	0.050	0.050	0.016	0.050	0.050	0.060	0	0.050	0.060	0.050	0.031	0.031	0.060	0.060	0.060	0.060
E12	0.002	0.031	0.050	0.031	0.016	0.016	0.016	0.031	0.002	0.050	0.060	0	0.060	0.060	0.060	0.060	0.031	0.031	0.031	0.050
E13	0.002	0.031	0.050	0.031	0.002	0.031	0.002	0.050	0.050	0.050	0.060	0.050	0	0.050	0.031	0.031	0.031	0.050	0.050	0.050
E14	0.002	0.016	0.031	0.050	0.031	0.050	0.002	0.031	0.031	0.031	0.031	0.050	0.050	0	0.031	0.050	0.050	0.016	0.016	0.031
E15	0.002	0.031	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.050	0.050	0.060	0.060	0.060	0	0.060	0.016	0.016	0.016	0.050
E16	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.031	0.031	0.002	0.060	0.002	0	0.016	0.050	0.031	0.050
E17	0.002	0.031	0.050	0.060	0.050	0.031	0.031	0.060	0.050	0.050	0.050	0.016	0.016	0.031	0.002	0.016	0	0.002	0.002	0.002
E18	0.002	0.002	0.050	0.050	0.031	0.031	0.016	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.031	0.031	0.016	0	0.060	0.050
E19	0.002	0.002	0.050	0.050	0.050	0.050	0.016	0.050	0.050	0.050	0.050	0.031	0.050	0.002	0.002	0.002	0.002	0.050	0	0.060
E20	0.016	0.050	0.050	0.050	0.031	0.031	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.060	0.050	0.002	0.060	0.050	0

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 12. The Total relation matrix (M)

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	E12	E13	E14	E15	E16	E17	E18	E19	E20
E1	0.004	0.113	0.104	0.104	0.053	0.054	0.029	0.104	0.101	0.114	0.117	0.061	0.062	0.063	0.051	0.054	0.062	0.064	0.065	0.076
E2	0.009	0.081	0.092	0.090	0.121	0.125	0.053	0.116	0.109	0.149	0.156	0.139	0.139	0.125	0.122	0.129	0.142	0.141	0.142	0.172
E3	0.011	0.169	0.101	0.155	0.156	0.161	0.108	0.172	0.163	0.193	0.202	0.170	0.171	0.176	0.158	0.158	0.175	0.155	0.156	0.211
E4	0.010	0.142	0.137	0.088	0.135	0.122	0.075	0.149	0.123	0.166	0.173	0.153	0.155	0.166	0.118	0.124	0.148	0.165	0.167	0.190
E5	0.008	0.120	0.097	0.081	0.066	0.086	0.064	0.123	0.100	0.145	0.149	0.107	0.109	0.110	0.069	0.073	0.106	0.112	0.113	0.156
E6	0.008	0.121	0.071	0.070	0.069	0.071	0.035	0.124	0.119	0.148	0.154	0.130	0.114	0.133	0.117	0.105	0.126	0.116	0.134	0.160
E7	0.011	0.165	0.155	0.153	0.153	0.158	0.050	0.160	0.151	0.180	0.197	0.167	0.176	0.172	0.146	0.154	0.171	0.151	0.152	0.206
E8	0.010	0.137	0.100	0.099	0.112	0.134	0.071	0.095	0.136	0.169	0.176	0.131	0.149	0.151	0.130	0.120	0.152	0.160	0.162	0.183
E9	0.009	0.124	0.105	0.103	0.102	0.091	0.039	0.099	0.076	0.144	0.150	0.135	0.118	0.137	0.101	0.108	0.138	0.146	0.147	0.166
E10	0.010	0.143	0.120	0.118	0.135	0.140	0.075	0.158	0.142	0.120	0.184	0.154	0.155	0.159	0.118	0.143	0.159	0.158	0.169	0.192
E11	0.010	0.141	0.118	0.116	0.133	0.138	0.060	0.148	0.140	0.174	0.125	0.152	0.162	0.156	0.116	0.123	0.156	0.165	0.166	0.189
E12	0.008	0.104	0.117	0.099	0.083	0.088	0.051	0.108	0.075	0.140	0.156	0.085	0.142	0.146	0.127	0.135	0.109	0.116	0.116	0.153
E13	0.009	0.108	0.122	0.103	0.075	0.107	0.040	0.131	0.125	0.146	0.161	0.137	0.090	0.140	0.104	0.110	0.114	0.140	0.141	0.159
E14	0.007	0.082	0.091	0.107	0.088	0.109	0.033	0.099	0.093	0.112	0.118	0.121	0.121	0.079	0.090	0.114	0.118	0.091	0.092	0.122
E15	0.007	0.078	0.051	0.049	0.046	0.051	0.024	0.054	0.049	0.108	0.114	0.115	0.114	0.118	0.047	0.112	0.068	0.075	0.075	0.119
E16	0.005	0.031	0.034	0.034	0.031	0.033	0.015	0.034	0.032	0.039	0.069	0.064	0.037	0.092	0.031	0.032	0.046	0.083	0.065	0.090
E17	0.007	0.101	0.109	0.118	0.112	0.096	0.064	0.130	0.116	0.134	0.138	0.092	0.092	0.110	0.065	0.082	0.077	0.080	0.082	0.098
E18	0.009	0.085	0.125	0.123	0.104	0.108	0.054	0.134	0.128	0.149	0.155	0.139	0.140	0.143	0.106	0.111	0.102	0.095	0.153	0.163
E19	0.008	0.079	0.117	0.115	0.115	0.119	0.051	0.127	0.121	0.140	0.145	0.112	0.130	0.088	0.072	0.074	0.081	0.135	0.089	0.162
E20	0.020	0.096	0.094	0.093	0.075	0.076	0.026	0.055	0.051	0.065	0.069	0.060	0.059	0.061	0.103	0.098	0.052	0.115	0.106	0.072

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Sum of rows= 1.455, 2.354, 3.121, 2.707, 1.993, 2.214, 3.028, 2.573, 2.239, 2.753, 2.690, 2.160, 2.261, 1.887, 1.474, 0.896, 1.902, 2.324, 2.080, 1.446

Sum of columns= 0.181, 2.220, 2.059, 2.017, 1.963, 2.067, 1.019, 2.319, 2.151, 2.737, 2.907, 2.424, 2.436, 2.525, 1.992, 2.157, 2.301, 2.462, 2.490, 3.039

5.7. Setup Degree of Central Role and Relation

The degree of central role (D+R) in DEMATEL represents the strength of influences both dispatched and received. The degree of influence of green procurement drivers are presented in Table 13.

5.8. Causal Diagram

The relationships of green procurement drivers are constructed in graphical form which will enable to understand the relationships in a transparent manner. The causal diagram is presented in Figure 4.

6. DISCUSSION ON FUZZY DEMATEL ANALYSIS

The total relation matrix (M) includes the direct and indirect effects. $(D+R)_i$ provides an index of strength of influences dispatched and received, i.e., $(D+R)_i$ shows the degree that the element I plays in the problem. The more positive the $(D+R)_i$ the greater is the degree of influence on other elements. If $(D-R)_i$ is positive, then element I is affecting other elements, and if $(D-R)_i$ is negative, then element I is being influenced by other elements. The current study used 20 criteria. The development of diagraphs in Figure 4 shows the interrelationships amongst each of 20 green procurement criteria. We can also distinguish general clusters into cause and effect groups.

The green procurement criteria that are part of the cause cluster include Government policy and Regulations (E1), Management Support (E3), Management Review (E4), Organization Culture (E7) and Green process and Technology (E8).

The effect group cluster consist of Total Quality Environmental management (E2), Continuous education of employees (E5), Cross functional team building (E6), Information System Infrastructure (E9), Green Design (E10), Re-use, Re-engineering and Recycling of products and materials (E11), Supplier Flexibility (E12), Suppliers' capability to Innovate (E13), Supply risk management (E14), Trust building in suppliers (E15), Low supplier lead time (E16), Customer Satisfaction (E17), Annual Savings from green procurement practices (E18), Annual Saving of natural resources (E19) and Procurement Excellence (E20).

If the firm wants to obtain high performance in the "effect criteria", it would control and pay more attention to the "cause criteria" beforehand. The criteria Government policy and Regulations (E1), Management Support (E3), Management Review (E4), Organization Culture (E7) and Green process and Technology (E8) influence dispatching evaluation criteria. These criteria influence Total Quality Environmental management (E2), Continuous education of employees (E5), Cross functional team building (E6), Information System Infrastructure (E9), Green Design (E10), Re-use, Re-engineering and Recycling of products and materials (E11), Supplier Flexibility (E12), Suppliers' capability to Innovate (E13), Supply risk management (E14), Trust building in suppliers (E15), Low supplier lead time (E16), Customer Satisfaction (E17), Annual Savings from green procurement practices (E18), Annual Saving

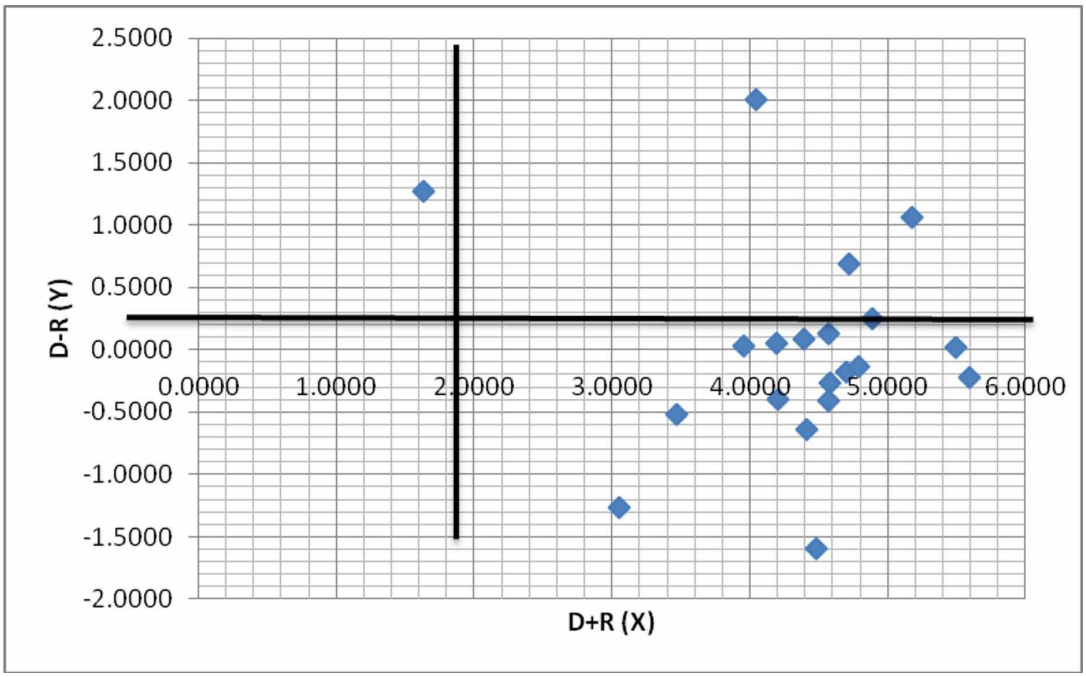
EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 13. The degree of central role (D+R)

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	E12	E13	E14	E15	E16	E17	E18	E19	E20
D	1.455	2.354	3.121	2.707	1.993	2.124	3.028	2.573	2.239	2.753	2.690	2.160	2.261	1.887	1.474	0.896	1.902	2.324	2.080	1.446
R	0.181	2.220	2.059	2.017	1.963	2.067	1.019	2.319	2.151	2.737	2.907	2.424	2.436	2.525	1.992	2.157	2.301	2.462	2.490	3.039
D+R	1.636	4.574	5.180	4.724	3.956	4.191	4.048	4.892	4.391	5.490	5.597	4.584	4.697	4.411	3.466	3.053	4.203	4.786	4.571	4.485
D-R	1.274	0.134	1.061	0.690	0.030	0.058	2.009	0.254	0.088	0.015	-0.217	-0.263	-0.176	-0.638	-0.518	-1.261	-0.399	-0.138	-0.410	-1.593

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 4. The causal diagram



of natural resources (E19) and Procurement Excellence (E20). If firm wanted to improve the effectiveness of a specific criteria i.e., Total Quality Environmental management (E2), Continuous education of employees (E5), Cross functional team building (E6), Information System Infrastructure (E9), Green Design (E10), Re-use, Re-engineering and Recycling of products and materials (E11), Supplier Flexibility (E12), Suppliers' capability to Innovate (E13), Supply risk management (E14), Trust building in suppliers (E15), Low supplier lead time (E16), Customer Satisfaction (E17), Annual Savings from green procurement practices (E18), Annual Saving of natural resources (E19) and Procurement Excellence (E20), it would be necessary to pay attention to Government policy and Regulations (E1), Management Support (E3), Management Review (E4), Organization Culture (E7) and Green process and Technology (E8). This is because E1, E3,E4,E7 and E8 are influencing criteria and can be improved, while E2, E5, E6, E9, E10, E11, E12,E13, E14,E15,E16,E17,E18, E19and E20 are influence criteria and can arrive at the effect criteria. Then it is easier for a firm to find the performance of appropriate green procurement drivers by using the above result.

From the cause diagram the results show that (E4) management review is the central criteria for evaluating indirectly the criteria of E1, E2, E3, E5, E6, E7, E8, E9, E10, E11, E12, E13, E14, E15, E16, E17, E18, E19, E20. Management review on periodical basis is important in evaluating the progress of green procurement action plans. Management review provides visibility of the entire green procurement program. It is clear whether team members are taking responsibility, accountability, meeting timelines, and taking appropriate actions for the critical path.

The results also show that (E7) organization culture is the most important and most influencing criterion because its position has the highest intensity of relationships to other criteria. This means that

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

organization culture plays a key role in green procurement practices. The organization silos need to be broken and a healthy organization culture must be created for successful green procurement practices.

7. CONCLUSION

Decision making situations where multiple criteria are involved makes it really difficult to select the right research method for data analysis. Keeping the limitations and benefits in mind here two different MCDM technique has been used to separately analyze the same set of criteria. The results are encouraging and offer practical solutions to problems faced by procurement managers in green procurement decision making.

The driving factors which emerged from Fuzzy TISM and MICMAC analyses are Government policy and Regulations (E1), Total Quality Environmental management (E2), Management Support (E3), Management Review (E4), Continuous education of employees (E5), Cross functional team building (E6), Organization Culture (E7), and Green process and Technology (E8).

Fuzzy DEMATEL analysis resulted into emergence of the cause and effect groups. The green procurement criteria that are part of the cause cluster include Government policy and Regulations (E1), Management Support (E3), Management Review (E4), Organization Culture (E7) and Green process and Technology (E8).

The effect group cluster consist of Total Quality Environmental management (E2), Continuous education of employees (E5), Cross functional team building (E6), Information System Infrastructure (E9), Green Design (E10), Re-use, Re-engineering and Recycling of products and materials (E11), Supplier Flexibility (E12), Suppliers' capability to Innovate (E13), Supply risk management (E14), Trust building in suppliers (E15), Low supplier lead time (E16), Customer Satisfaction (E17), Annual Savings from green procurement practices (E18), Annual Saving of natural resources (E19) and Procurement Excellence (E20).

It is observed that Organization Culture (E7) is the most influence and the strongest connection to other criteria.

The results of Fuzzy TISM and Fuzzy DEMATEL show that some common criteria are falling in the driving/cause group, i.e., Government policy and Regulations (E1), Management Support (E3), Management Review (E4), Organization Culture (E7) and Green process and Technology (E8). These elements are the key players which must be considered while planning green procurement programs.

7.1. Managerial Implications

Firm can gain multiple benefits from green procurement. Firstly, firm can become lean and save lot of money apart from improving quality and wastage reduction. Secondly green procurement promotes sustainability in inventory management, sustainability in production operations, sustainability in distribution chain operations and drives business excellence.

Procurement managers must carefully select the cause criterion and understand its influence on effect criterion while making green procurement decisions otherwise the entire effort may fall back.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

7.2. Limitations and Future Research Directions

The present research has certain limitations. The model is developed purely based on interview with five procurement management experts from the manufacturing sector. Author proposes to statistically validate the model and further extend theory in the field of green procurement.

REFERENCES

Agarwal, A., & Vrat, P. (2015). Line and Staff Functions in Organizations Revisited: A Bionic System Analogy Using ISM. *Vision: The Journal of Business Perspective*, *19*(2), 89–103.

Ageron, B., Gunasekaran, A., & Spalanzani, A. (2012). Sustainable supply management: An empirical study. *International Journal of Production Economics*, *140*(1), 168–182. doi:10.1016/j.ijpe.2011.04.007

Appolloni, A., Sun, H., Jia, F., & Li, X. (2014). Green Procurement in the private sector: A state of the art review between 1996 and 2013. *Journal of Cleaner Production*, *85*, 122–133. doi:10.1016/j.jclepro.2014.08.106

Arslan, T., Yilmaz, V., & Aksoy, H. K. (2010). Structural Equation Model for Environmentally Conscious Purchasing Behavior. *International Journal of Environmental of Research*, *6*(1), 323–334.

Attri, R., Dev, N., & Sharma, V. (2013). Interpretive Structural Modeling (ISM) approach: An overview. *Research Journal of Management Sciences*, *2*(2), 3–8.

Azevedo, S. G., Carvalho, H., & Machado, V. C. (2011). The influence of green practices on supply chain performance: A case study approach. *Transportation Research Part E, Logistics and Transportation Review*, *47*(6), 850–871. doi:10.1016/j.tre.2011.05.017

Bag, S. (2014). *Developing a GSCM model for the Indian rubber goods manufacturing sector [unpublished Doctoral Dissertation]. University of Petroleum & Energy Studies*. Dehradun: Uttarakhand, India. Retrieved from http://ils.ddn.upes.ac.in:8001/cgi-bin/koha/opac-authoritiesdetail.pl?authid=13645

Bag, S. (in press). Green Strategy, Supplier Relationship building and Supply Chain Performance: Total Interpretive Structural Modeling approach. *International Journal of Procurement Management*.

Bag, S., & Anand, N. (2015). Modeling Barriers of Sustainable Supply Chain Network Design using Interpretive structural modeling: An insight from Food Processing Sector in India. *International Journal of Automation and Logistics*, *1*(3), 234–255. doi:10.1504/IJAL.2015.071722

Burja, A. (2009). Using Green Public Procurement (GPP) for sustainable consumption and production. *Journal for European Environmental & Planning Law*, *6*(3), 319–338. doi:10.1163/161372709X12608898676391

Caniëls, M. C., Gehrsitz, M. H., & Semeijn, J. (2013). Participation of suppliers in greening supply chains: An empirical analysis of German automotive suppliers. *Journal of Purchasing and Supply Management*, *19*(3), 134–143. doi:10.1016/j.pursup.2013.02.005

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chakrabarty, A., De, A., & Dubey, R. (2014). A flexible approach towards multi-frequency re-engineering of the moving average convergence divergence indicator. *Global Journal of Flexible Systems Management*, *15*(3), 219–234. doi:10.100740171-014-0068-7

Chang, B., Chang, C.-W., & Wu, C.-H. (2011). Fuzzy DEMATEL method for developing supplier selection criteria. *Expert Systems with Applications*, *38*(3), 1850–1858. doi:10.1016/j.eswa.2010.07.114

Chang, B., Chang, C. W., & Wu, C. H. (2011). Fuzzy DEMATEL method for developing supplier selection criteria. *Expert Systems with Applications*, *38*(3), 1850–1858. doi:10.1016/j.eswa.2010.07.114

Chiou, T. Y., Chan, H. K., Lettice, F., & Chung, S. H. (2011). The influence of greening the suppliers and green innovation on environmental performance and competitive advantage in Taiwan. *Transportation Research Part E, Logistics and Transportation Review*, *47*(6), 822–836. doi:10.1016/j.tre.2011.05.016

Dawson, G. F., & Probert, E. (2007). A sustainable product needing a sustainable procurement commitment: The case of green waste in Wales. *J. Sustainable Development*, *15*(2), 69–82. doi:10.1002d.307

Day, C. (2005). Buying green: The crucial role of public authorities. *Local Environment*, *10*(2), 201–209. doi:10.1080/1354983042000388214

Diabat, A., & Govindan, K. (2011). An analysis of the drivers affecting the implementation of green supply chain management. *Resources, Conservation and Recycling*, *55*(6), 659–667. doi:10.1016/j.resconrec.2010.12.002

Dubey, R., & Ali, S. (2014). Identification of flexible manufacturing system dimensions and their interrelationship using total interpretive structural modelling and fuzzy MICMAC analysis. *Global Journal of Flexible Systems Management*, *15*(2), 131–143. doi:10.100740171-014-0058-9

Dubey, R., Bag, S., Ali, S., & Venkatesh, V. (2013). Green purchasing is key to superior performance: An empirical study. *International Journal of Procurement Management*, *6*(2), 187–210. doi:10.1504/IJPM.2013.052469

Dubey, R., Gunasekaran, A., Papadopoulas,T., and Childe, S.J., (2015b), Green Supply Chain Enablers: Mixed Methods Research, *Sustainable Production and Consumption*, DOI:. doi:10.1016/j.spc.2015.07.001

Dubey, R., Gunasekaran, A., Singh, S., & Singh, T. (2015c). Building theory of sustainable manufacturing using total interpretive structural modeling, *International Journal of Systems Science: Operations & Logistics*.

Dubey, R., Gunasekaran, A., Wamba, S. F., & Bag, S. (2015a). Building theory of Green Supply Chain Management using Total Interpretive Structural Modeling. *IFAC-PapersOnLine*, *48*(3), 1688–1694. doi:10.1016/j.ifacol.2015.06.329

Dubey, R., Sonwaney, V., Aital, P., Venkatesh, V. G., & Ali, S. S. (2014). Antecedents of innovation and Contextual relationship. *Int J Business Innovation and Research*, *9*(1), 1–14. doi:10.1504/IJBIR.2015.065950

Fu, X., Zhu, Q., & Sarkis, J. (2012). Evaluating green supplier development programs at a telecommunications systems provider. *International Journal of Production Economics*, *140*(1), 357–367. doi:10.1016/j.ijpe.2011.08.030

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Gharakhani, D. (2012). The evaluation of supplier selection criteria by fuzzy DEMATEL method. *Journal of Basic and Applied Scientific Research*, *2*(4), 3215–3224.

Gimenez, C., Sierra, V., & Rodon, J. (2012). Sustainable operations: Their impact on the triple bottom line. *International Journal of Production Economics*, *140*(1), 149–159. doi:10.1016/j.ijpe.2012.01.035

Govindan, K., Azevedo, S., Carvalho, H., & Cruz-Machado, V. (2015). Lean, green and resilient practices influence on supply chain performance: interpretive structural modeling approach. International Journal of Environmental Science & Technology, 12(1), 15-34.

Green, K., Morton, B., & New, S. (1998). Green purchasing and supply policies: Do they improve companies environmental performance? *Supply Chain Management: An International Journal*, *3*(2), 89–95. doi:10.1108/13598549810215405

Green, K., Morton, B., & New, S. (2000). Greening organizations purchasing, consumption, and innovation. *Organization & Environment*, *13*(2), 206–225. doi:10.1177/1086026600132003

Gunasekaran, A., & Spalanzani, A. (2012). Sustainability of manufacturing and services: Investigations for research and applications. *International Journal of Production Economics*, *140*(1), 35–47. doi:10.1016/j.ijpe.2011.05.011

Hassini, E., Surti, C., & Searcy, C. (2012). A literature review and a case study of sustainable supply chains with a focus on metrics. *International Journal of Production Economics*, *140*(1), 69–82. doi:10.1016/j.ijpe.2012.01.042

Hervani, A. A., Helms, M. M., & Sarkis, J. (2005). Performance measurement for green supply chain management. *Benchmarking*. *International Journal (Toronto, Ont.)*, *12*(4), 330–353.

Ho, L. W. P., Dickinson, N. M., & Chan, G. Y. S. (2010). Green procurement in the Asian public sector and the Hong Kong private sector. *Natural Resources Forum*, *34*(1), 24–38. doi:10.1111/j.1477-8947.2010.01274.x

Hsu, C. W., Kuo, T. C., Chen, S. H., & Hu, A. H. (2013). Using DEMATEL to develop a carbon management model of supplier selection in green supply chain management. *Journal of Cleaner Production*, *56*, 164–172. doi:10.1016/j.jclepro.2011.09.012

Jayalakshmi, B., & Pramod, V. R. (2015). Total Interpretive Structural Modeling (TISM) of the Enablers of a Flexible Control System for Industry. *Global Journal of Flexible Systems Management*, *16*(1), 63–85. doi:10.100740171-014-0080-y

Ji, P., Ma, X., & Li, G. (2014). Developing green purchasing relationships for the manufacturing industry: An evolutionary game theory perspective. *International Journal of Production Economics*.

Kaiser, B., Eagan, P. D., & Shaner, H. (2001). Solutions to Health Care Waste: Life-Cycle Thinking and Green Purchasing. *Environmental Health Perspectives*, *109*(3), 205–207. doi:10.1289/ehp.01109205 PMID:11333178

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Kannan, D., Khodaverdi, R., Olfat, L., Jafarian, A., & Diabat, A. (2013). Integrated fuzzy multi criteria decision making method and multi-objective programming approach for supplier selection and order allocation in a green supply chain. *Journal of Cleaner Production*, *47*, 355–367. doi:10.1016/j.jclepro.2013.02.010

Khatwani, G., Singh, S. P., Trivedi, A., & Chauhan, A. (2015). Fuzzy-TISM: A fuzzy extension of TISM for group decision making. *Global Journal of Flexible Systems Management*, *16*(1), 97–112. doi:10.100740171-014-0087-4

Khidir ElTayeb, T., Zailani, S., & Jayaraman, K. (2010). The examination on the drivers for green purchasing adoption among EMS 14001 certified companies in Malaysia. *Journal of Manufacturing Technology Management*, *21*(2), 206–225. doi:10.1108/17410381011014378

Kunzlik, P. (2013). Green Public Procurement—European Law, Environmental Standards and What To Buy Decisions. *Journal of Environmental Law*, *25*(2), 173–202. doi:10.1093/jel/eqt006

Large, R. O., & Thomsen, C. G. (2011). Drivers of green supply management performance: Evidence from Germany. *Journal of Purchasing and Supply Management*, *17*(3), 176–184. doi:10.1016/j.pursup.2011.04.006

Lee, S. Y. (2008). Drivers for the participation of small and medium-sized suppliers in green supply chain initiatives. *Supply Chain Management: An International Journal*, *13*(3), 185–198. doi:10.1108/13598540810871235

Lin, C. J., & Wu, W. W. (2008). A causal analytical method for group decision-making under fuzzy environment. *Expert Systems with Applications*, *34*(1), 205–213. doi:10.1016/j.eswa.2006.08.012

Lin, R. J. (2013). Using fuzzy DEMATEL to evaluate the green supply chain management practices. *Journal of Cleaner Production*, *40*, 32–39. doi:10.1016/j.jclepro.2011.06.010

Liu, X., Wang, C., Shishime, T., & Fujitsuka, T. (2012). Sustainable consumption: Green purchasing behaviours of urban residents in China. *Sustainable Development*, *20*(4), 293–308. doi:10.1002d.484

Mavi, R. K., Kazemi, S., Najafabadi, A. F., & Mousaabadi, H. B. (2013). Identification and assessment of logistical factors to evaluate a green supplier using the fuzzy logic DEMATEL method. *Polish Journal of Environmental Studies*, *22*(2), 445–455.

Min, H., & Galle, W. P. (1997). Green purchasing strategies: Trends and implications. *International Journal of Purchasing and Materials Management*, *33*(2), 10–17. doi:10.1111/j.1745-493X.1997.tb00026.x

Min, H., & Galle, W. P. (2001). Green purchasing practices of US firms. *International Journal of Operations & Production Management*, *21*(9), 1222–1238. doi:10.1108/EUM0000000005923

Paladino, A., & Ng, S. (2013). An examination of the influences on green mobile phone purchases among young business students: An empirical analysis. *Environmental Education Research*, *19*(1), 118–145. doi:10.1080/13504622.2012.687044

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Palmujoki, A., Parikka-Alhola, K., & Ekroos, A. (2010). Green Public Procurement: Analysis on the Use of Environmental Criteria in Contracts. *Review of European Community & International Environmental Law*, *19*(2), 250–262. doi:10.1111/j.1467-9388.2010.00681.x

Pujari, D., Wright, G., & Peattie, K. (2003). Green and competitive: Influences on environmental new product development performance. *Journal of Business Research*, *56*(8), 657–671. doi:10.1016/S0148-2963(01)00310-1

Shen, L., Olfat, L., Govindan, K., Khodaverdi, R., & Diabat, A. (2013). A fuzzy multi criteria approach for evaluating green suppliers performance in green supply chain with linguistic preferences. *Resources, Conservation and Recycling*, *74*, 170–179. doi:10.1016/j.resconrec.2012.09.006

Srivastava, S., & Dubey, R. (2014). Supply Chain Skill Gap Modelling using Interpretive Structural Modelling and MICMAC Analysis. *International Journal of Operations and Quantitative Management*, *20*(1), 33–47.

Sunstein, C. R., & Reisch, L. A. (2014). Automatically Green Behavioral Economics and Environmental Protection. *The Harvard Environmental Law Review*, *38*(1), 127–158.

Sushil. (2005a). Interpretive matrix: A tool to aid interpretation of management and social research. *Global Journal of Flexible Systems Management*, *6*(2), 27-30.

Sushil. (2005b). A flexible strategy framework for managing community and change. *International Journal of Global Business and Competitiveness*, *1*(1), 22-32.

Sushil. (2009). Interpretive ranking process. *Global Journal of Flexible Systems Management*, *10*(4), 1-10.

Sushil. (2012). Interpreting the Interpretive Structural Model. *Global Journal of Flexible Systems Management*, *13*(2), 87-106.

Tanner, C., & Kast, S. W. (2003). Promoting sustainable consumption: Determinants of green purchases by Swiss consumers. *Psychology and Marketing*, *20*(10), 883–902. doi:10.1002/mar.10101

Tranfield, D., Deyner, D., & Smart, P. (2013). Towards a methodology for developing evidence-Informed management knowledge by means of systematic review. *British Journal of Management*, *14*(3), 207–222. doi:10.1111/1467-8551.00375

Tsai, M.-T., Chuang, L.-M., Chao, S.-T., & Chang, H.-P. (2012). The effects assessment of firm environmental strategy and customer environmental conscious on green product development. *Environmental Monitoring and Assessment*, *184*(7), 4435–4447. doi:10.100710661-011-2275-4 PMID:21818538

Tseng, M. L., & Chiu, A. S. (2013). Evaluating firms green supply chain management in linguistic preferences. *Journal of Cleaner Production*, *40*, 22–31. doi:10.1016/j.jclepro.2010.08.007

Vachon, S., & Klassen, R. D. (2008). Environmental management and manufacturing performance: The role of collaboration in the supply chain. *International Journal of Production Economics*, *111*(2), 299–315. doi:10.1016/j.ijpe.2006.11.030

Wu, K. J., Tseng, M. L., & Vy, T. (2011). Evaluation the drivers of green supply chain management practices in uncertainty. *Procedia: Social and Behavioral Sciences*, *25*, 384–397. doi:10.1016/j.sbspro.2012.02.049

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Yang, M. G. M., Hong, P., & Modi, S. B. (2011). Impact of lean manufacturing and environmental management on business performance: An empirical study of manufacturing firms. *International Journal of Production Economics*, *129*(2), 251–261. doi:10.1016/j.ijpe.2010.10.017

Young, W., Hwang, K., McDonald, S., & Oates, C. J. (2010). Sustainable consumption: Green consumer behaviour when purchasing products. *Sustainable Development*, *18*(1), 20–31.

Zhu, Q., & Sarkis, J. (2004). Relationships between operational practices and performance among early adopters of green supply chain management practices in Chinese manufacturing enterprises. *Journal of Operations Management*, *22*(3), 265–289. doi:10.1016/j.jom.2004.01.005

Zhu, Q., & Sarkis, J. (2006). An inter-sectoral comparison of green supply chain management in China: Drivers and practices. *Journal of Cleaner Production*, *14*(5), 472–486. doi:10.1016/j.jclepro.2005.01.003

Zhu, Q., Sarkis, J., Cordeiro, J. J., & Lai, K. H. (2008). Firm-level correlates of emergent green supply chain management practices in the Chinese context. *Omega*, *36*(4), 577–591. doi:10.1016/j.omega.2006.11.009

Zhu, Q., Sarkis, J., & Lai, K. H. (2013). Institutional-based antecedents and performance outcomes of internal and external green supply chain management practices. *Journal of Purchasing and Supply Management*, *19*(2), 106–117. doi:10.1016/j.pursup.2012.12.001

This research was previously published in the International Journal of Applied Management Sciences and Engineering (IJAMSE), 3(2); edited by Carolina Machado and J. Paulo Davim, pages 21-49, copyright year 2016 by IGI Publishing (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 28
Green Information Systems for Sustainability

Mahesh S. Raisinghani
TWU School of Management, USA

Efosa Carroll Idemudia
Arkansas Tech University, USA

ABSTRACT

Green Information Systems (IS) refers to the use of IS to achieve environmental objectives, whereas green Information Technology (IT) refers to the practice and study of using IT and computer resources in a more environmentally responsible and effective manner (Dedrick, 2010). Information Systems, computers and computing in general consume an immense amount of natural resources, the energy used to power them, and the problems that arise in the disposing of obsolete hardware. Mark O'Neill, the author of Green IT for Sustainable Business Practice defines green IT as, "a collection of strategic and tactical initiatives that directly reduces the carbon footprint of an organization's computing operation" (O'Neill, 2010). Issues of sustainability have started to become a significant topic of discussion in the information systems community. IT practitioners are focused more now than ever on reducing the direct impact that IT use has on the environment (Dedrick, 2010).

IMPACT OF GREEN INFORMATION SYSTEMS

Information Systems (IS) and Information Technology (IT) have changed societal behaviors drastically in the last few decades and, as such, have the conceivable backing to shift to a more sustainable society. "The role and contribution of IS to eco-sustainability has become the concern of many IS researchers" (Ijab & Molla, 2011). IS communities around the globe have begun to look seriously at the role IT can play in both creating and reducing environmental impacts. Much of the dialogue is focused on lessening the direct environmental impacts of Information Technology by making IT equipment more energy efficient (Dedrick, 2010). "These efforts can directly reduce IT costs, so there is a strong incentive for organizations to adopt them. Evidence from surveys confirms that IS organizations are responding to these incentives by adopting green practices" (Dedrick, 2010). Many businesses are focused on imple-

DOI: 10.4018/978-1-5225-7915-1.ch028

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

menting green business models. They have learned that implementing green IT solutions not only aid in meeting shareholder expectations but help to improve their organizations' corporate image, all while offering cost saving benefits.

By adopting initiatives that have a positive effect on the environment, they save money, and at the same time, use technology more efficiently. Great opportunities lie in the IT department, where reducing the environmental footprint of technology is now top of mind for many IT leaders. ("Green IT: Why")

While cost cutting is the largest impact and factor of implementing green IS practices in an organization, environmental stewardship follows closely behind. Many companies are adopting the mindset of introducing green Information Systems because "it is the right thing to do". The Vice President of Information Technology at a large international investment firm demonstrated this outlook when he said, "Cost cutting is important to every organization, let's be real, but [our] philosophy as an organization is that we live in this world and we want to be good neighbors. With our new investments, we are doing both" ("Green IT: Why,").

USE OF GREEN INFORMATION SYSTEMS

Over the recent decades, there has been a rising concern and various studies in the different ways that information systems have an impact on sustainability through the uses of various energy sources, types of transportation, ways of building and manufacturing for the current society.

- Advanced wind turbines are being transformed with various forms of sensors and controllers that enable the turbines to operate efficiently and safely in various wind speeds and weather conditions.
- A type of smart grid technology is being developed to allocate more energy more efficiently and effectively.
- Smart buildings use various sensors to adjust the surroundings from a distance such as temperature controls.
- Smart meters allow users to make changes to use of energy at various times.
- Having a smart car can improve air emissions as well as reducing the time and energy that is wasted in traffic jams.

EFFECTS OF GREEN INFORMATION SYSTEMS

Taking a longer term, more dynamic view, researchers have framed the impacts of technology on the environment as primary, secondary and tertiary order effects.

- The primary effects are the direct impacts from the hardware during the life of the product, including production, use and disposal of computer equipment.
- The secondary effects are the effects of ICTs (information and communications technologies) and their environmental impact on various developments such as industrial production or transportation.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- Tertiary effects are longer term and more dynamic. They occur when widespread use of ICTs leads to changes in lifestyles and economic structures. Tertiary effects may be seen in specific cases, such as telecommuting or the growth of home-based businesses built on e-commerce platforms such as eBay or Amazon. So far, these transformative effects are limited, but widespread adoption of the Internet is only a decade or less old in many countries. By comparison, widespread use of automobiles led to suburbanization, motels, fast food chains, and other changes in lifestyle and economic systems, but these changes were not evident until decades after the introduction.

GREEN TECHNOLOGIES THAT ARE IMPROVING ORGANIZATION

Radio-frequency identification (RFID) has transformed transportation and logistics by enhancing the success of companies and growing new sources of profits via information-based means. From a sustainability point of view, IS facilitates the companies to capture, monitor, utilize and standardize data that aid power efficiencies. Companies are decreasing energy and improving supply chain efficiency by decreasing printed items and having them available online.

PRIOR STUDIES ON GREEN IT/PRODUCTS

Worldwide despite the rapid spread of pro-green attitudes; consumers are purchasing non-green alternative because of higher prices, quality, performance, and convenience (Olson 2014). Some scholars and researchers have argued that the environments can be protected and preserved through the development and promotion of green products (Huang and Rust 2011; Hult 2011). It should be noted that it is not easy to be green because environmental friendly products might force customers to make tradeoffs on important attributes relating to price, quality, performance, and effectiveness (Barr 2006; Rokka & Uusitalo 2008). The adoption of green product worldwide is low because most people in the world do not know, understand, and appreciate the advantages and benefits of green product. There has been very few studies that have investigated the adoption of green product (Olson 2014). Worldwide, the US is the leader in per capital energy use; while China is the largest greenhouse gas emitter (Buckley 2010; Lewis 2010). Worldwide most citizens are expressing support for green products and environmental issues (Olson 2014).

All over the world, the average weight and horsepower of cars have been increasing consistently since the mid-1970 (Olson 2014). Also, there have been a consistent increase in the size of most products such as the median TV screen size leading to the rapid increase in electricity consumption (Farhi 2009; Walkeron 2008). It should be noted that the increase in the size of most product is due to consumers preference and choices. Murugesan (2008) argues that Green IT is the process by which individuals and organizations adopt environmental sustainable practices using information technology/systems. Organizations and individuals are legally, ethically, and socially required to use Green IT products; and at the same time implement practices that enhances the adoption of Green IT (Murugesan 2008). Coffey et al. (2013) argue that international approaches and practices toward Green IT are still in their early stages. To date, unlike carbon footprint monitoring, there are very few international guidelines relating to Green IT/Management (Coffey et al. 2013). Organizations and individuals' decision to adopt Green IT is based on financial, legal, moral, and ethical considerations (Chen et al. 2010). Ruth (2009) argues

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

that IT infrastructure is going green based on significant new regulations relating to IT equipment for PCs and hardware. Also, some countries are now having national standards relating to data center power savings (Ruth 2009). Green IT and computing started in the early 1992 (Ruth 2009).

Green information technologies and systems refer to initiatives and programs that directly or indirectly address environmental sustainability in organizations (Jenkin et al., 2011). Green IT/IS is a compound word and refers to the environment and ITIS. It can refer to either "green of ITIS" or "green by ITIS" based on the roles of ITIS in the business operation (Park, Cho et al. 2009). "Green of IT IS" means making the ITIS industry green, while "Green by IT IS" means making activities green by using ITIS. Therefore, green ITIS focuses on either energy-saving IT equipment and information systems or an energy-efficient society by ITIS application.

Jenkin et al., (2011) develop a multilevel research framework to guide future research. To do so, we review the existing green information technology and systems literature, and also draw more broadly from research that addresses environmental sustainability in the management, environmental psychology, and social marketing domains. From this review, we identify important research gaps and present a set of propositions to guide future research. The three aspects of green ITIS adoption motivations are: regulations, competitiveness and ecological responsibility (Zheng, 2014). There is little research involved in business strategy, motivations, and corporate social responsibility (CSR) framework together to explain the phenomenon of green ITIS adoption. Obviously, the motivations of organization and technology are associated with the organization themselves, and the motivations of regulation are not associated with the environment. Thus, business strategy moderates the motivation of organization and technology, and has no relationship with the motivation of regulation. Although there has been research concerning green ITIS in the application of ecological practice, investigation of current IS literature reveals that there is a notable absence of research on green ITIS at the strategic level (Zheng, 2014).

Bhadauria et al. (2014) developed a structural model depicting the impact of green information systems on environmental, economic, and operational performance for which data were collected from 159 manufacturing managers and analyzed using a structural equation modelling methodology. Their findings indicate that green information systems positively and directly impact environmental, economic, operational performance. Green information systems also indirectly impact operational performance through environmental performance and indirectly impact economic performance through environmental performance. Evidence supports the need for manufacturers to develop green information system capabilities to improve environmental and operational performance and their results support the proposition that green information systems are necessary to achieve environmental and economic sustainability.

Fang et al. (2014) report that to better cope with the Internet usage shift from host-centric end-to-end communication to receiver-driven content retrieval, innovative Information-Centric Networking (ICN) architectures have been proposed. However with the explosive increase of global network traffic, the energy efficiency issue in ICN is a growing concern. A number of approaches have been proposed to address the energy efficiency issue in ICN. However, several significant research issues and challenges remain to be addressed before its widespread deployment, including but not limited to shutdown, slow-down, mobility and cloud computing.

Jenkin et al., (2011) develop a multilevel Green Information Technology/Systems (IT/S) research framework to guide future research by placing the fragmented Green IT/IS literature in conversation with the more well-established environmental sustainability literatures in management, environmental psychology, and social marketing domains. From this review, they have identified important research gaps and present a set of propositions to guide future research. This could be a starting point for future

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

research agenda in this domain. For example, within-level and between-level alignment of environmental orientation, as well as its relationship to environmental initiatives (both Green IT/S strategy and Green IT/S implemented) and environmental impacts is a critical area for future research.

MOTIVATIONS FOR GREEN INFORMATION SYSTEMS

Current studies show that various systems of production *and consumption* go hand in hand. Hence, to solve the solutions to the current environmental issues, we should reflect on how consumption and production work together to interact with the environment. Most companies only focus on the production and manufacturing procedures that often simply move the problem somewhere else in the system. An overall perspective is crucial when the companies consider the development of their services department. These departments use various forms of information, sharing and data acquirement to produce 60 percent of U.S. economic production and employment. The various businesses in these departments execute key financial and societal tasks such as education, health care, public utilities, entertainment, banking and finance, transportation, as well as retail and wholesale trade. All of these devour energy and resources which ultimately sway the atmosphere, such as financial institutions and banking. Other than utilities and transportation, these services are not generally linked with environmental impacts. These services thus represent an unexploited resource for improving the environment. Service companies are well positioned to control their suppliers, as well as their consumers, towards a complete change. The more information they have in hand, the more it will aid their decisions.

The communications and information uprising is making various changes to current atmosphere. The changes in the industry are being noticed already, mostly in the materials and energy used, monitoring and managing of emissions from various forms of transportation, inventory and quality, and the improved control of the production processes. The integration of electronic sensors in the energy-saving machinery has been shown to promote cleaner assembly and allows the user to input various information to control the process. For accurate execution and agreement with the regulations, the majority of these processes usually require online computers that use intricate and complex procedures.

Communications and information machinery also increase the inventory control and facilitate to decrease and eradicate defective or substandard products. Due to high demands for companies to decrease expenditure, achieve environmental goals, to increase manufacturability, quality, or performance have been attained by constant development and have resulted in the shared procedures. These developments are supported by the implementation of IT that circulate data and help administer inventory. By combining these benefits and applying IT with new management viewpoints, it could cause more harm to the environment and become more consequential. Companies who have just-in-time can increase the types of transportation, therefore leading to an increase in pollution as well as use of energy.

The majority of the machinery has produced fewer materials per unit of product. Instead of using an old vacuum-tube machine, it is more efficient to use a semiconductor because it has more power without eating up energy and materials. In the same way, on the materials front, metal consumption over the past 20 years has decreased immensely. Most of these reductions can be accredited to the information and communications uprising itself, which inspires many companies to have improved product design systems. These machines also have facilitated advancement of more effective manufacturing processes.

The information and communications uprising is creating a far more incorporated nation. Concentrating on environmental and sustainability issues entails various viewpoints that are entwined with the

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

universal financial system and with nature. The theory of sustainability involves a universal agreement with its sustaining natural environment which will produce a healthier atmosphere, one that is dense with information.

Even though information substitution is a significant contributor, it will not produce the model environment by itself; such substitutions are not without trade-offs. In the transportation industry, there has been an integration of machinery in various forms of transportation and traffic systems, which aid in traffic flow and accidents. Having a significant improvement on public transportation has shown to increase ridership on public transportation which has been shown as a solution for traffic jams. Working from home is another alternative that companies are starting to include but can often lead to low productivity, interfere with privacy of the content, as well as technical issues.

LITERATURE REVIEW

The immense use of information technology in a society to improve economy and provide efficient services has been the motivation to pursue green information systems. Organizations are inspired to 'go green' because it is cost effective for them. There are a number of internal and external processes in an organization. These include email, video conferencing, teleconferencing and file transfer protocols, etc. Adopting environment friendly processes has quantifiably improved businesses and its processes. An example is companies switching their reports from hard copies to soft copies. Prior to 1996, AT&T printed hard copies of their 100,000 page annual environmental report (de Geus, 1997). When they stopped printing the report and started using the internet to publish the reports, their cost for printing was reduced by ten percent. Similarly, Sun Microsystems is also using a system of operation to keep all recorded data in electronic format (Craig, 1997).

Industries have introduced the concept of digital signatures as well to avoid indulging in time consuming activities of sending documents to and fro and waiting for them to be delivered. Electronic marketing and banking is also becoming common among consumers due to ease of use. This, in return, helps the company save additional resources like forms and hard copy notices to the customers. A June, 2013 study by the consulting firm Celent, revealed that 42 percent of Android users in the United States relied on online banking for financial transactions versus 27 percent of people who did not own a smart phone ("Smartphone users prefer," 2013). The advancements in technology have made it easy to adopt environmentally friendly practices especially in supply chain management. Technology, particularly smart phones, are now a part of everyday life for most people. Transportation costs are reduced by providing online facilities for reporting, registering and delivering of goods and other everyday items. The adoption of green information systems requires companies to revamp their processes in order to effectively meet the goal. Some people are resistant to change but once they adopt the processes and understand them, they feel comfortable in doing more in less time.

Apart from cost savings, companies benefit by building healthy public relations and attracting consumers of like mind. A study conducted in 2010 by Accenture revealed that 49 percent of the companies had their brand reputation improved and gained trust of customers by taking sustainability measures (Anne, 2011). A report also shows how Newmarket gained customer satisfaction by delivering software electronically rather than delivering compact discs through courier. The report also shows that the company saved $42,000 in shipping costs ("Choosing sustainability in", n.d.). Providing ease to customers always attract them for future services as well. As people are becoming aware of the benefits of using

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

recyclable material, they prefer companies whose products are environment friendly. Research suggests that companies who go green provide a healthier workplace to employees; thus, their sick leaves are reduced by 20 percent and the company has to pay less for the medical programs they offer. Governments in many countries have also provided compensation in the form of tax incentives for companies that are providing and practicing environmentally friendly services (Joesph, n.d.). This has convinced more and more companies to collaborate with the government in introducing processes for the common public that are environmentally friendly.

By adopting green information systems, staff productivity can be increased. In order to make employees feel as if they are a part of the team and that they are contributing to society by following environmental processes, companies can contribute in the global mission of using resources responsibly. People feel happier to work in a place that is helping society as they realize that investment is required initially in following environmental friendly processes. They feel proud to be a part of a company that invested financial resources for the environment rather than adding it in their profits. They spread awareness in their social circles by explaining their methodologies to handle activities at work. One such example is 10000 friends - a project by individuals and organizations in Pennsylvania dedicated to providing a platform for awareness and practices of eco-friendly activities in organizations and at home. Studies have shown that turnover ratio decreases when people are happy at a workplace and they feel more obliged to contribute to the welfare of the company. By reducing telecommuting costs and allowing work from home, employees are saved from parking issues and are happy to be near their family (Abella & Yap, 2012).

Energy efficient green information systems involve the process of reduction, reusability and recycling of resources for sustainability. One way to do this is to increase the life of a product. To incorporate latest technology with existing ones, modularity concept is embedded in existing systems for easy upgrade. One other way for making efficient systems is to create centric data. A large chunk of data required by users is not sensitive and hence needs not to be decentralized. As far as the software development is concerned, researches are done to investigate the impact of development units in conserving energy and creating an environmental friendly lifecycle of development. These software development units include algorithm execution, efficient allocation and virtualization of resources, usage of terminal servers, power management, availability requirements of data centers, storage medium, support of operating systems, telecommunication and network devices, display and video graphics. Where hardware is concerned, devices are equipped with energy saving materials e.g. light emitting diodes for display, PC power management at module levels and then providing sleep modes at software levels etc. Leading giant industry IBM ("Green IT") has launched a series of computer hardware for efficient energy consumption and sustainability. The Z196 series saves energy up to 75 percent as compared to the other series of hardware that is in use today. The interesting factor about this hardware is that the energy conservation is done by not compromising on performance. This encourages consumers to buy energy efficient computing machines to accomplish their tasks. Gartner estimates presented at Gartner Symposium indicate that IT contributes to 2 percent of the current carbon emission in the world. The Climate Group and Global e Sustainability Initiative estimated in 2008 that by the year 2020, IT can reduce carbon emissions by 15 percent. This is only possible by following methodologies and processes that are environmentally friendly within organizations as mentioned by the Verizon Business ("Go Green"). SAP is business process management software that allows sustainability by providing a number of resources that are efficient as well. The major modules include information lifecycle management and IT infrastructure management that are widely used.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The literature review discussed above shows how significantly operations have improved in organizations by adopting green IT. This includes cost reduction, performance enhancement and customer satisfaction. It also encourages employees, as they feel motivated to be a responsible member of society by following Green IT processes.

IMPLICATIONS FOR RESEARCH: KEY TAKEAWAYS FOR RESEARCH

In the immediate to near future, Green IS will fundamentally impact organizations. The transformative capacity of these technologies can already address service challenges across customer service needs, industry and government planning operations, and new research and innovation. Green IS is the central way of improvement, as its paves the way for future requirements and links to more discoveries and emerging advanced applications.

The overall performance of an organization can already be fused and positively affiliated with coordinated efforts through the use of Green IS. Green supply chain managers are reducing costs and improving their environmental performance through better synergized logistics, tracking, and monitoring environmental information. Their bottom-line effectiveness, as well as competitiveness, benefits from green supply chain management. The Environmental Protection Agency (EPA) finds that enhancing green supply chain management processes will reduce waste, decrease operating costs, lower training needs, increase revenues and lower the use of hazardous waste materials. The green supply chain management process, and its informatics obtained through the use of Green IS, is one example of how companies are accounting for their environmental advantages and expenses. The EPA's guidebook on improving environmental performance suggests that by synthesizing best management practices, some leading U.S. companies "have saved millions of dollars while reducing or eliminating significant impacts" (The Lean and Green, 2000).

Green information systems are transforming environmental issues and revolutionizing global, social, and cross-cultural relations. These technologies provide increasing efficiencies and opportunities that once limited organizations in the physical world. The immediate nature of virtual reality and cloud computing modernizes the way critical problems impacting the environment and communities are researched. Large universities can now offer a multidisciplinary approach to academic research through the use of these technological dimensions. The opportunity to share knowledge and collaborate intellectually gives researchers access to more data, allowing them greater chances of making a global impact.

Business intelligence is the foundation for a green information system network that supports an organization's ability to manage, communicate and develop its intangible assets sustainably. As interactions with other developed countries intensifies, so does the need to share information and knowledge. These intangible assets serve as a new commodity and business intelligence. This ever increasing production of knowledge, as well as information sharing, promotes new solutions and applications for environmental problems. While the possibilities for green information systems are vast, an increasingly global economy and its interconnectedness necessitate more attention. In some way, "knowledge is more important as a product than it has been hitherto – we are seeing the rise of new forms of activity based on the trading of knowledge products" (Smith, 2002). Business information that grants expediency of transactions, access to greater and more diverse customers, and the removal of cultural barriers in the process, provide critical technologies for competing and surviving in today's interconnected market.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Green IS is a dynamic and iterative technology that brings new advancements to the global market. As new environmental strategies provide positive evidence of their impact, the resulting quantifiable and qualitative data fuel more information for business solutions and sustainability purposes. This exchange of knowledge yields to new understandings of environmental change and allows for its transparency. This creates a cycle for new policies, environmental solutions, and supporting technologies.

The use of Green IS stands to directly and indirectly impact human behavior. Business organizations that utilize Green IS and practice sustainability are more likely to foster environmentally charged behaviors in their workforce. Professionals who support and engage in activities that promote sustainable business practices are more apt to understand its importance and adopt new behavior changes. The basis to human involvement in sustainable practices involves consumer awareness. Green IS alone cannot change behavior. Rather, the "emerging and effective tool for encouraging positive change" (McKenzie-Mohr, 2011) is the outcome of Green IS.

CONCLUSION

Information Systems bridge the gap between countries, organizations, and societies, and it enhances their operations through its platform for collaboration. Green Information Systems is a vehicle which is successfully giving rise to the principles of sustainability and fundamentally changing the collaborative, yet complex society dedicated to progressing environmental advancements. The transformative powers of Green IS offer new insights into previously unrealized economic, social, and ecological competitive advantages. There is also a growing awareness that Green IS is not only a contributor, but perhaps will be a key facilitator for sustainable strategies. As the interest for environmental strategies unfolds, so does the understanding for how Green IS will be part of the solution. Its relevance and ever increasing employment only broadens the context of environmental sustainability. Green IS has the strongest capability to impact societal behaviors. Communities around the globe are creating and reducing their environmental impacts by a means of dialogue and interconnectivity that never existed two decades ago. The significant environmental progress at the individual, organizational, and international level through the transformative powers of Green IS is paving the way for future sustainability requirements and discoveries.

ACKNOWLEDGMENT

The authors would like to acknowledge the research support provided by Crystal Ash, Afreen Assad, Pei-Chun Chao, and Melody Emadiazar.

REFERENCES

Abella, D. D., & Yap, D. C. (2012). The organizational benefits of going green. Inquirer Business, Retrieved from http://business.inquirer.net/100449/the-organizational-benefits-of-going-green

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Anne, M. (2011, June 1). Sustainability initiatives exceed expectations, businesses say. Greener Package, Retrieved from http://www.greenerpackage.com/corporate_strategy/sustainability_initiatives_exceed_expectations_businesses_say

Babin, R., & Nicholson, B. (2009). How Green Is My Outsourcer-Environmental Responsibility in Global IT Outsourcing, International Conference on Information Systems 2009 Proceedings, Paper 83, http://aisel.aisnet.org/icis2009/83

Berkes, F., & Folke, C. (Eds.). (2000). *Linking Social and Ecological Systems for Resilience and Sustainability*. Cambridge, England: Cambridge University Press.

Choosing sustainability in an uncertain economy. (n.d.). Retrieved from http://www.gbb.org/case-studies/choosing-sustainability-in-an-uncertain- economy/

Craig, E. (1998). Personal Communication. Sun Microsystems.

de Geus, A. (1997). Presentation on the knowledge economy at AT&T, Basking Ridge, N.J. September 9.

Dedrick, J. (2010). Green IS: Concepts and Issues for Information Systems Research. *Communications of the Association for Information Systems*, *27*(11). Retrieved from http://aisel.aisnet.org/cais/vol27/iss1/11

Go green. (n. d.). Retrieved from www.verizonbusiness.com/solutions/green

Green IT – energy efficiency. (n. d.). Retrieved from http://www-03.ibm.com/systems/z/advantages/energy/

Green IT: Why mid-size companies are investing now. (n. d.). Retrieved from http://www-03.ibm.com/press/attachments/GreenIT-final-Mar.4.pdf

Hilty, L. M., Arnfalk, P., Erdmann, L., Goodman, J., Lehmann, M., & Wager, P. A. (2006). The relevance of information and communication technologies for environmental sustainability - A prospective simulation study. *Environmental Modelling & Software*, *21*(11), 1618–1629. doi:10.1016/j.envsoft.2006.05.007

Ijab, M., & Molla, A. (2011). *The study of green information systems from the theory of practice perspective. Informally published manuscript*. Melbourne, Australia: RMIT University. Retrieved from http://aisel.aisnet.org/cgi/viewcontent.cgi?article=1023&context=mcis2011

Joesph, C. (n. d.). What are the benefits of going green for a business? Retrieved from http://smallbusiness.chron.com/benefits-going-green-business-3225.html

McKenzie-Mohr, D. (2011). *Fostering Sustainable Behavior*. Canada: New Society Publisher.

Melville, N. (2010). Information Systems Innovation for Environmental Sustainability. *Management Information Systems Quarterly*, *34*, 1–21.

O'Neill, M. (2010). *Green IT for sustainable business practice*. Swindon, United Kingdom: British Informatics Society Limited. Retrieved from http://www.bcs.org/upload/pdf/greenit-promo-ebook.pdf

Sayeed, L., & Gill, S. (2009).Implementation of Green IT: Implications for a Dynamic Resource. Proceedings of the Americas Conference on Information Systems '09. Retrieved from http://aisel.aisnet.org/amcis2009/381

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Smartphone users prefer online banking over mobile (2013, October 10). eMarketer. Retrieved from http://www.emarketer.com/Article/Smartphone-Users-Prefer-Online-Banking-Over-Mobile/1010289

Smith, K. (2002, June). What is the 'Knowledge Economy'? Knowledge Intensity and Distributed Knowledge Bases. UNU/INTECH Discussion Papers. Masstricht, The Netherlands.

The Climate Group and Global Sustainability Initiative. (2008, June). SMART 2020: Enabling the Low Carbon Economy in the Information Age. Retrieved from http://www.smart2020.org/_assets/files/03_Smart2020Report_lo_res.pdf

The Lean and Green. (2000). Washington, D.C.: Environmental Protection Agency.

ADDITIONAL READING

Ansari, N. L., Ashraf, M. M., Malik, B. T., & Grunfeld, H. (2010). Green IT Awareness and Practices: Results from a Field Study on Mobile Phone Related E-Waste in Bangladesh. *Proceedings of the International Symposium on Technology and Society (ISTAS)* (pp. 375-383). 10.1109/ISTAS.2010.5514618

Aoun, C., Vatanasakdakul, S., & Cecez-Kecmanovic, D. (2011). Can Is Save the World? Collaborative Technologies for Eco-Mobilisation. *Proceedings of the Australasian Conference on Information Systems*.

Bachour, N., & Chasteen, L. (2010). Optimizing the Value of Green IT Projects within Organizations. *Proceedings of the Green Technologies Conference*. *IEEE.* 10.1109/GREEN.2010.5453804

Bengtsson, F., & Ågerfalk, P. J. (2011). Information Technology as a Change Actant in Sustainability Innovation: Insights from Uppsala. *The Journal of Strategic Information Systems*, *20*(1), 96–112. doi:10.1016/j.jsis.2010.09.007

Bhamra, R. (2012). Sustainable Outsourcing: A Practice Survey and Research Opportunities. *International Journal of Sustainable Engineering*, *5*(4), 304–311. doi:10.1080/19397038.2012.689024

Bose, R., & Luo, X. (2011). Integrative Framework for Assessing Firms' Potential to Undertake Green IT Initiatives Via Virtualization–a Theoretical Perspective. *The Journal of Strategic Information Systems*, *20*(1), 38–54. doi:10.1016/j.jsis.2011.01.003

Bose, R., & Luo, X. R. (2012). Green IT Adoption: A Process Management Approach. *International Journal of Accounting and Information Management*, *20*(1), 63–77. doi:10.1108/18347641211201081

Boudreau, M.-C., Chen, A., & Huber, M. (2008). *Green Is: Building Sustainable Business Practices.*

Brocke, J. v., Watson, R. T., Dwyer, C., Elliot, S., & Melville, N. (2012). Green Information Systems: Directives for the Is Discipline. *Proceedings of the International Conference on Information Systems*

Brocke, J. v., Watson, R. T., Dwyer, C., Elliot, S., & Melville, N. (2013). Green Information Systems: Directives for the Is Discipline. *Communications of the Association for Information Systems*, *33*(1), 509–520.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Brooks, S., Wang, X., & Sarker, S. (2010). Unpacking Green IT: A Review of the Existing Literature. *Proceedings of the Americas Conference on Information Systems*.

Brooks, S., Wang, X., & Sarker, S. (2012). Unpacking Green Is: A Review of the Existing Literature and Directions for the Future. In *Green Business Process Management* (pp. 15–37). Springer. doi:10.1007/978-3-642-27488-6_2

Butler, T. (2011). Compliance with Institutional Imperatives on Environmental Sustainability: Building Theory on the Role of Green Is. *The Journal of Strategic Information Systems*, *20*(1), 6–26. doi:10.1016/j.jsis.2010.09.006

Cai, S., Chen, X., & Bose, I. (2013). Exploring the Role of It for Environmental Sustainability in China: An Empirical Analysis. *International Journal of Production Economics*, *146*(2), 491–500. doi:10.1016/j.ijpe.2013.01.030

Capra, E., & Merlo, F. (2009). Green IT: Everything Starts from the Software. *Proceedings of the European Conference of Information Systems*.

Cater-Steel, A., & Tan, W.-G. (2011). The Role of It Service Management in Green IT. *Australasian Journal of Information Systems*, *17*(1). doi:10.3127/ajis.v17i1.609

Chai-Arayalert, S., & Nakata, K. (2011). The Evolution of Green ICT Practice: UK Higher Education Institutions Case Study. *Proceedings of the International Conference on Green Computing and Communications* (pp. 220-225). IEEE Computer Society. 10.1109/GreenCom.2011.45

Chen, A. J., Watson, R. T., & ... . (2009). Organizational Adoption of Green IS&IT: An Institutional perspective. *Proceedings of the International Conference on Information Systems*.

Chen, A. J. W., Boudreau, M.-C., & Watson, R. T. (2008). Information systems and ecological sustainability. *Journal of Systems and Information Technology*, *10*(3), 186–201. doi:10.1108/13287260810916907

Davis, F. D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *Management Information Systems Quarterly*, *13*(3), 318–340. doi:10.2307/249008

Group, G. C. (2008). *Smart 2020: Enabling the low carbon economy in the information age*. Climate Group/GESI.

Henriques, I., & Sadorsky, P. (1999). The relationship between environmental commitment and managerial perceptions of stakeholder importance. *Academy of Management Journal*, *42*(1), 87–99. doi:10.2307/256876

Kettinger, W. J., Grover, V., Guha, S., & Segars, A. H. (1994). Strategic Information Systems Revisited: A Study in Sustainability and Performance. *Management Information Systems Quarterly*, *18*(1), 31–58. doi:10.2307/249609

Kuo, B. N., & Dick, G. N. (2010).Organizational Green IT: It seems the bottom line rules. *Proceedings of the Sixteenth Americas Conference on Information Systems*, Lima, Peru.

Liang, H., Saraf, N., & ... . (2007). Assimilation of Enterprise Systems: The Effect of Institutional Pressures and the Mediating Role of Top Management. *Management Information Systems Quarterly*, *31*(1), 59–87.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Mann, H., Grant, G., & ... . (2009). Green IT: an Implementation Framework. *Proceedings of the Americas Conference on Information Systems*, San Francisco, California, USA.

McDaniel, S. W., & Rylander, D. H. (1993). Strategic Green Marketing. *Journal of Consumer Marketing*, *10*(3), 4–10. doi:10.1108/07363769310041929

Melville, N. P. (2010). Information Systems Innovation for Environmental Sustainability. *Management Information Systems Quarterly*, *34*(1), 1–21.

Osch, W. V., & Avital, M. (2010). From Green IT to Sustainable Innovation. *Proceedings of the Sixteenth Americas Conference on Information Systems*, Lima, Peru.

Palekar, S., & Sedera, D. (2013). The Competing-Complementarity of Social Media. *Proceedings of the International Conference on Information Systems*, Milan, Italy.

Park, J. K., Cho, J. Y., & ... . (2009). A Proposed Framework for Improving IT utilization in the Energy Industry, *World Academy of Science*. *Engineering and Technology*, *58*, 387–393.

Pitt, L. F., Parent, M., Junglas, I., Chan, A., & Spyropoulou, S. (2011). Integrating the Smartphone into a Sound Environmental Information Systems Strategy: Principles, Practices and a Research Agenda. *The Journal of Strategic Information Systems*, *20*(1), 27–37. doi:10.1016/j.jsis.2010.09.005

Rahim, R. E. A., & Rahman, A. A. (2013). Green IT Capability and Sustainable Development, Green Computing. *Proceedings of the Technology and Innovation Conference*, *The Society of Digital Information and Wireless Communication* (pp. 80-88).

Rao, S. V. R. K., Saravanakumar, J., Sundararaman, K., Parthasarathi, J., & Ramesh, S. (2011). Intelligent Green IT Management for Enterprises through System Profiling. *Proceedings of the IEEE/ACM International Conference on Green Computing and Communications (GreenCom)* (pp. 206-211). 10.1109/GreenCom.2011.42

Rawai, N. M., Fathi, M. S., Abedi, M., & Rambat, S. (2013). Cloud Computing for Green Construction Management. Intelligent System Design and Engineering Applications (pp. 432-435).

Rogers, E. M. (1995). *Diffusion of Innovation*. New York, New York, U.S.A.: The Free Press.

Ruth, S. (2009). Green IT More Than a Three Percent Solution? *Internet Computing* (pp. 74–78). IEEE. doi:10.1109/MIC.2009.82

Sandberg, B. (2002). Creating the market for disruptive innovation: Market proactiveness at the launch stage. *Journal of Targeting*. *Measurement and Analysis for Marketing*, *11*(2), 184–196. doi:10.1057/palgrave.jt.5740076

Sarkar, P., & Young, L. (2009). Managerial Attitudes Towards Green IT: An Explorative Study of Policy Drivers. *Proceedings of the Pacific Asia Conference on Information Systems* (pp. 95).

Sarkar, P., & Young, L. (2009). Managerial attitudes towards green IT: An explorative study of policy drivers. *Proceedings of the Pacific Asia Conference on Information Systems*, Hyderabad, India.

Sayeed, L., & Gill, S. (2009). Implementation of Green IT: Implications for a Dynamic Resource. *Proceedings of the Americas Conference on Information Systems*.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Seidel, S., Recker, J., & Vom Brocke, J. (2013). Sensemaking and Sustainable Practicing: Functional Affordances of Information System in Green Transformations. *Management Information Systems Quarterly*, *37*(4).

Seidel, S., Recker, J. C., Pimmer, C., & vom Brocke, J. (2010). Enablers and Barriers to the Organizational Adoption of Sustainable Business Practices. *Proceedings of the Americas Conference on* Information Systems, Sustainable IT Collaboration around the Globe: Association for Information Systems.

Simula, H., Lehtimaki, T., & ... . (2009). Managing Greenness in Technology Marketing. *Journal of Systems and Information Technology*, *11*(4), 331–346. doi:10.1108/13287260911002486

Stolze, C., Janßen, D., & Thomas, O. (2012). *Sustainability as a Topic of Is Research–Reviewing a Decade of Literature*.

Taha Ijab, M., Molla, A., & Cooper, V. A. (2011). A Theory of Practice-Based Analysis of Green Information Systems (Green Is) Use. *Proceedings of the Australian Conference on Information Systems*.

Teo, H. H., Wei, K. K., & ... . (2003). Predicting Intention to Adopt Interoganizational Linkages: An Institutional Perspective. *Management Information Systems Quarterly*, *27*(1), 19–49.

Thirupathi Rao, K., Kiran, P. S., & Reddy, L. S. S. (2010). Energy Efficiency in Datacenters through Virtualization: A Case Study, *Global*. *Journal of Computer Science and Technology*, *10*(3).

Trimi, S., & Park, S.-H. (2013). Green IT: Practices of Leading Firms and Ngos. *Service Business*, *7*(3), 363–379. doi:10.100711628-012-0163-9

Uddin, M., & Rahman, A. A. (2012). Energy Efficiency and Low Carbon Enabler Green IT Framework for Data Centers Considering Green Metrics. *Renewable & Sustainable Energy Reviews*, *16*(6), 4078–4094. doi:10.1016/j.rser.2012.03.014

Vlek, C., & Steg, L. (2007). Human Behavior and Environmental Sustainability: Problems, Driving Forces, and Research Topics. *The Journal of Social Issues*, *63*(1), 1–19. doi:10.1111/j.1540-4560.2007.00493.x

Vykoukal, J., Wolf, M., & Beck, R. (2009). Does Green IT Matter? Analysis of the Relationship between Green IT and Grid Technology from a Resource-Based View Perspective. *Proceedings of the Pacific Asia Conference on Information Systems*.

Watson, R. T., Boudreau, M. C., & Chen, A. J. (2010). Information Systems and Environmentally Sustainable Development: Energy Informatics and New Directions for the Is Community. *Management Information Systems Quarterly*, *34*(1), 23–38.

Woodruff, A., Hasbrouck, J., & Augustin, S. (2008). A Bright Green Perspective on Sustainable Choices. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 313-322). 10.1145/1357054.1357109

Zhang, L. M., Li, K., & Zhang, Y. Q. (2010). Green Task Scheduling Algorithms with Energy Reduction on Heterogeneous Computers. Progress in Informatics and Computing (PIC) (pp. 560-563).

Zhiwei, X. (2012). Measuring Green IT in Society. Computer Society (pp. 83-85).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

KEY TERMS AND DEFINITIONS

Business Intelligence: Business intelligence is the foundation for a green information system network that supports an organization's ability to manage, communicate and develop its intangible assets sustainably. As interactions with other developed countries intensifies, so does the need to share information and knowledge. These intangible assets serve as a new commodity for business intelligence.

Eco-Sustainability: Evidence supports the need for manufacturers to develop green information system capabilities to improve environmental and operational performance and their results support the proposition that green information systems are necessary to achieve environmental and economic sustainability.

Environmental Issues: Concentrating on sustainability and environmental issues entails various viewpoints that are entwined with the universal financial system and with nature. The theory of sustainability involves a universal agreement with its sustaining natural environment which will produce a healthier atmosphere, one that is dense with information.

Environmental Objectives: Green information technologies and systems refer to initiatives, policies, rules, guidelines, and programs that directly or indirectly address environmental sustainability so as to achieve environmental objectives.

Environmental Sustainability: There is also a growing awareness that Green IS is not only a contributor, but perhaps will be a key facilitator for sustainable strategies. As the interest for environmental strategies unfolds, so does the understanding for how Green IS will be part of the solution. Its relevance and ever increasing employment only broadens the context of environmental sustainability.

EPA: The Environmental Protection Agency (EPA) finds that enhancing green supply chain management processes will reduce waste, decrease operating costs, lower training needs, increase revenues and lower the use of hazardous waste materials. The EPA's guidebook on improving environmental performance suggests that by synthesizing best management practices, some leading U.S. companies "have saved millions of dollars while reducing or eliminating significant impacts" (The Lean and Green, 2000).

Green IT: Refers to the practice and study of using IT and computer resources in a more environmentally responsible and effective manner (Dedrick, 2010).

Techniques for Sustainability: Over the recent decades, there has been a rising concern and various studies in the different ways that information systems have an impact on sustainability through various techniques such as the uses of various energy sources, types of transportation, ways of building and manufacturing for the current society. From a sustainability point of view, IS facilitates the companies to use various techniques to capture, monitor, utilize and standardize data that aid power efficiencies. Companies are decreasing energy and improving supply chain efficiency by decreasing printed items and having them available online.

This research was previously published in the Handbook of Research on Waste Management Techniques for Sustainability edited by Ulas Akkucuk, pages 212-226, copyright year 2016 by Information Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 29
Value Engineering–Based Method for Implementing the ISO14001 System in the Green Supply Chains

Jun-Der Leu
National Central University, Taiwan & Munich University of Applied Sciences, Germany

Larry Jung-Hsing Lee
National Central University, Taiwan

André Krischke
Munich University of Applied Sciences, Germany

ABSTRACT

Numerous green regulations currently require companies to be responsible for their effect on the natural environment, in addition to achieving their economic goals. In view of this, many companies have implemented the ISO14001 system in their supply chain to comply with green regulations. However, implementing such a system involves technical and communication efforts; hence, an effective method is needed to support the implementation. In this paper, the authors propose a value engineering (VE)-based model with quality tools to support the implementation of the ISO14001 system in the Green Supply Chains. In it, they applied the framework of VE with the quality engineering tools Fishbone Analysis and Failure Mode Effect Analysis for the qualitative and quantitative analysis of green issues in supply chains to cover quality, risk, and value of the system. The proposed method was applied to a global electronics manufacturing company in Taiwan, and the application results showed positive outputs in terms of CO2 emission, power consumption, water consumption, and waste water recovery. Based on the evidence, academic and industrial implications are discussed.

DOI: 10.4018/978-1-5225-7915-1.ch029

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

1. INTRODUCTION

The green supply chain concept is a model in which companies minimize the environmental impact of their industrial activities while maintaining their quality, reliability, cost-efficiency, performance, and energy efficiency. The concept involves a paradigm shift in business operations by transforming the end-of-pipe control operations of an organization to conform to environmental regulations that facilitate the minimization of ecological damage, while maximizing total economic profits (Srivastava 2007). From researching different manufacturing companies, implemented ISO14001 is the way to set up robust environment policy by transforming the entire supply chain to green through greener products and strong regulatory pressure from government and non-government organizations (Dey and Cheffi, 2013). It is critical for organisations to meet the requirements of green guidelines by producing green products and managing their entire supply chain. This also implies an obligation for organisations to treat used materials and products appropriately. Because external pressures have encouraged innovators to identify or develop greener processes and products, companies must incorporate environmental factors into their supply chain system to meet customer expectations (Swanson et al., 2005; Grote et al., 2007).

Walton et al. (1998) asserted that the green supply chain is a value-added concept that assists companies to maintain stable long-term relations with suppliers to benefit both the environment and businesses. However, implementing a green supply chain is complicated. The industrial survey by Al-Darrab et al. (2013) found that most implementation of quality management projects was unproductive and required an integrated approach. We developed a value engineering (VE)-based model combined with quality tools to improve the green performance of a supply chain. To achieve this, we considered the balance between environmental expenses and firm benefits.

In this paper, we first review related literature and then present the methodology of the VE-based model with quality tools in Section 3. We then apply this method to an industrial case in Section 4. On the basis of the application evidence, we discuss the academic and industrial implications in Section 5. Finally, we present our conclusion and suggestions for future research.

2. LITERATURE REVIEW

In this section, we review the literature on green supply chains and research methods. First, we review ISO14001 and green supply chain models. Second, we review green businesses. Third, we review papers on VE and its use in environmental and quality improvements. Lastly, we discuss the findings and gaps in the literature.

2.1. ISO14001 and Green Supply Chain Model

ISO14001 provides the industry with primary guiding principles for developing an environmental management system, and offers self-checking mechanisms on environmental performance. The ISO14001 objectives include both quality and environmental aspects that seek to mitigate emissions and effluents, reduce the environmental effect of industries, and enhance customer satisfaction (Chen, 2005). Nishitani (2009) stated that the relationship between the adoption of ISO14001 and economic performance is positive; implementing ISO14001 satisfies stakeholders because it demonstrates that a firm employs advanced environmental management practices (Prajogo et al., 2014). Asif et al. (2011) discussed envi-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

ronmental issues from the corporate sustainability perspective and proposed a framework for integrating sustainability in the quality management system.

The green supply chain concept provides companies an opportunity to develop win-win strategies that increase their profits and market share while reducing their environmental risks and impact, thereby improving their ecological efficiency (van Hoek, 1999, Zhu et al., 2012, Mohanty and Prakash, 2014). Zhu et al. (2008) reviewed more than 300 manufacturers implementing a green supply chain model and classified them based on regulatory, market, supplier, and internal pressures. They subdivided these four categories into five measurement items: internal environmental management, green purchasing, customer cooperation, investment recovery, and eco-design. Among these items, two related specifically to ISO14001 certification. Mathiyazhagan et al. (2015) chose ten industries which have already gotten ISO 14001 environmental certification for their studies. Analytical Hierarchy Process was applied to find the ranking of pressures for green supply chain management implementation. The pressures were divided into four groups as environmental regulations, external source, financial factors, and production and operation factors. The result showed that external source is the highest pressure on green supply chain implementation.

Srivastava (2008) developed a framework for analysing a reverse-logistics network and identified raw materials, manufacturing, distribution, and customers as four critical functional aspects. Sheu et al. (2005) formulated the green supply chain to an integrated framework. They identified raw material suppliers, manufacturers, wholesalers, retailers, and end-customers as manufacturing chain members, and defined collection points, recycling plants, disassembly plants, final disposal points, secondary material markets, and remanufacturing factories as reverse-logistics chain members. Lee et al. (2014) selected five dimensions of green supply chain management practices to test the relations with technology innovation. The five dimensions were developed by literature review as internal environmental management, investment recovery, Eco-design, green purchasing, and cooperation with customers. A partial least square-structural equation modelling approach was adopted to get the results as top management commitment and support towards green supply chain management is essential; internal environment management, Eco-design and investment recovery are significantly and positively related to technology innovation but green purchasing and cooperation with customers have an insignificant negative impact over technology innovation.

Ferretti et al. (2007) used a single-buyer single-vendor system to propose a complete numeric model to evaluate the economic and environmental impact of industrial practices. The models showed that green supply chains decreased their pollution output and penalty costs by 10% and 15%, respectively. Sheu (2008) presented a multi-objective optimization programming approach to implement a green supply chain model. The results showed that the model improves performance from 7.4% to 18.4%, depending on the weights associated with the objective functions of the raw materials supplier and waste reverse-logistics chains.

2.2. Green Business

2.2.1. Green Regulations

The European Union (EU) promulgated the EuP directive to promote environmental protection. The directive covers all products that consume any type of energy, although it excludes energy consumed for transportation. Furthermore, any products exceeding a volume of 200,000 units per year must fulfil all

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

specifications stipulated by the EuP directive if the products have a substantial impact on the environment, or if they can be improved (Grote et al., 2007). In 1998, the European Commission proposed the Waste Electronic and Electrical Equipment (WEEE) directive to regulate collecting and recycling electrical and electronic wastes, which specifies targets to increase recycling, reduce hazardous substances, and ensure the proper management of all post-recycling waste. The directive also requires all EU member states to establish collection systems for electrical and electronics waste, and stipulates that manufacturers are accountable for all processing costs from collection points to waste treatment (Webster & Mitra, 2007). The Restriction of Hazardous Substances (RoHS) directive prohibits the use of hazardous substances such as lead, mercury, and cadmium in new electrical equipment. Subsequently, innovative manufacturers have identified or developed substitutes for the lead solder used in assembling integrated circuit boards. The RoHS and WEEE directives are similar, and are a crucial element of a legislative initiative that addresses problems associated with toxic waste (Wang & Gupta, 2011).

2.2.2. Eco-Design

Eco-design is product or process design that systematically integrates environmental considerations. Eco-design addresses the environment throughout all stages of product development, and strives to minimize the environmental impact of products throughout the entire product life cycle (Aoe, 2007). Innovation is essential to realize effective eco-design concepts. Information and communication technologies are enablers of this realization because these two technologies facilitate the dissemination of knowledge and the ability to participate, thereby improving the quality of education, products, and services. Technological innovations offer new and economical tools for improving the efficiency, reuse, recycling, and substitution of natural resources (Azapagic et al., 2004).

2.2.3. Green Purchasing

Green purchasing refers to purchasing products and services that have a minimum impact on human health and the environment. Companies that adopt green purchasing practices into their management systems inspire all suppliers to reconsider the entire process of their production systems, from sourcing raw materials to treating final waste (Chen, 2005; Swanson et al., 2005). To improve the green purchasing behaviour of firms, Li (2007) highlighted three green purchasing strategies in green-suppliers and green-materials that assisted in reducing the source of waste. Zhu et al. (2007) recommended the following five conditions to implement an effective green purchasing strategy: (a) provide suppliers with design specifications for eco-friendly components; (b) cooperate with suppliers to achieve environmental objectives; (c) audit the environmental status of suppliers' upper management; (d) purchase from suppliers that are ISO14001-certified; and (e) evaluate the environmentally friendly practices of second-tier suppliers.

2.3. Value Engineering

VE is a systematic approach employed by a multidisciplinary team to improve the value of a project by analysing its functions. The objective of VE processes is to identify any unnecessary or hidden costs that do not contribute to the function and the desired approval of customers. It involves analysing and modifying the design, process, and specifications of a product or process to maximize value while minimizing costs. By defining value to be function over cost, VE studies are conducted by a multidisciplinary team,

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

which first establishes functional relationships. The VE team then develops a system function matrix against the corresponding costs to achieve the required functions with the lowest system-life cycle cost. This can be achieved using novel materials, creative design, optimized processes, innovative methods, cost- and time-efficiency, improved quality and safety, and minimal environmental impacts. Gupta (2009) examined more than 100 VE projects for four companies and showed that any organization pursuing VE goals can ensure long-term growth despite continuity and change.

Value-based management primarily applies data-driven conceptual approaches. The benefits of designing model-driven decision-making for performance and risk optimisation by implementing value-added performance metrics and applying robust optimisation methods to mitigate risk serve to sequentially optimise the physical and financial dimensions of a business (Hahn and Kuhn, 2012). The traditional VE framework comprises the following six phases: information phase, functional analysis phase, creative phase, evaluation phase, development phase, and presentation phase for value improvement opportunities (SAVE International, 2007).

The traditional value methodology begins by questioning the value of each product feature, and then attempts to apply creative techniques to generate an equal value at a lower cost. It uses a systematic job plan comprising specific steps to analyse a product or service effectively to develop the maximum number of alternatives, thereby achieving the required functions of a product or service (Webb, 1993). The functional analysis phase is the basis of the value study, which elucidates the hierarchical relationships of functions and focuses their creative efforts on identifying ways of accomplishing a specific function that are more efficient (Lewis, 2001).

Romano and Formentini (2010) applied a VE model for a shipbuilding company to improve the recycling systems of a large cruise ship. This project used the VE model as a decision-support tool to improve decision error, which enhanced communication with upstream and downstream suppliers, leading to the adoption of innovative alternatives. Tohidi (2011) demonstrated the VE role in promoting quality and proposed a five-phase project management model using VE techniques throughout the life of IT projects, controlling IT project risk, reducing project costs, and increasing project quality.

2.4. Findings and Gaps from Literature

From the aforementioned literature review, we found that customer satisfaction on environmental issues can be achieved by implementing ISO14001 and green supply chains. However, the critical factors for establishing a green business must be identified. Different situations will need different factors. In this study, we focus on green regulations, eco-design, and green purchasing. The regulations in different countries and times are different and change occasionally. A system to update must be established to meet current requirements. From the eco-design literature, we found that an innovative method ensures high performance in the green issue. However, to continuously create ideals, a suitable method and support system must be established. Input definitely affects output. Green purchasing enables the inputs to conform to environmental regulations and meet eco-design requirements. A green supplier evaluation system is required. However, effective communication with suppliers is critical in green purchasing. From a literature review on VE, we found that VE can be adopted in different industries by using quantitative analyses and evaluations to propose useful alternatives for improvement. The last two papers in the review section demonstrate VE improvements in the green issue and IT performance. The results of the case studies show that the methods are feasible. However, each case is different to implement ISO14001 and green supply chain. Therefore, we developed the following method for addressing the green issue.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

3. METHODOLOGY

The realization of an ISO14001-compliant green supply chain involves a systematic engineering approach. Companies must holistically consider all value-added creation processes rather than address specific problems using a traditional problem-finding and problem-solving method (Yang et al. 2011). The traditional costing concept is not suited for all green supply chain situations because of the trade-off between production and contamination. A case study provided an innovative alternative to appraise and apply environmental measures to make economic aspects might not be thought as possible obstacles to sustainability (Savino et al., 2015). Ecosystem encompasses not just companies that make up the supply chain but also consists of their financial and informational partners, governments and regulators of the host countries, infrastructures that enable flow of goods, information, and finance (Viswanadham and Kameshwaran, 2013). Therefore, we examined resource inputs by applying value to compensate for the costs of negative output problems of the green supply chain. To implement the green supply chain, we modified the traditional VE framework and integrated quality engineering tools to produce a VE-based green supply chain model comprising current state investigation, functional analysis, future state creation, confirmation, and an e-green supply chain. Figure 1 presents the framework. Finally, the combined model was verified using a case study.

3.1. Current State Investigation

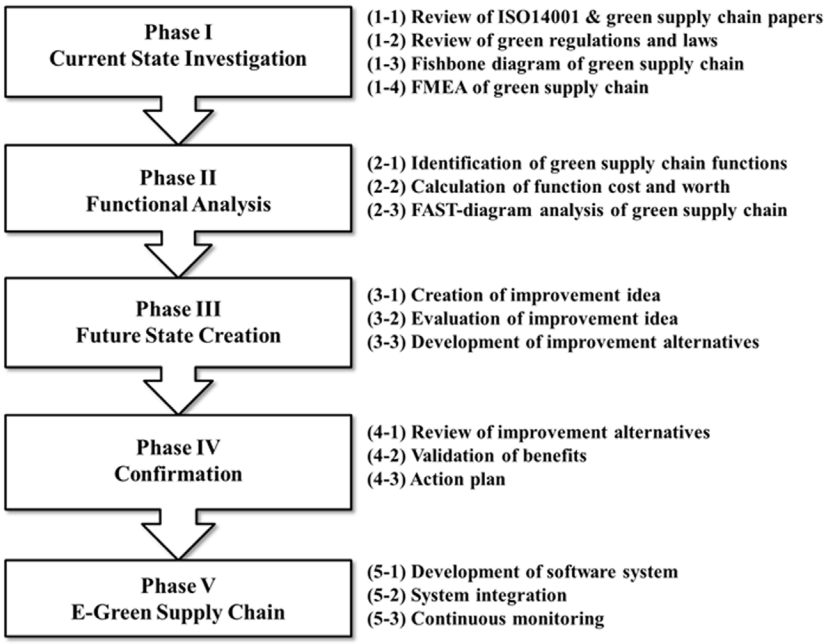
Optimizing total performance requires identifying the core value of an organization and analysing the mapping between core values and the performance management framework (Abdullah et al., 2012). In the current-state investigation phase, we reviewed the supply chain value-added process and the environmental laws and regulations. We applied the fishbone diagram to assist the team in brainstorming activities to execute cause-effect analysis and to determine critical criteria of the green supply chain (Jayswall et al., 2011).

The quality management field has largely adopted the Failure Mode and Effects Analysis (FMEA) technique to conduct failure analysis, which assists in anticipating critical points throughout the entire supply chain (Ebenezer et al., 2011; Chin et al., 2009). Risks posing from all the components of the ecosystem must be predicted well in advance and corresponding mitigation strategies must be formulated. Otherwise there will be project delays which would eventually affect the economy to a large extent (Viswanadham and Kameshwaran, 2013). The priority of a failure mode for action plans is determined by the risk priority number (RPN), defined as the product of the severity (S), occurrence (O), and detection (D) of a failure. These three factors are rated from one to 10, with lower scores being more favourable. The severity (S) rating with a score of one is regarded as "no effect," whereas a score of 10 is regarding as a hazard warning. The occurrence (O) rating relies on the probability. A nearly non-existent chance of failure is scored as one, whereas imminent failure has a score of 10. A detection (D) rating of one indicates an absolute certainty, whereas a score of 10 indicates an absolute uncertainty. Equation (1) provides the formula.

$$\text{RPN} = \text{Severity} \cdot \text{Occurrence} \cdot \text{Detection} \tag{1}$$

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 1. Framework of VE- green supply chain method



3.2. Functional Analysis

In the functional analysis phase, we analysed the functions of the green supply chain. We calculated function cost, function worth, and thereby value index (VI) to obtain the key functions of the green supply chain. We described the functions using a two-word active verb and measurable noun; for example, the supplier function is defined as "provide materials." We allocated function cost using real cost, whereas function worth is the minimum cost required to perform the function. Costs of item and function are different. Usually an item provides several functions. We need to weight those functions to calculate function cost. Function worth is the least cost of the function. Ordinary, we have many ways to achieve a function, no matter feasible or not. In this way, we could find out some innovative methods. We then calculated the value index of each function using function cost over function worth (Equation 2). A higher value index implies that a product or process is improvable.

$$VI_{ij} = \frac{w_{ij} \cdot C_i}{B_{ij}} \ \forall i, j \tag{2}$$

where $\sum_j w_{ij} = 1 \ \forall i$

i index of main operations or items, $i=1,2,\ldots,I$

j index of operation function, $j=1,2,\ldots,J$

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

C_i function cost of the operation or item

w_{ij} cost weight of each function

B_{ij} function worth (the least cost of the function)

VI_{ij} value index (cost/worth)

The functional analysis evaluates any evidence referring to the green supply chain. Upon completing the functional analysis phase, the key green-supply chain functions can be identified, and the Function Analysis System Technique (FAST) diagram can be adopted for further development.

3.3. Future State Creation

The future state creation facilitates the creation and evaluation of ideas to identify suitable green alternatives according to the key functions identified in the functional analysis phase. The goal of alternative development is to develop workable green alternatives from specific creative ideas to assist designers or managers in making decisions. Analysing each alternative is necessary to ensure that it meets the requirements for adopting appropriate technologies. The idea-creation phase emphasizes group creativity. To improve creativity, daring to be illogical and overcoming resistance to change in an organization are critical; occasionally, an unconventional approach is more suitable for solving problems. Attempting to remove all mental blocks and personal inhibitions encourages imaginative growth. All ideas should be encouraged and not ridiculed, because often great ideas seem absurd when first proposed.

The objective of evaluations is to minimize the number of ideas with the greatest potential for improving the green supply chain. The ideas that are unsupported or those that cannot be accomplished in the near future are disregarded. The remaining ideas are adjusted, combined, and then screened. In this phase, cost is not the only factor to consider; however, other design comments such as weight, volume, and reliability should also be considered. Consulting the marketing department to determine whether customer acceptance could be a problem might also be necessary. The criteria for evaluating value are related to costs, profits, green performance, customer requirements, and safety.

3.4. Confirmation

The confirmation phase includes reviewing alternatives, establishing action plans, validating project benefits, and the commitment of the management board and other stakeholders. The alternative review provides a preliminary report by holding a project strategic meeting to determine the characteristics of each green alternative, establishing action plans for the accepted alternatives, and documenting the rationale for the rejected alternatives. Subsequently, it is necessary to obtain executive commitments, review the time feasibility, and define the execution of the accepted alternatives. An execution plan is next established to track green achievement for the implemented alternatives to validate beneficial changes to ensure that new practices become embedded.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

3.5. E-Green Supply Chain

In this phase, we design or adjust related systems, such as the eco-design and green vendor management systems. These systems must have system-design processes in place to ensure that the new systems fit into the original business information system and connect smoothly with each other. Better planning, selection of contractors, monitoring and execution are the answers to improve the situation. Use of IT, standardization of procurement and other processes, monitoring and execution using call centre based decision support systems, use of supply hubs, automation of financial and other government clearance processes are solutions that can be followed (Viswanadham and Kameshwaran, 2013). IT professionals should develop green supply chain systems. IT system development requires performing operational analyses and mapping business requirements, followed by an analysis of the system gap. Before operating the system, it is necessary to test the environmental setup, train relevant personnel prior to the system pilot run, establish the production application, and support the data conversion. Finally, we commenced the official production run and established vendor and partner portals for green management, including developing green management dashboards for monitoring all green issues.

4. CASE STUDY

The purpose of a case study is to investigate the evidence of real-world phenomena for exploring and explaining the real-world environment (Yin, 1994). Case research is a research method involving the investigation of one or a small number of social entities or situations about which data are collected using multiple sources, and the development of a holistic description (Easton, 2010). A case study concerning the application of a balanced scorecard method for evaluating green suppliers in a large multinational pharmaceutical company was conducted to identify challenges from reality (Genovese et al., 2014). Real case data were adopted from the European automobile supply chain. The data envelopment analysis approach enables management to link performance with external factors such as uncertainties in the supply, process, demand, and control. Hence, it enables managers to address critical questions for making strategic decisions (Gallear et al., 2014). This method is especially appropriate for hypothesis generation and the exploration of problems for which existing knowledge is limited (Cavaye, 1996). To avoid the misuse of case study, researchers should not blindly follow blueprints provided in previously published case studies but carefully revise possible design alternatives (Keutel et al., 2014). We applied the proposed VE-based green supply chain method to a global electronics manufacturing company whose main products include motherboards, digital televisions, notebooks, and all-in-one systems. The main revenue sources for the company are motherboards (33%), desktop personal computers (32%), and notebooks (28%). Approximately 98% of the products are exported. The case company is headquartered in Taiwan and has more than 1,000 business partners and distributors worldwide. Its branch offices and plants operate in the Americas, Europe, China, Japan, South Korea, Brazil, Russia, and the Netherlands. For sustainability in the world market under rigorous green requirements, the case company invested in supply chain management, and more than 1,000 vendors are involved in this study. The project team comprised various units including corporate social responsibility, finance, procurement, production, logistics, marketing, IT, and quality management as well as external experts as consultants. The green supply chain project lasted from 2006 to 2007. The green performance reports of the green supply chain

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

project were acquired from the Industrial Development Bureau, Ministry of Economic Affairs, Taiwan, and the corporate social responsibility annual reports and financial reports of the case company from 2007 to 2010 were obtained.

4.1. Current State Investigation

In the first phase, we collected, reviewed, and analysed related information and literature on green supply-chain issues by brainstorming and employing a fishbone diagram. Figure 2 shows the result of the brainstorming led by quality manager of the case company from cause and effect point of view. There are four main items that affect the green supply chain as supply, manufacture, distribution, and rules and laws. The supplier evaluation and vendor management are concerned in supply item. Applying the eco-design and clean production principles in manufacture item is necessary. The transportation and packing design are focused on the distribution item, whereas minimizing pollution and energy consumption belong to the rules and laws item.

We next performed the FMEA by focusing on four essential items adopted from the result of fishbone diagram as supply, manufacture, distribution, and rules and laws from the angle of failure prevention. Through intensive discussion, we identified the most critical potential failure modes (items) as "break rules" (rules and laws), "wrong equipment" (manufacture), "wrong materials" (manufacture), "wrong design" (manufacture), "wrong operation" (supply), and "wrong materials" (supply). The possible actions taken are re-designing, training, and examination. Table 1 presents a summary of the information. The RPNs show how the potential failure affects the system.

Using this investigation phase, we obtained a more concrete picture regarding the green supply chain regarding supplier management, eco-design, and production to improve manufacturing, packing, and transportation, and to reduce pollution and energy use according to the rules and laws item. The result of this phase is that the four critical items are considered for function analysis in the next phase.

Table 2 shows the results of the function analysis based on the results of fishbone diagram and FMEA and focused on functions, using the two-word combination of an active verb and a measurable noun to describe each item and its related initial cost and worth. The item costs were provided by financial department of the case company. Then the VE team discussed and decided the weights of the item functions for calculations according to Equation (2).

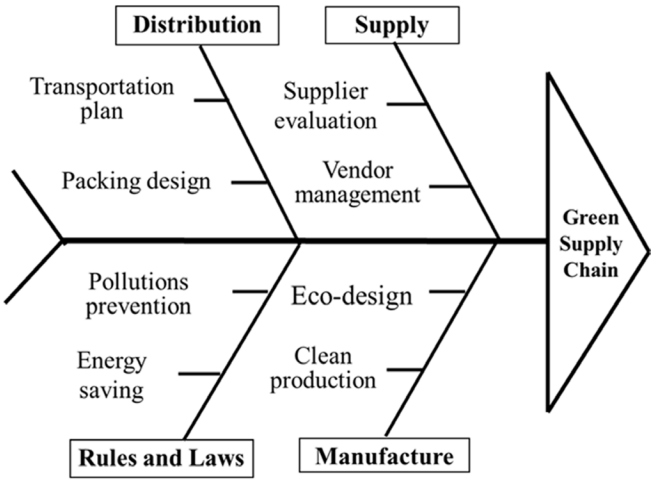
After calculating Equation (2), we identified the following key functions: "pack product," "improve product," "provide materials," and "present regulation." To develop more detailed functions, the VE team designed the FAST diagram referring to the results of fishbone analysis, FMEA, and function analysis to present the essential functions supporting the basic functions of the green supply chain. The primary functions for constructing a green supply chain are "manage supply," "streamline manufacture," "optimize distribution," and "conform rules and laws." Figure 3 shows the results. The output of this phase is identifying the primary functions of the green supply chain for further creation activities. We also developed basic system requirements for integrating these functions with the current management system.

4.2. Future State Creation

In this phase, we employed various idea-generation techniques, such as brainstorming and using checklists, to produce as many ideas as possible. The main ideas for "pack product" were reducing packing materials, using different packing materials, reusing packing materials, and redesign. The main ideas for

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 2. Fishbone analysis for the current state investigation



"improve product" were potential improvements including redesign, using different materials, employing different methods, and using different equipment. The main ideas for "provide materials" were managing suppliers to provide acceptable materials including conforming related environmental issues. The main ideas for "present regulation" were studying regulation and analysing regulation, training, and the green database and portal. All ideas can evolve into new related ideas for solving the same problem. During the evaluation process, we screened all of the ideas and excluded certain unsupported ideas.

After evaluating the ideas for green supply-chain management, we selected feasible green alternatives for advancing development. This phase established final executive plans for selected alternatives to persuade management to accept the final alternatives.

4.3. Confirmation

In this phase, we reviewed the preliminary reports following several project meetings to determine the characteristics of each green alternative. We established numerous action plans, including a period to review the accepted green alternatives, such as supplier management, eco-design, reuse, redesign, and establishing a green database and portals. We planned a schedule to track the green achievement results of the implemented alternatives to ensure they were effective, and validated the benefits of the implemented changes to ensure that the management system had successfully incorporated the new practices. This phase confirmed green alternatives in anticipation of developing the green supply-chain management system.

4.4. E- Green Supply Chain

Many companies have adjusted their enterprise's value system in order to maintain good public images to design greener products by adopting new energy saving technology and enhance their supply chain management capability to release environmental concerns (Wang et al., 2011; Dam and Petkova, 2013). In the e-green supply-chain phase, the case company built a green vendor portal and a green partner portal

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 1. FMEA of green supply chain

Product Process	Potential Failure Mode	Potential Effect(s) of Failure	Severity (S)	Potential Cause(s)/ Mechanism(s) of Failure	Occurrence (O)	Current Process Controls	Detection (D)	RPN = S·O·D	Actions Taken
P1. Supply	**P1-01. wrong material**	air pollution	3	chemical reaction	7	check list	8	**168***	request in vendor management
		increase waste	4	surface damage	3	unprotected	2	24	()
		pollution	3	toxic reaction	8	check list	8	**192***	request in vendor management
	P1-02. wrong supplier	supplier resistance	5	environmental regulations	2	supplier selection	1	10	()
		energy waste	3	long distance	2	supplier selection	2	12	()
		increase waste	4	over packaging	1	check list	2	8	()
		pollution	3	wrong operation	1	supplier selection	2	6	()
	P1-03. wrong procurement	against law	6	not follow the requirement	1	check list	1	6	()
		increase waste	4	wrong purchase item	2	check list	2	16	()
		pollution	3	toxic material	2	check list	2	12	()
P2. Manufacture	**P2-01. wrong material**	increase waste	6	operation flaw	5	checklist	8	**240***	train related personnel
		against law	6	toxic waste	2	SOP	1	12	()
		customer complain	6	toxic material	1	checklist	2	12	()
	P2-02. wrong equipment	energy waste	5	incorrect operation	7	eyes check	7	**245***	train related personnel
		pollution	3	malfunction	3	maintenance program	2	18	()
		increase waste	4	maintenance problem	2	maintenance program	2	16	()
	P2-03. wrong operation	energy waste	5	process flaw	6	checklist	7	**210***	education on SOP
		pollution	3	wrong instruction	2	SOP	1	6	()
	P2-04. wrong personnel	increase waste	4	incorrect operation	1	checklist	2	8	()
		pollution	3	incorrect operation	3	checklist	1	9	()
P3. Distribution	**P3-01. packing problem**	increase waste	4	personal overlook	5	SOP	4	80	()
		pollution	3	toxic material	2	checklist	1	6	()
		wrong material	4	toxic material	1	checklist	2	8	()
	P3-02. wrong transpotation	energy waste	3	process flaw	5	contract	4	60	()
		can't arrive in time	5	delaying	1	contract	2	10	()
		pollution	3	wrong vehicle	1	contract	1	3	()
P4. Rules and Laws	**P4-01. break rule**	return product	5	process flaw	8	checklist	8	**320***	train related personnel
		customer complain	6	product flaw	2	SOP	2	24	()
	P4-02. against law	money compansation	4	incorrect operation	6	eyes check	4	96	()
		law suit	8	break law	1	checklist	1	8	()

Remark: * significant () not significant

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 3. FAST diagram of green supply chain

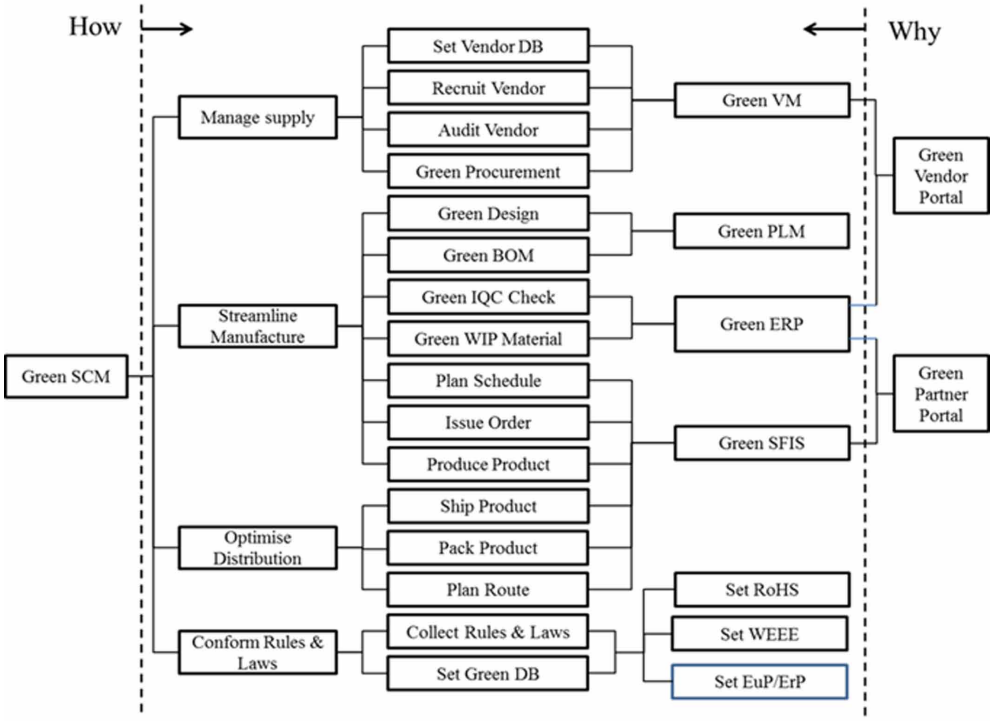


Table 2. Function analysis of green supply chain

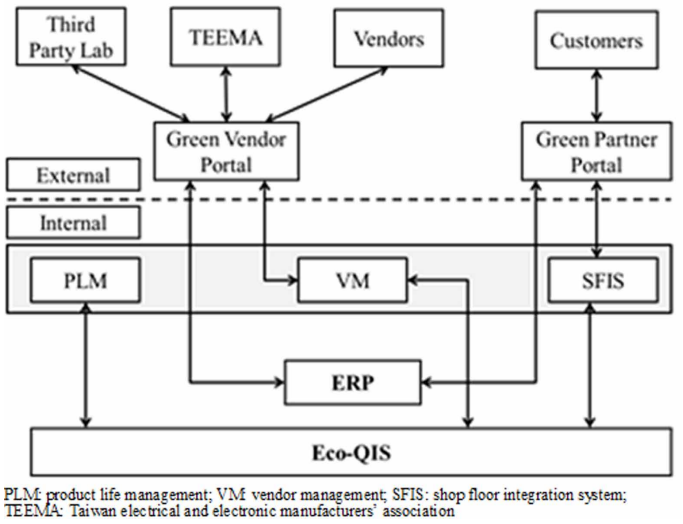
Sub Item	Function(A)			Estimated Initial Cost (B)	Worth (C)	Value Index (D) = (B)/(C)	Priorit
	Verb	Noun	Kind				
supply	Provide	materials	B	$2,251	$1,418	1.6*	3
	provide	service	S	$2,209	$1,958	1.1	()
manufacture	produce	product	B	$1,367	$1,256	1.1	()
	improve	product	S	$1,957	$1,142	1.7*	2
distribution	pack	product	S	$941	$503	1.9*	1
	transmit	product	B	$340	$315	1.1	()
rules and laws	present	regulation	B	$134	$91	1.5*	4
	adjust	regulation	S	$179	$159	1.1	()

Remark: B = Basic function * significant
S = Sub function
RS = Required sub function

to the enterprise resource planning (ERP) system. The scope of ERP has expanded beyond classical data and process integration to provide enhanced modelling and analytical capabilities for complex business problems. Strategic business development integrates PLM (product lifecycle management) and SCM to consider value-creating decisions (Hahn and Kuhn, 2012). A shop-floor integration system (SFIS) is an effective cooperation sub-system included in the ERP system, which offers state information of factory activities to the administrator in order to control the factory effectively. For the inter-organizational infor-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 4. E-green supply chain of eco-quality information systems



mation, we developed three modules and integrated them with the ERP system: the green PLM system, the green vendor management (VM) system, and the green SFIS. Figure 4 presents the architecture, in which the PLM system enables the collaboration of eco-design and "reduce and reuse" between the case company and suppliers. The PLM system includes the green component data storage, green product Bill-Of-Materials (BOM), and green vendor tracking and review. The system improves efficiency for data verification of restricted substances and regulates collecting and verifying green documents.

The green component data are uploaded to the green BOM system for its approval. Based on green parts and the green BOM database, the case company can guarantee that the green production and green products meet RoHS standards. It also defines the responsibility between the case company and vendors and a production tracing system for sustainable management. The VM system supports the operations of new vendor recruitment, vendor green capability management, and conforming to the rules of green issues. The SFIS outlines the master production schedule and manufacturing execution.

The result of this project was that the case company could effectively produce products by fully employing raw materials using manufacturing technology, operating management, raw material, packing material, and product plans and reforms, in addition to recycling and reuse strategies. The results show the following benefits: (a) approximately US$167,000 in annual savings; (b) approximately 65% of waste was recycled and reused; (c) recovery rate of products reached 85%; (d) the purchasing cost was reduced by 10% from the green vendor management system; and (d) the greenhouse gas production in 2010 was 49,672 metric tons of CO2 emissions, which was approximately 4.1% less than the previous year, fulfilling the environmental responsibility of reducing carbon emissions and mitigating climate change (Table 3). Tables 4 and 5 present the power and water consumption analysis, showing an improvement tendency. Approximately 236,000 m3 of wasted water was recovered annually (Table 6). Figure 5 presents a summary of the green performance of the case company.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 3. CO_2 emission of case company

Unit: Metric tons CO_2e				
Location	2007	2008	2009	2010
Factory in Taipei (HQ)	3,241	2,966	3,539	3,288
Factory in Shengzen	63,570	49,368	36,161	36,023
Factory in Suzhou	10,076	13,145	12,088	10,361
Total	76,888	65,478	51,788	49,672

Table 4. Power consumption of case company

Unit: K-KWH				
Location	2007	2008	2009	2010
Factory in Taipei (HQ)	4,955	4,448	5,256	5,169
Factory in Shengzen	57,310	46,962	34,095	34,035
Factory in Suzhou	10,604	12,872	11,783	11,088
Total	72,869	64,282	51,134	50,292

Table 5. Water consumption of case company

Unit: Ton				
Location	2007	2008	2009	2010
Factory in Taipei (HQ)	26,593	28,875	25,463	22,878
Factory in Shengzen	538,586	452,290	440,982	462,183
Factory in Suzhou	171,548	103,124	90,272	86,339
Total	736,727	584,289	556,717	571,400

Table 6. Wasted water recovery of case company

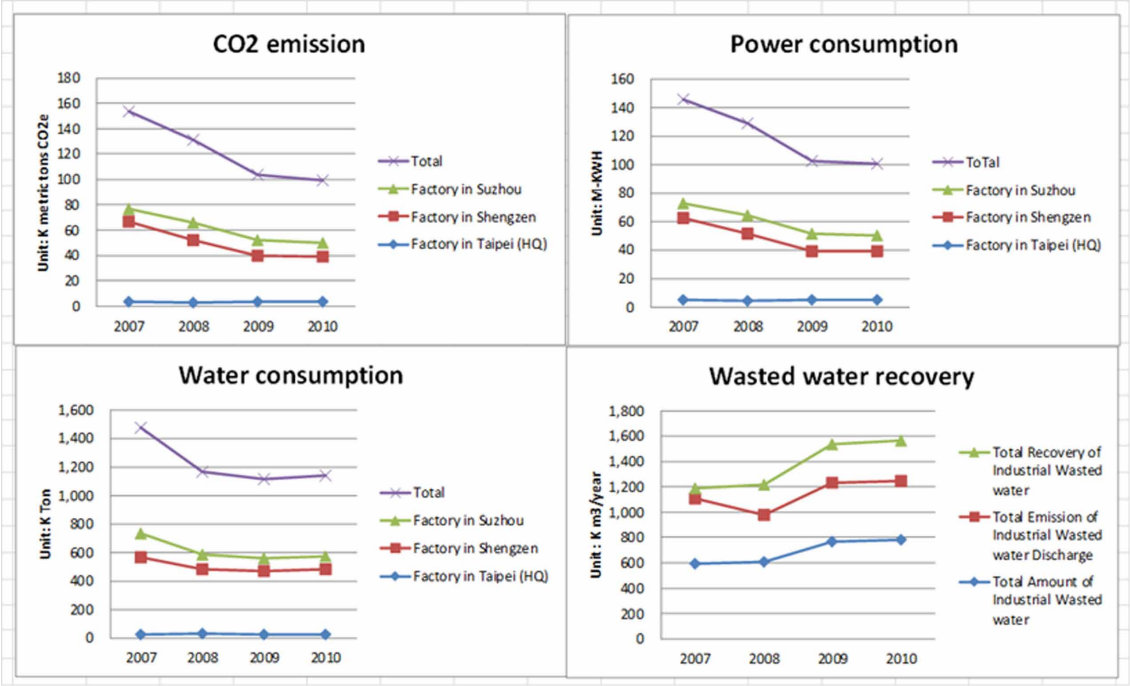
Unit: m^3/year				
Item	2007	2008	2009	2010
Total Amount of Industrial Wasted water (m^3)	594,600	610,100	768,000	780,796
Total Emission of Industrial Wasted water Discharge (m^3)	514,600	366,100	460,800	468,477
Total Recovery of Industrial Wasted water (m^3)	80,000	244,000	307,200	312,319

5. DISCUSSION AND IMPLICATIONS

Seuring (2013) surveyed the models for sustainable manufacturing, classified their decision goals as economic, environmental, and social, and considered integrating all three dimensions. The models for sustainable manufacturing are classified into the following four categories: (1) life-cycle assessment models; (2) equilibrium models; (3) multi-criteria decision making; and (4) an analytical hierarchy pro-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 5. The green performance of the case company



cess. These models allow decision-makers to calculate their sustainability strategy to obtain a win-win situation, trade-offs, or minimal performance for environmental and social issues. This survey shows that the cost-oriented decision model dominates the modelling approach for the economic dimension because the social impacts and environmental assessments are difficult to evaluate using quantitative models.

However, the green issue is not only an economic issue; it is also a scientific and social issue. Businesses must adopt both an economic- and organizational-based approach to support sustainability. VE is a systematic methodology that achieves multiple goals by considering the potential worth of a company's deployed resources. During the realization process, VE emphasises teamwork and creative techniques, which are typically positive factors in organisational change. In addition, the ISO 14001 system focuses on continuous environmental quality improvement management, and is an internationally approved management tool. Therefore, we developed a VE-based framework combined quality tools. To verify the feasibility of the model, a case study was conducted, and the application results show that the proposed VE-based green supply chain model is viable.

Srivastava (2007) recommended that operational management teams integrate green issues to yield a more integrative framework that would contribute more to the green supply chain. The proposed VE-green supply chain model follows the five phases to address the problems of green supply-chain implementation. We integrated the developed green systems into the current operational management processes, as recommended by Srivastava (2007) and compared the proposed VE-green supply chain method and the published approaches in the literature. We discussed the differences among them based on the following three dimensions: aim, implementation, and performance.

- **Aim:** The VE-based green supply chain optimises the green supply chain to focus on eliminating unfavourable outputs in the value-added process. However, the published green supply chain ap-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

proach in the literature reduces environmental risks and impacts, improving ecological efficiency, minimising ecological damage, and maximizing the total economic profit (van Hoek, 2000; Srivastava, 2007; Dey and Cheffi, 2013).

- **Implementation:** The VE-based green supply chain model comprises current state investigation, functional analysis, future state creation, confirmation, and an e-green supply chain on the basis of a five-phase model to perform green product procurement, manage suppliers, reduce waste, minimise energy consumption, and establish a green IT system. This five-phase model integrates both quantitative quality engineering tools and organisational collaboration approaches. However, the published green supply chain approach in the literature uses a multilayer supply chain and either five or seven phases that focus primarily on quantitative approaches to improve functions, optimise reusable equipment, and accomplish IT projects (Sheu et al., 2005, Duhaime et al., 2001, Tohidi, 2011).
- **Performance:** The VE-based green supply chain focuses on reducing waste, improving recycle and reuse rates, and reducing both the procurement cost and the level of greenhouse gas emissions. However, the published green supply chain approach in the literature reduces pollution and incurs less penalty cost, improves the supply of raw materials and waste-reverse logistics chains, and improves processing times, operation costs, and recovery rates (Ferretti et al., 2007; Sheu, 2008; Srivastava, 2008).

The academic implications are that to merge different tools into one framework, each tool must be reviewed thoroughly to identify the components that should be retained or combined with other tools. The adjustments must be continuously optimised. The proposed method is different from DMAIC of sig-sigma approach. The six-sigma DMAIC activities begin by improving the characteristics of a regular process. The DMAIC process involves identifying solutions to eliminate the root causes of performance problems that result in inconsistent processes, while preserving the integrity of the basic process to minimise the occurrence of defects, variations and unnecessary costs resulting from poor quality (Srinivasan, 2014). Applying case study is one of the most effective ways to verify a model. However, choosing a suitable case requires effort. During the case study, communication skills are required. Particularly when dealing with case data, we must distinguish which part should be kept confidential while the study still can be smoothly conducted. Lastly, the management of the case company might demand immediate high performance; substantial evidence must be provided to ensure future favourable results.

The industrial implications are that the legal requirements in different countries might be different; hence, we must be careful when creating the related database. To adopt a new system, training at different personnel levels with different training materials is required. After investigating companies certified with ISO14001, the result shown that environmental training is positively and significantly related to environmental management maturity. Managers must invest in environmental training if they also want to improve environmental management; industry associations may help companies to plan and offer environmental training; universities may also help companies to plan and improve environmental training activities (Jabbour, 2015). Implementing a certified ISO 14001 system is a promise to conduct sustainable business. Adding a complete environmental information system to the current IT system will ensure that the system performs effectively. Substantial experience in environmental protection and IT systems management is essential for implementing a green supply chain. The case company has run a pollution, prevention, and pay committee for years, providing a favourable foundation for green issues.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

A large IT division was assigned in the case company to address all IT affairs including the e-green supply chain. Suitable consultants would be helpful for implementing a project such as the green supply chain. Lastly, the VE study is not a one-time project; multiple studies must be analysed separately to provide value for the enterprise.

6. CONCLUSION

We proposed a VE-based methodology that combines quality engineering tools for implementing ISO14001 with a green supply chain, and designs IT systems to support the requirements of specific green issues. We detailed an empirical case study to implement green supply-chain systems in a global electronics manufacturing company, which executes all methodology phases to verify feasibility. The results indicate improved recycled and reused waste, recovered products, procurement costs, and greenhouse gas production. After receiving the ISO14001 environmental management system certification, factories established a complete environment management system. This study serves as a reference for related researchers and practitioners in implementing green supply chains and contains certain limitations. Although the model combines the advantages of quality engineering tools to produce a workable framework, it does not address all problems associated with green supply chains, but primarily focuses on material supply, manufacturing, distribution, and rules and laws. Future studies should focus on a collaborative eco-design system, material exchange system, and distribution system.

ACKNOWLEDGMENT

This work has been developed within the framework of a research project funded by the Ministry of Science and Technology (MOST) Taiwan, titled “A Distribution Planning Method for the Regional Logistics Center Using Electric Vehicles”, reference MOST-104-2410-H-008-066. Furthermore, the authors would like to thank the Fellowship Programme 2015/2016 of the Munich University of Applied Sciences, Germany, and the reviewers for the constructive and helpful comments.

REFERENCES

Abdullah, M., Hamid, M. R. A., Mustafa, Z., Husain, N., Idris, F., Suradi, N. R. M., & Ismail, W. R. (2012). Value-based total performance excellence model: A conceptual framework for organisations. *Total Quality Management & Business Excellence*, *23*(5-6), 557–572. doi:10.1080/14783363.2011.637786

Al-Darrab, I. A., Gulzar, W. A., & Ali, K. S. (2013). Status of implementation of safety, quality and environmental management systems in Saudi Arabian industries. *Total Quality Management & Business Excellence*, *24*(3-4), 336–354. doi:10.1080/14783363.2012.733257

Aoe, T. (2007). Eco-efficiency and eco-design in electrical and electronic products. *Journal of Cleaner Production*, *15*(15), 1406–1414. doi:10.1016/j.jclepro.2006.06.004

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Asif, M., Searcy, C., Garvare, R., & Ahmad, N. (2011). Including sustainability in business excellence models. *Total Quality Management & Business Excellence*, *22*(7), 773–786. doi:10.1080/14783363.2011.585784

Azapagic, A., Perdan, S., & Clift, R. (2004). *Sustainable Development in Practice: Case Studies for Engineers and Scientists*. Hoboken, NJ, U.S.A.: John Wiley & Sons, Ltd. doi:10.1002/0470014202

Cavaye, A. L. M. (1996). Case study research: A multi-faced research approach for IS. *Information Systems Journal*, *6*(3), 227–242. doi:10.1111/j.1365-2575.1996.tb00015.x

Chen, C. C. (2005). Incorporating green purchasing into the frame of ISO 14000. *Journal of Cleaner Production*, *13*(9), 927–933. doi:10.1016/j.jclepro.2004.04.005

Chin, K. S., Wang, Y. M., Poon, G. K. K., & Yang, J. B. (2009). Failure mode and effects analysis using a group-based evidential reasoning approach. *Computers & Operations Research*, *36*(6), 1768–1779. doi:10.1016/j.cor.2008.05.002

Dam, L., & Petkova, B. N. (2013). The impact of environmental supply chain sustainability programs on shareholder wealth. *International Journal of Operations & Production Management*, *34*(5), 586–609. doi:10.1108/IJOPM-10-2012-0482

Dey, P. K., & Cheffi, W. (2013). Green supply chain performance measurement using the analytic hierarchy process: A comparative analysis of manufacturing organisations. *Production Planning and Control*, *24*(8–9), 702–720. doi:10.1080/09537287.2012.666859

Easton, G. (2010). Critical realism in case study research. *Industrial Marketing Management*, *39*(1), 118–128. doi:10.1016/j.indmarman.2008.06.004

Ebenezer, I. A., Devadasan, S. R., Sreenivasa, C. G., & Murugesh, R. (2011). Total failure mode and effects analysis in tea industry: A theoretical treatise. *Total Quality Management & Business Excellence*, *22*(12), 1353–1369. doi:10.1080/14783363.2011.625188

Ferretti, I., Zanoni, S., Zavanella, L., & Diana, A. (2007). Greening the aluminium supply chain. *International Journal of Production Economics*, *108*(1-2), 236–245. doi:10.1016/j.ijpe.2006.12.037

Gallear, D., Ghobadian, A., Li, Y., ORegan, N., Childerhouse, P., & Naim, M. (2014). An environmental uncertainty-based diagnostic reference tool for evaluating the performance of supply chain value streams. *Production Planning and Control*, *25*(13-14), 1182–1197. doi:10.1080/09537287.2013.808838

Genovese, A., Koh, S. C. L., Kumar, N., & Tripathi, P. K. (2014). Exploring the challenges in implementing supplier environmental performance measurement models: A case study. *Production Planning and Control*, *25*(13–14), 1198–1211. doi:10.1080/09537287.2013.808839

Grote, C. A., Jones, R. M., Blount, G. N., Goodyer, J., & Shayler, M. (2007). An approach to the EuP directive and the application of the economic eco-design for complex products. *International Journal of Production Research*, *45*(18-19), 4099–4117. doi:10.1080/00207540701450088

Gupta, V. K. (2009). Flexible strategic framework for managing forces of continuity and change in value engineering processes: Study in Indian context. *Global Journal of Flexible Systems Management*, *10*(4), 55–65.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Hahn, G. J., & Kuhn, H. (2012). Designing decision support systems for value-based management: A survey and an architecture. *Decision Support Systems*, *53*(3), 591–598. doi:10.1016/j.dss.2012.02.016

Jabbour, C. J. C. (2015). Environmental training and environmental management maturity of Brazilian companies with ISO14001: Empirical evidence. *Journal of Cleaner Production*, *96*, 331–338. doi:10.1016/j.jclepro.2013.10.039

Jayswal, A., Li, X., Zanwar, A., Lou, H. H., & Huang, Y. (2011). A sustainability root cause analysis methodology and its application. *Computers & Chemical Engineering*, *35*(12), 2786–2798. doi:10.1016/j.compchemeng.2011.05.004

Keutel, M., Michalik, B., & Richter, J. (2014). Towards mindful case study research in IS: A critical analysis of the past ten years. *European Journal of Information Systems*, *23*(3), 256–272. doi:10.1057/ejis.2013.26

Lee, V. H., Ooi, K. B., Chong, A. Y. L., & Seow, C. (2014). Creating technological innovation via green supply chain management: An empirical analysis. *Expert Systems with Applications*, *41*(16), 6983–6994. doi:10.1016/j.eswa.2014.05.022

Lewis, J. (2001). Using treemaps to tie QFD and 6 sigma concepts to function analysis, *Proceedings of SAVE '01* (pp. 254-275).

Li, L. (2007). *Supply Chain Management: Concept, Techniques and Practices Enhancing Value through Collaboration*. Singapore: World Scientific. doi:10.1142/6273

Mathiyazhagan, K., Diabat, A., Al-Refaie, A., & Xu, L. (2015). Application of analytical hierarchy process to evaluate pressures to implement green supply chain management. *Journal of Cleaner Production*, *107*, 229–236. doi:10.1016/j.jclepro.2015.04.110

Mohanty, R. P., & Prakash, A. (2014). Green supply chain management practices in India: An empirical study. *Production Planning & Control: The Management of Operations*, *25*(16), 1322–1337. doi:10.1080/09537287.2013.832822

Nishitani, K. (2009). An empirical study of the initial adoption of ISO 14001 in Japanese manufacturing firms. *Ecological Economics*, *68*(3), 669–679. doi:10.1016/j.ecolecon.2008.05.023

Prajogo, D., Tang, A. K. Y., & Lai, K. H. (2014). The diffusion of environmental management system and its effect on environmental management practices. *International Journal of Operations & Production Management*, *34*(5), 565–585. doi:10.1108/IJOPM-10-2012-0448

Romano, P., Formentini, M., Bandera, C., & Tomasella, M. (2010). Value analysis as a decision support tool in cruise ship design. *International Journal of Production Research*, *48*(23), 6939–6958. doi:10.1080/00207540903352686

SAVE International. (2007). *Value Method Standard, Society of American Value Engineering*. SAVE International.

Savino, M. M., Manzini, R., & Mazza, A. (2015). Environmental and economic assessment of fresh fruit supply chain through value chain analysis. A case study in chestnuts industry. *Production Planning and Control*, *26*(1), 1–18. doi:10.1080/09537287.2013.839066

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Seuring, S. (2013). A review of modeling approaches for sustainable supply chain management. *Decision Support Systems*, *54*(4), 1513–1520. doi:10.1016/j.dss.2012.05.053

Sheu, J. B. (2008). Green supply chain management, reverse logistics and nuclear power generation. *Transportation Research Part E, Logistics and Transportation Review*, *44*(1), 19–46. doi:10.1016/j.tre.2006.06.001

Sheu, J. B., Chou, Y. H., & Hu, C. C. (2005). An integrated logistics operational model for green-supply chain management. *Transportation Research Part E, Logistics and Transportation Review*, *41*(4), 287–313. doi:10.1016/j.tre.2004.07.001

Srinivasan, K., Muthu, S., Devadasan, S. R., & Sugumaran, C. (2014). Enhancing effectiveness of Shell and Tube Heat Exchanger through Six Sigma DMAIC phases. *Procedia Engineering*, *97*, 2064–2071. doi:10.1016/j.proeng.2014.12.449

Srivastava, S. K. (2007). Green supply-chain management: A state-of-the-art literature review. *International Journal of Management Reviews*, *9*(1), 53–80. doi:10.1111/j.1468-2370.2007.00202.x

Srivastava, S.K. (2008). Network design for reverse logistics. *Omega - The International Journal of Management Science*, 36(4), 535-548.

Swanson, M., Weissman, A., Davis, G., Socolof, M. L., & Davis, K. (2005). Developing priorities for greener state government purchasing: A California case study. *Journal of Cleaner Production*, *13*(7), 669–677. doi:10.1016/j.jclepro.2003.12.011

Tohidi, H. (2011). Review the benefits of using value engineering in information technology project management. *Procedia Computer Science*, *3*(1), 917–924. doi:10.1016/j.procs.2010.12.150

van Hoek, R. I. (1999). From reversed logistics to green supply chains, *Supply Chain Management. International Journal (Toronto, Ont.)*, *4*(3), 129–135.

Viswanadham, N., & Kameshwaran, S. (2013). *Ecosystem – Aware Global Supply Chain Management*. Singapore: World Scientific. doi:10.1142/8802

Walton, S. V., Handfield, R. B., & Melnyk, S. A. (1998). The green supply chain: Integrating suppliers into environmental management processes. *International Journal of Purchasing and Materials Management*, *34*(2), 2–11. doi:10.1111/j.1745-493X.1998.tb00042.x

Wang, F., Lai, X., & Shi, N. (2011). A multi-objective optimization for green supply chain network design. *Decision Support Systems*, *51*(2), 262–269. doi:10.1016/j.dss.2010.11.020

Wang, H. F., & Gupta, S. M. (2011). *Green Supply Chain Management: Product Life Cycle Approach*. New York, NY, U.S.A.: Mc Graw Hill.

Webb, A. (1993). Value engineering part 1. *Engineering Management Journal*, *3*(4), 171–175.

Webster, S., & Mitra, S. (2007). Competitive strategy in remanufacturing and the impact of take-back laws. *Journal of Operations Management*, *25*(6), 1123–1140. doi:10.1016/j.jom.2007.01.014

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Yang, C. C., Yang, K. J., & Peng, S. Y. (2011). Exploration strategies and key activities for the system of environmental management. *Total Quality Management & Business Excellence*, *22*(11), 1179–1194. doi:10.1080/14783363.2011.603201

Yin, R. K. (1994). *Case study research: Design and methods* (2nd ed.). Thousand Oaks, CA, U.S.A.: Sage.

Zhu, Q., Sarkis, J., & Lai, K. (2007). Initiatives and outcomes of green supply chain management implementation by Chinese manufacturers. *Journal of Environmental Management*, *85*(1), 179–189. doi:10.1016/j.jenvman.2006.09.003 PMID:17084502

Zhu, Q., Sarkis, J., & Lai, K. H. (2008). Confirmation of a measurement model for green supply chain management practices implementation. *International Journal of Production Economics*, *111*(2), 261–273. doi:10.1016/j.ijpe.2006.11.029

Zhu, Q., Tian, Y., & Sarkis, J. (2012). Diffusion of selected green supply chain management practices: An assessment of Chinese enterprises. *Production Planning & Control: The Management of Operations*, *23*(10–11), 837–850. doi:10.1080/09537287.2011.642188

This research was previously published in the International Journal of Strategic Decision Sciences (IJSDS), 7(4); edited by Madjid Tavana, pages 1-20, copyright year 2016 by IGI Publishing (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 30
Intelligent IoT-Enabled System in Green Supply Chain Using Integrated FCM Method

Rui-Yang Chen
Aletheia University, Taiwan

ABSTRACT

From green supply chain perspective of the internet of things, actualization of the IOT into the complex system for green inventory management will link the real world with the digital world seamlessly. Modeling the complex systems in green supply chain can be hard in a computational utilization and inventory management of relationships exists. Two of the problems of IoT-enabled system are the lack of stable integrated architecture and autonomous mechanism. This paper proposes the intelligent IoT-enabled system in green supply chain using FCM and fuzzy QFD method. It aims to simulate complex system by linked physical and digital objects with relationships while enhancing decision-making performance efficiency for green inventory management. A case study and experiment evaluation of the proposed FCM approach on green supply chain is presented to provide some indication for work improvement. The experiment compares the total effects performance of the green inventory status as estimated by the two methods using the proposed IoT-enabled FCM and traditional FCM.

1. INTRODUCTION

The interrelated networks of green supply chain consist of manufacturers, suppliers, distributors, wholesalers, retailers, recycler and consumer. During the green life cycle of any parts, suppliers of material as well as manufacturers of intermediate/finished goods, distributors, retailer, recyclers and consumers are interconnected due to exchange of product and data. Integration of green supply chain is not easily achieved because different companies may have different or conflicting targets. Thus, supply chain partners must be coordinated and cooperate to achieve a common target. This integration improves the inventory visibility of the green supply chain. A model has been designed based on inventory management aspects of the project from a sustainability perspective. It is important that sustainable behavior

DOI: 10.4018/978-1-5225-7915-1.ch030

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

in business has increasing its impact on supply chain management (SCM). So, it might also serve as platform for pervasive presence and ubiquitous computing, enabling smart environment to create industry-driven green supply chain operation. Green supply chain initiatives should provide operation value and environmental benefits. From the perspective of green supply chain operation, inter-organizational exchange of information about physical and virtual objects with unique ID will link the real world with the digital world seamlessly. They are able to active and interact services for green supply chain operations in the associated information platform (CERP-IoT, 2009). With the advent of information system and related emerging technology, such as IoT (Internet of Things) and cloudy computing, a new generation of platform called intelligent industry resource planning (IRP) is available in the market. The internet of things attributed to the Auto-ID Labs (2013) develops novel technology that refers to the possibility of endowing physical objects with the ability to identify and interact with each other to reach cooperation goals (Giusto, 2010). As a consequence of supply chain integration, software system should propose innovative architecture fulfilling the link related to the nature of the IoT. Cheng et al. (2012) presented a knowledge-based customization system for supply chain integration which captures and recognizes the complexity of network analysis.

According to the above mentioned, modeling the green supply chain integration of complex systems can be hard in a computational utilization and inventory management of relationships exists. So, two important problems that need to be solved for IoT-enabled information systems are the lack of stable integrated architecture and autonomous mechanism. To the best of our research, very few presented approaches focus on the integration of IoT-enabled and green supply chain. Furthermore, few papers address the complex relationships of green supply chains and how these relationships can affect both environmental and inventory management outcomes using IoT-enabled system.

The approaches of the two problems are described as following:

1.1. First Problem

The stable architecture to deploy green supply chain application is a heterogeneous collection software system of ubiquitous devices. It has intrinsic status that makes it very cumbersome to development platform for green supply chain application where arbitrary devices and process interact. In the first problem, we propose constructing the IoT-enabled information system architecture for green inventory management in supply chain.

1.2. Second Problem

In the past years, conventional methods were used to modeling complex system is limited in human operation. Human operation mechanism and the complex system involving relationship may be nonlinear underlying IoT environment. Surana et al. (2005) proposed an idea of managing the integrated supply chain transforming information system into an autonomous and dynamic network. The complexity capabilities can autonomously react to a wide range of different situations in order to minimize human intervention (Miorandi et al., 2012). The main task of relationship management of the complex relationship must handle among communication, cooperation and collaboration in the green supply chain. Human way of thinking process is used to describe the autonomous mechanism for the relationship management in IoT-enabled information systems. For such situations, fuzzy cognitive maps (FCM) is considered to deal with complex system (Stylios, 2001). FCM modeling of IoT-enabled system mainly relies on a variety

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

of interconnecting component and supply chain partners to survey and analyze relationship management such as inventory management. In the second problem, we propose the utilization of the fuzzy casual characteristics of FCM and fuzzy QFD as the underlying approach in order to generate a hierarchical and dynamic network of interaction performance impact in green supply chain.

By using the above mentioned two approaches, this paper designs the intelligent IRP platform for green inventory management based on IoT technology in the green supply chain using FCM and fuzzy QFD method. It aimed to simulate green inventory system by linked physical object and digital object with imprecise relationships while enhancing decision-making efficiency for green inventory management. The objective of this article is to explore how IoT-enabled information-sharing can help green supply chains used the proposed green inventory status management stages increase both environmental and inventory management benefits. Our research, through a IoT-enabled inventory management system and FCM analysis, shows two main competitive advantages to the green supply chain:(1) Real-time green inventory traceability, sustainability and visibility (2) Green product inventory management. The former allows continuous inventory replenishment and consumption in order to handle environmental operations for raw material, component, green product, and non-green product in the supply chain. The latter facilitates green inventory coordination and collaboration inside the supply chain.

In a word, this paper proposes an integrated FCM with fuzzy QFD (FQFD) algorithm to model stably the hierarchical IoT-enabled information system in the green supply chain. This paper consists of five sections. Section 2 presents related work of literature overview. Section3 presents IoT-enabled system architecture for green inventory management in the green supply chain and an overview of the FCM with AHP and FQFD. A case study and experiment evaluation of the proposed FCM approach on green supply chain is presented to provide some indication for work improvement in the section4. Section5 concludes and briefly discusses future research.

2. RELATED WORK

2.1. Internet of Things

Miorandi et al. (2012) presented a survey of technologies, applications and research challenges for IoT. The IoT describes a global network infrastructure, internet-based information service architecture around us of a variety of things (objects)-such as Radio frequency identification (RFID) tag, sensors, readers, actuators, mobile phone, near field communication (NFC) etc. Internet of things is as an infrastructure to facilitate the information exchange of products (Atzori, 2010; Amaral, 2011). Atzori et al. (2012) presented to explore social IoT in more effective and efficient way. Carlos et al., (2013) presented novel research that is to establish if an automatic discovery process of relevant and credible news events can be achieved. The followings describe a global network infrastructure and internet-based information service architecture.

2.2. Global Network Infrastructure

The RFID system can improve to cut lead time on inventory management and increase the accuracy of inventory status information. Delen et al. (2007) analyze the inventory data collected from supplier and retailers based on RFID technology. A RFID-based system can provide real-time the traceability

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

of products and visibility to control actual inventory situation throughout the entire supply chain. The RFID technology can be used for the efficient tracing or tracking of parts through supply chain (Niederman et al., 2007; Bi and Lin, 2009). Sarac et al. (2010) conclude the major research on the impact of RFID on supply chain management for inventory inaccuracy problems. In recent years, a new inventory tracking technology has been introduced in the supply chain based on RFID system (Zhu et al., 2012). The application through RFID can be applied in different types and industry of supply chains such as fashion, food and a variety of industries (Banks et al., 2007; Pigni et al., 2008; Ferrer et al., 2010; Lee et al., 2011; Lao et al., 2012).

The technical development of the required infrastructure of components is specified by EPCglobal (2013). Henseler et al. (2008) proposed a network-based approach to adopting RFID system into supply chain using simulation technique and EPCglobal technology. Thakur et al. (2011) proposed a new methodology for modeling traceability information using the EPC information system (EPCIS) framework. Nam et al. (2011) proposed a business-aware framework for developing RFID process in supply chain on the EPCglobal Network. The main purpose of the EPCglobal network provide real-time object visibility, product track and trace (MiraglIoTta et al., 2009). Mo et al. (2009) proposed the advantages of the EPCglobal such as traceability, compatibility and exchangeability. Pilar et al. (2011) proposed distributed EPCglobal network architecture allows level track and trace capabilities of supply chain. From the above mentioned, some previous studies offer several contributions to supply chain through RFID or EPCglobal technology, but they few present network or architecture with RFID such as EPCglobal based on complex information system in the green supply chain.

In the global network infrastructure, it has the following components such as:

- **Various Devices:** These devices consist of reader sensor, PDA, computer, iPad and smart phone which are subject to identify all kinds of physical product.
- **Embedded Product:** The so-called "Embedded product" are meant to use in the IOT which may be defined as physical and virtual objects with unique ID using RFID technology
- **Wireless Sensor Network:** The role of WSN (wireless sensor network) in the IOT is that of a virtual skin by becoming aware of their surroundings to take informed decisions in industrial environments.
- **RFID/NFC Middleware:** The middleware is a filtering and communication interface that aims to capture available data between various devices and software application.
- **EPC Application:** The EPC application is an information repository to capture events/tasks facilitating integration with querying data from RFID/NFC middleware.

2.3. Internet-Based Information Service Architecture

Liu et al. (2013) proposed a model to investigate how IT capabilities affect performance through supply chain agility. Supply chain agility provide collaborative capability to perform integrated activities with supply chain partners (Swafford et al., 2008; Cao et al., 2011). Dominguez-P'ery et al. (2013) proposed an IT-driven service innovation with case study in the jewellery supply chain. Kuremaa et al. (2010) proposed a particular e-business standard (RosettaNat) integrating the telecommunications supply chain. Damien (2005) presented the relationship between the use of business to business (B2B) e-commerce enabling technologies and infrastructure, cooperative partnerships between trading partners, firm performance, and a "systems" view of strategy formulation processes.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

A service-oriented architecture (SOA) information system can deal with seamless integration of supply chain operation by using extensible markup language (XML) and hypertext transfer protocol (HTTP). Applying the service-oriented architectures to information system is an internet-based approach to aggregate the composed services. The service can be transferred into real-time e-service composition for. The internet-enabled information system architecture consists of web-based interface, collaborative environment, modular design and service component. Today, the new technology paradigms are emerging and further affect the future development of internet-enabled information system architecture such as Internet of things.

According to the above mentioned, we know that actualization of the IoT into the information system is possible through the integration of several enabling technology such as EPC (electronic product code). The EPC could support the spread use of RFID in industry-driven global standards based on IoT technology for the EPCGlobal network. Bottani and Rizzi (2008) presented to share EPC information through EPC network using RFID technology. From the EPCGlobal point of view, there is a demand for the development of complex information systems in the IoT-enabled systems that can be archived taking advantage of intelligent IRP platform like autonomous reasoning of systems.

2.4. FCM, Fuzzy QFD and AHP

The Fuzzy theory was proposed by a famous thesis- the "Fuzzy Set" published by professor Zadeh from the University of California at Berkeley in 1965. Basically, the theory was developed to deal with the fuzzy concept and to introduce the concept of Membership Grade. The relationship of the element and the set was defined between the range of 0 and 1, which demonstrated a mathematical description of the real phenomena. Fuzzy Cognitive Maps (Kosko, 1986) is a hierarchy methodology for complex decision systems with graphical illustration by multiple maps, loops, cycles etc.

Quality Function Deployment is a famous quality management theory first proposed by Yoji Akao and Shigeru Mizuno from Japan in 1966. Its main performance is to transfer the customers' expectations and preferences into the design parameters of the product. Zhai et al. (2011) proposed rough-fuzzy QFD system combines fuzzy arithmetic operations to help in improving the discernibility of design objectives and thus facilitate the decision making in product development. Hauser and Clausing (2008) proposed to use the HOQ (House of Quality) matrix in analyzing the relationship of customer requirements, the product characteristics, and the process characteristics. Fuzzy logic-based approach to QFD has found the most invention due to its ability in analyzing the fuzzy represent action. In the respect, rough-fuzzy QFD combines fuzzy arithmetic operations with rough boundary interval (Zhai et al., 2010). The fuzzy QFD methods may be defined the boundary intervals of fuzzy members.

The analytic hierarchy process (AHP) method developed by Saaty (1980). AHP is used to calculate relative weights to the decision-making indices. This method is based on pair-wise comparison between attribute and alternatives (Saaty, 1979). AHP pairwise comparison process is the benefits of decision-making performance with decision maker's judgments. These pair-wise comparisons maybe stated verbally as in "attribute item 1 is equally, mode rarely more or strongly more important than attribute item 2".

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

3. RESEARCH APPROACH

3.1. IoT-Enabled System Architecture in the Green Supply Chain

As green supply chain is a complex decision problem, we construct this architecture to solve this problem. Green supply chain integrates the intra- and inter-corporate processes as a whole system according to environmental impact performance. The performance of a green supply chain could be influenced by many partners, among which green inventory sharing is the crucial one. Green inventory information sharing can significantly improve the environmental impact performance of green supply chain. IoT is broadly used to refer to the global network interconnecting intelligent products by means of extended web-based technology. IoT-enabled system can be used to create end-to-end green inventory visibility to enabling supplier, manufacturers, logistics provides and retailers to track and trace intelligent product information through the entire green supply chain real-time and at any location. Green inventory status visibility is critical to quick response systems so as to control quickly to market and environmental changes. Besides the capability to track products inventory status as they move through the green supply chain, product traceability is to ensure product on environmental impact consideration. IoT-enabled supply chain integration is the fully automated inter-organizational system-to-system and physical-to-physical exchange of information. This proposed architecture provides a decision support system of green inventory status which can be accessed by tracking or tracing operation based on IoT-enabled system. IoT-enabled system is considered major supply chain partners for inter-organizational collaboration. While in most occasions human decision makers play main roles in green supply chain management, we proposed the IoT-enabled architecture that provides real-time visibility, traceability and sustainability of green inventory status by analyzing automatically and autonomously collected intelligent product data and software agent.

This sub-section presents an overview of the IoT-enabled system architecture for green inventory management in the green supply chain. The IoT-enabled complex system provides green product identification services for green supply chain, and facilitates the inventory implemented in the EPCIS system that is a very advanced, comprehensive and complex system. In such as IoT-enabled system of green supply chain, each enterprise must have its own EPC sub-system interact other supply chain partners for EPC network architecture in Figure 1 in the Appendix. This proposed architecture is described three phases such as fundamental phase, smart objects phase and IRP phase as following:

3.2. Fundamental Phase

First, the fundamental phase consists of physical layer, network layer and protocol layer as follows.

3.2.1. The Physical Layer

The physical layer consists of widely varying objects, including the entities of green supply chain operations, such as green parts, green and non-green product objects. And then these objects will be equipped with smart objects via RFID-related technology. Automatic identified object has recently been investigated in order to realize a ubiquitous computing. At the single product level, the IoT will be based on the notion of “intelligent product”. For what concerns the object of physical product into

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

information system, the relevant activities are mostly carried by the object ID. The object ID should be interoperable with the identification description such as IPv6 address, EPC code. The material of parts, product and shipment that are being tracked, are provided with unique EPC code stored in the chip that is embedded in the RFID tag.

3.2.2. The Network Layer

The network layer defines the environment scattered with wireless network, which the varying objects in the physical layer could communicate with each other using context-aware & semantic web based on wireless sensor network (WSN). A network layer devoted to the sensing of the physical product allows for an interconnection of the existing and widespread short distance communication way, such as: near filed communication and wireless sensor network. Sensor enabled RFID tags provide environmental impact data such as eco-efficiency. From self-organization perspective, sensor networks are able to sensing the environment. Via sensor network, these entities construct three sub-networks which are where-used, channel and EOL activities sub-network. Then, all sub-networks is described as follows. The term" where-used" indicate that raw material or component is used which finish goods. The term "where-used sub-network" indicates how to construct BOM (bill of material) network including design & production for environmental impact consideration with raw material or part/component. The channel sub-network constructs green product operation in sale & distribution channel. The EOL activities sub-network constructs green/non-green product operation for EOL activities such as repair, reuse, remanufacture and recycle.

3.2.3. The Protocol Layer

The protocol layer defines the communication protocols, which the varying equipment how could communicate with each other in the wireless network. In this propose approach, the mechanism of protocol is operated through functions of software agents to interact the entire green supply chain. The software agent can sorted into three categories: BOM agent, sale &distribution agent and eco-efficiency agent. This study attempted to analyze agent-based behaviors of green inventory status to interact among partners in green supply chain. With the IoT-enabled information systems, it has become possible how to create seamless green supply chains in order to control green inventory status of business performance and environmental eco-efficiency.

3.3. Smart Objects Phase

Next, in the smart objects phase, make the object-oriented entities, i.e. each entity object was given the unique ID code which corresponds to the virtual unique object in the virtual world. In accordance with the business model, these virtual objects (green parts, green and non-green product) will be converted to enterprise objects (role objects, behavior objects, organization or group objects, product objects, flow or process objects and structure objects). The enterprise objects are handled in the green supply chain operations. The structure object consists of BOM data of green product based on where-used subnetwork. The flow object consists of green product operation process in sale & distribution channel.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The behavior object describes green/non-green product how to operate during EOL activities. The role object mainly defines supply chain partner such as supplier, manufacturer and recycle provider. To put the information system into practice based on digitized information, the enterprise objects are required to be digitized and converted to logic objects in the information system.

3.4. IRP Phase

Finally, in the IRP phase, the resources integration platform of the Internet of Things will be designed in accordance with the business model. The above mentioned is linked up with industrial resource planning (IRP) information system of the Internet of Things. It will become a new generation of enterprise application information system linked up with cloud commerce. This phase consists of application layer, EPCIS layer and cloud commerce layer as follows.

3.4.1. The Application Layer

The application layer structure is first categorized into three stages such as Stage1, Stage2 and Stage3. The three stages for green inventory status management system as follows:

Stage 1: Green parts: Design & production for environmental impact consideration with raw material or part /components
Stage 2: Green product: Green product operation in scale & distribution channel
Stage 3: Non-green and green product: Product for EOL activities on reverse logistics operation

Over the last decade, green product has become an important activity of product development (Boons, 2002). Furthermore, the term "green parts" is considered as environmental impact of raw material component during the green product life cycle. Some previous studies had presented to identify and analyze the published definitions of green supply chain management (GSCM) (Abbasi and Nilsson, 2012; Gimenez and Tachizawa, 2012).

Jitendra et al. (2012) proposes a flexible decision model to be engaged in product recovery systems to handle reverse logistics. Reverse logistics has become important to the electronic consumer industry due to unavoidable product recalls and recycle in order to capturing the remaining value in end-of life products. End-of-life activities face some challenging issue such as what end-of-life products to collect, where to collect them, etc. Srivastava (2007) presents GSCM encompassing product design, manufacturing process and end-of-life management. On EOL products, it is important that incorporate EOL product 3R concept into product development to reduce environmental, economic and social impact. In fact, EOL activity is one stage of the product life cycle have gained market value From the supply chain relationship perspective, it is necessary to involve early module design of green product function for new product development process. Thus, green product may be designed to handle the recycling of these green product usages at their EOL activities such as repair, reuse, remanufacture and disposal. Zhu et al. (2004) and Srivastava (2007) have shown that reverse logistics operations handle the end-of-life (EOL) activities with highly uncertain. However, the green supply chain involves heterogeneous entities from both forward and reverse logistics. Many industries apply reverse logistics to operate recycled or disposal products. Nativi and Lee (2012) model the inventory monitoring using two scenarios through simulation-based analysis based on FRID technology on a decentralized supply chain with reverse logistics.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

There are different criteria such as physical product, protocol pattern, network category, digital object and operational activities within each stage. To facilitate the collaborative green inventory process in the IoT-enabled green supply chain, a certain process is classified into the above-mentioned three stages. To assess the three stages level of green supply chain performance, all criteria associated with each attribute have to be incorporated in the green inventory operation

The inventory status of green product life cycle process are called "green inventory" in Table 1 (see Appendix), which consists of four types: Quantity, where-used, location and eco-efficiency during the three stages. The status of green inventory across green supply chain tiers can be precisely obtained with the real-time visibility and traceability of RFID. For achieving efficiency and effective management of green supply chain, the IoT-enabled system is vital for tailoring the composition of eco-efficiency services provided by integrating various digital objects according to intelligent product. The seven major eco-efficiency elements A-G are defined from WBCSD (world business council for sustainable development) for green products which develop eco-design (Karlsson and Luttropp, 2006) in order to reduce environmental impacts (Desimone and Popoff, 1997). Chen and Liu (2003) proposed the relationships between each eco-efficiency element and 39 engineering parameters.

A. Material reduction.
B. Energy reduction.
C. Toxicity reduction.
D. Material recyclables.
E. Resource sustainable.
F. Product durability.
G. Product service.

3.4.2. EPCIS Layer

The EPCIS layer is based on EPCglobal network. The main objective of the EPCglobal network was to link all physical products together for green supply chain operation in term of end-to-end data exchange within a supply chain. The capturing inventory management must be changed by partner to generate EPCIS events from change in the green supply chain. The EPCIS capturing application generates EPCIS events from the obtained tag data through query interface in the repository with some local EPCIS from a global EPCIS. One of the key components of EPCglobal network required to implement track and trace capabilities is the discovery service. The EPCIS is a component for receiving tag data from the filtering operation and allowing the translation of data into business events. It tracked or traced the whole status of a green inventory throughout a green supply chain from the factory to the store where it is sold to the end user.

3.4.3. Cloud Commerce Layer

This architecture has been developed considering the following objectives: facilitate the green inventory operation of the EPCGlobal Network elements through industrial resource planning in the cloud commerce layer. However, EPCIS by distributed intelligent product (smart object) on the internet is achievable through linking and cross-linking with the help of an object naming service (ONS). The role of ONS is to map one or more Universal Resource Locator (URL) corresponding one EPC for details

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

information of physical product. The ONS is based on the well-known Domain Name System (DNS). The intelligent product of EPC code must be converted into a format that the DNS can understand. Queries to the local ONS are therefore performed by means of a DNS query for a URL derived from an EPC. From industrial resource planning perspective, the IoT-enabled system is based on an architectural view focused on reusable service components attributed in three domains aiming at generalizing and facilitating green inventory applications according to its green supply chain operation. The main elements of this architecture consist of three domains such as application system, autonomous operation and intelligent product. ONS is an important component of EPC architecture which partners to find data related to specific EPC based on the DNS. The DNS of the internet leads to the concept of ONS. In the meanwhile, the use of ONS can convert the EPC serial number into the standard DNS query format. Local ONS of the supplier achieves its address mapping related data and reports to the root ONS in order to obtain information query in the EPC network.

3.5. Overview of the FCM With AHP and FQFD

In this article, a novel approach for decision making of casual relationship impact to simulation process using AHP, Fuzzy QFD and FCM is evaluated and contains of three steps in the Figure 2 in the Appendix. This novel approach is separately discussed in the following subsections.

3.5.1. Step 1: IoT-Enabled AHP

However, relationships between IoT-enabled system architecture at the different level with no apparent casual relationships are not always clear. Thus human reasoning of the casual relationships impact of the IoT-enabled system architecture to the efficiency of the decision-making is not always feasible. To resolve this issue, this paper builds a hierarchy of the relative importance of IoT-enabled system architecture using AHP method. The AHP method was used to determine the relative importance of the environmental impact variables enhance and reduction. This determines the weight of each decision element using eigenvalue computations to derive the weights of these variables. These variables were expressed in the form of a pair-wise comparison matrix from each set of judgment are found using expert choice software. The Expert Choice (http://www.expertchoice.com), a computer software package for AHP method, is used to structure the decision into criteria and alternatives. The proposed AHP (namely IoT-enabled AHP) could solve complex system problem involving multiple attributes by constructing problem to the goal, attribute and alternatives for decision making. IoT-enabled AHP constructs three levels in the Figure 3 in the Appendix.

Level 1 is the goal of IoT-enabled system to decide the best casual relationship impact. Level 2 divided into three domains consisting of nine attributes (factors) according to IoT-enabled system architecture. Level 3 contains of three decision alternatives such as visibility, traceability and sustainability that affect the best selection of the goal. The three alternatives were invited to evaluate the relative importance of the casual relationship impact in the IoT-enabled system.

- **Visibility:** Through the green supply chain operation life cycle in industry-driven, many defects and exceptions may occur. However, the complex system must be able to keep its functions working visibility and apply seamless interaction to green inventory operation issue.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- **Traceability:** These green inventory status among supply chain partners are difficult to be integrated automatically. In order to overcome the drawback, we have focused on a real-time traceability alternative.
- **Sustainability:** However, service of green supply chain operation are ever-increasing, they are complexities link with each other. These complexities cause less sustainability of business in IoT-enabled system.

3.5.2. Step 2: Fuzzy Relationship Using FCM

To identify these factors relevant to the goal of IoT-enabled AHP, fuzzy QFD should be built and then analyzed. Furthermore, a fuzzy casual model based on the factor elicited from the three domains of IoT-enabled system includes nine basic service components using FCM, which describes the relationships between these factors. Based this result of interrelationship matrix by FQFD, we can build the fuzzy relationship to gain initial version adjacency matrix of FCM. The initial version of adjacency matrix can be converted into a following refined values fall between -1 and 1.

3.5.3. Step 3: FCM With AHP and FQFD

In this article, modeling with Fuzzy QFD was used to determine the complex casual relationships of FCM among factors based on three domains of IoT-enabled system. Casual relationships link component to each other and they formulate the adjacency matrix. This step exploited the adjacency matrix representation of fuzzy cognitive maps. The much casual chaining information can be gained from reachable adjacency matrices. Causality admits of degree, and vague degrees at that.

The proposed FCM with AHP and FQFD considers both physical object and digital object related factors and links them with their interrelationships associated with a fuzzy linguistic weight. After representation of the FCM, this step is used to simulate the inference process underlying three alternatives way of the IoT-enabled system for green inventory management in the complex system such as IoT-enabled system using the numerical analysis of FCM.

3.6. Simulate the Inference Process

Based on the nine factors of three domains from IoT-enabled AHP, it describes three input vectors separately from the three alternatives perspectives. Based on the nine service components of three domains from fuzzy QFD, it describes nine factors the adjacency matrix of FCM. In addition, the adjacency matrix can be used usefully for changes of multiple factors. Therefore multiplying effects resulting from this input vector, it can obtain output vector. Once the factor values of the input vector is modified, the output vector may be expressed such that changes way affect these factors each other.

3.7. The Numerical Analysis of FCM

It is necessary to conduct the numerical analysis of FCMs with the factors affecting the performance impact using total effects algorithm. The total effects algorithm for each factor should be evaluated to determine the impact in the IoT-enabled system.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

4. CASE STUDY

A case study was used to illustrate the proposed methodology with a notebook computer supply chain. This section presents experiment execution and application evaluation according three steps from Figure 2. This experiment execution is separately shown as follows. Figure 4 and Figure 5 in the Appendix are the calculated results by performed Expert choice software. The running data were gathered by interviewing the evaluators using a questionnaire. The study distributed a total of 30 copies of the questionnaire according to IoT-enabled AHP, 27 copies were valid. Figure 4 shows the outcome of IoT-enabled AHP and the priority value of the three alternatives. According to the result of the calculation, IoT-enabled AHP objective of the relative weights of the three alternatives are 0.476 (Visibility), 0.226 (Traceability) and 0.298 (Sustainability), respectively. AHP is being employed with the consistency of the subjective evaluations by the consistency ratio (CR). From the result of AHP calculated, the over inconsistency ratio is 0.06 (<=0.1). Then, fuzzy QFD is calculated in the Figure 5 from the nine attributes (factors) of Figure 4. Furthermore, Figure 6 in the Appendix shows fuzzy casual relationships represented FCM graphic according to the Figure 5 and forms initial version of adjacency matrix *W*.

4.1. Simulate the Inference Process

There are nine concept nodes in the Figure 7 (see Appendix) which are interrelated with fuzzy causality values. By referring to Figure 6, the adjacency matrix *W* is derived in Table 2 in the Appendix as follows. In addition, the adjacency matrix can be used for clearly measuring the effects resulting from change of multiple factors. Suppose that some factors are changed base on the questionnaire of three alternatives (Visibility, Traceability and Sustainability), the input vector may be obtained as follows:

Input Vector:
Visibility: [0.32,0,0,0.13,0.33,0,0,0,0.33]
Traceability: [0.18,0,0,0.33,0,0,0,0,0.18]
Sustainability: [0.15,0,0,0.15,0,0,0,0,0.15]

Therefore multiplying this input vector with adjacency matrix, We can obtain an output vector as follows:

Output Vector:
Visibility: [0.3,0,0.16,0.30,0.12,0,0,0.14,0.30]
Traceability: [0.33,0,0.21,0.38,0.5,0,0,0.18,0.33]
Sustainability: [0.12,0,0.05,0.13,0,0,0,0,0.12]

From the above calculated result, the output vector such as visibility alternative may be interpreted such that change in those factors including *Green part*s, *Sale &distribution agent, Eco-efficiency agent* and *Stage3* affect *Green parts* by 0.3,. *Green &non-green* by 0.16, *BOM agent* by 0.3, *Sale &distribution agent* by 0.12, *Stage2* by 0.14, *Stage3* by 0.3. Therefore, we can conclude that changes of four factors may affect the *Green parts, BOM agent* and *stage3* most favorably.

The adjacency matrix shows that the variation of some factors causes an effect on other factors and the effectiveness of green inventory management. The direction and strength of cause and effect linkages

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

are representing the state of relationship management and the performance of green inventory management. If the number of factors that are varied becomes higher, this leads to the great effectiveness of green inventory management. It is possible to find the input vector that leads to the highest effectiveness of green inventory management.

This paper will enhance the quality of performance impact of decision-making efficiency for green inventory management in the IoT-enabled system. According to the above-mentioned inference simulation process, we obtain the result of Table 3 in the Appendix. From Table 3, the results shown in the inference process are analyzed according to the following indicators of the inventory status of green product life cycle process during the three stages: Quantity, Where-used, Location and Eco-efficiency.

- **Quantity:** According to green inventory quantity flow during the supply chain, we can conclude that green inventory quantity control obtain better consistent accuracy performance with casual relationship.
- **Where-Used:** According to green parts is used which product in the design & production consideration, we can conclude that where-used control obtain better used degree performance with relationship.
- **Location:** According to green parts and green product is located which partners during the supply chain, we can conclude that location control obtain better distributive correction performance with casual relationship.
- **Eco-Efficiency:** According to green/non-green product for EOL activities on reverse logistics operation, we can conclude that eco-efficiency control obtain better effective ratio performance with relationship.

In a word, an important advantage of the green inventory status inference process is that they build better controllable capability in the three alternatives such as visibility, traceability and sustainability.

4.2. The Numerical Analysis of FCM

Thus, green inventory status path determines a series of activities that need to deliver a value chain service in green supply chain. The total-effect operation amounts to specifying the strongest of the casual link using min-max strategy. I suppose the casual values are given by{a little ≦ some ≦ much ≦ a lot}. The total effect of a cause variable I on effect variable II, denoted by T(I,II), is the sum of all the indirect effects from all the possible paths connecting I with II. In order to describe the degree of the relationship between causes, it is possible to use fuzzy linguistic terms, such as “a little” [0~0.2], “often” (0.2~0.4], “some”(0.4~0.6], “much”(0.6~0.8], “a lot”(0.8~1], etc. According to the total-effect algorithm, for example, the total-effect T(I, V) of some casual paths from I to V are $E_1(I,V)$: (I, III, IV, V), $E_2(I,V)$: (I, IV, V). So the some indirect effects of I to V are:

$$E_1(I,V) = \min\{\text{a little, a little, a little}\} = \text{a little}$$

$$E_2(I,V) = \min\{\text{some, a little}\} = \text{a little}$$

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

$T(I, V) = \max\{ E_1(I,V) , E_2(I,V) \}$

$= \max\{\text{a little, a little}\}$

$=$ a little

In words, I (Green parts) imparts a little causality to V (Sale &distribution agent).

According to the above-mentioned calculated process, we can obtain total effects of casual path in Table 4 in the Appendix. The highest and lowest casual effects are found in the path from I to IX and I to VIII in the Table 4. From the highest value of total effects, the two most significant factors are "Green parts " and "Stage3 ", respectively. In particular, when taking into consideration the factors "Green parts" and "Stage3", it can be immediately noted that they include the relationship management which are the most significant in improving the decision-making efficiency for green inventory management in the supply chain.

The experiments are conducted by utilizing metrics from green inventory management in the case study. Figure 7 compares the total effects performance of the green inventory status as estimated by the two methods using the proposed IoT-enabled FCM and traditional FCM. It shows the experimental results which exhibited trends similar to those of the experiments using six paths from the Table 4 for the bounded value of total effects. Summarizing, experimental results showed that the proposed IoT-enabled FCM reasoning of the impact of green inventory management can be effective.

5. CONCLUSION

The proposed approach have proved to be able to provide performance evaluation in assessing the most critical factors for controlling green inventory status in the supply chain. The proposed approach using FCM and FQFD can be able to provide a contribution in assessing the most critical factors for green supply chain operation in managing complex system such as IoT-enabled information system. Good complex information system such as inventory management must be provided a solution to the issue of evaluating the factors which are considered to affect the complex system's visibility, traceability and sustainability. This paper will enhance the quality of performance impact of green inventory decision-making efficiency for green inventory management in the IoT-enabled system. It aims to simulate complex system linked physical object and digital object with imprecise relationships while enhancing the impact of decision-making performance efficiency for green inventory management. In this article, a novel approach for decision making of casual relationship impact to human way of thinking simulation process using AHP, Fuzzy QFD and FCM is evaluated.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

REFERENCES

Abbasi, M., & Nilsson, F. (2012). Themes and challenges in making supply chains environmentally sustainable. *Supply Chain Management: An International Journal*, *17*(5), 517–530. doi:10.1108/13598541211258582

Amaral, L. A., Hessel, F. P., & Bezerrao, E. (2011). ECloudRFID-A mobile software framework architecture for pervasive RFID-based applications. *Journal of Network and Computer Applications*, *34*(3), 972–979. doi:10.1016/j.jnca.2010.04.005

Atzori, L., Antonio, I., Giacomo, M., & Michele, N. (2012). The Social Internet of Things (SIoT)-When social networks meet the Internet of Things: Concept, architecture and network characterization. *Computer Networks*, *56*(16), 3594–3608. doi:10.1016/j.comnet.2012.07.010

Atzori, L. A., Iera, G. M., & Morabito, G. (2010). The Internet of Things: A survey. *Computer Networks*, *54*(15), 2787–2805. doi:10.1016/j.comnet.2010.05.010

Auto-Id Labs. (2013). from http://www.autoidlabs.org/

Banks, J., Hanny, D., Pachano, M. A., & Thompson, L. G. (2007). *RFID applied*. John Wiley & Sons, Inc. doi:10.1002/9780470168226

Bi, H., & Lin, D. (2009). RFID-enabled discovery of supply networks. *IEEE Transactions on Engineering Management*, *56*(1), 129–141. doi:10.1109/TEM.2008.922636

Boons, F. (2002). Greening products: A framework for product chain management. *Journal of Cleaner Production*, *10*(5), 495–505. doi:10.1016/S0959-6526(02)00017-3

Bottani, E., & Rizzi, A. (2008). Economical assessment of the impact of RFID technology and EPC system on the fast-moving consumer goods supply chain. *International Journal of Production Economics*, *112*(2), 548–569. doi:10.1016/j.ijpe.2007.05.007

Cao, M., & Zhang, Q. (2011). Supply chain collaboration: Impact on collaborative advantage and firm performance. *Journal of Operations Management*, *29*(1–2), 163–180. doi:10.1016/j.jom.2010.12.008

CarlosC.MarceloM.BarbaraP. (2013). Predicting information credibility in time-sensitive social media, *Internet Research*, *23*, 5.

CERP-IoT Cluster. http://www.rfid-in-action.eu/cerp-IoT, (2009).

Chen, J. L., & Liu, C. C. (2003). An eco-innovative design approach incorporating the TRIZ method without contradiction analysis. *Journal of Sustain Prod Des*, *1*(4), 262–272.

Cheung, C. F., Cheung, C. M., & Kwok, S. K. (2012). A Knowledge-based Customization System for Supply Chain Integration. *Expert Systems with Applications*, *39*(4), 3906–3924. doi:10.1016/j.eswa.2011.08.096

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Damien, P. (2005). Strategy development processes as determinants of B2B e-commerce performance: A comparative model in a supply chain management context. *Internet Research*, *15*(5), 557–581. doi:10.1108/10662240510629493

Delen, D., Hardgrave, B.C., & Sharda, R. (2007). RFID for Better Supply-Chain Management through Enhanced Information Visibility. ITRI-WP078-1006, *Information Technology Research Institute: RFID Research Center, University of Arkansas.*

Desimone, L. D., & Popoff, F. (1997). *Eco-efficiency: the business link to sustainable development. Cambridge*. MA: Massachusetts Institute of Technology.

Dominguez, P. C., Ageron, B., & Neubert, G. (2013). A service science framework to enhance value creation in service innovation projects. An RFID case study. *International Journal of Production Economics*, *141*(2), 440–451. doi:10.1016/j.ijpe.2011.12.026

EPCglobal. (2013). from http://www.gs1.org/epcglobal

EPCglobal Inc. (2009). *The EPCglobal Architecture Framework EPCglobal Final Version*.

Ferrer, G., Dew, N., & Apte, U. (2010). When is RFID right for your service? *International Journal of Production Economics*, *124*(2), 414–425. doi:10.1016/j.ijpe.2009.12.004

Gimenez, C., & Tachizawa, E. M. (2012). Extending sustainability to suppliers: A systematic literature review. *Supply Chain Management: An International Journal*, *17*(5), 531–554. doi:10.1108/13598541211258591

Giusto, D., Iera, A., Morabito, G., & Atzori, L. (2010). The Internet of Things, Springer, ISBN: 78-1-4419-1673-0. doi:10.1007/978-1-4419-1674-7

Hasan, S. A., Pal, A. K., Dhawan, S. C., & Rajesh, L. (2008). Role of Indian educational and R & D institutions in knowledge sharing. *Journal of Scientific and Industrial Research*, *67*, 589–598.

Henseler, M., Rossberg, M., & Schaefer, G. (2008). Credential management for automatic identification solutions in supply chain management. *IEEE Trans Ind Inf*, *4*(4), 303–314. doi:10.1109/TII.2008.2009532

Jitendra, M., Kumar, P. F., & Chan, T. S. (2012). Decision and information interoperability for improving performance of product recovery systems. *Decision Support Systems*, *53*(3), 448–457. doi:10.1016/j.dss.2012.02.011

Karlsson, R., & Luttropp, C. (2006). EcoDesign: What's happening? An overview of the subject area of EcoDesign and of the papers in this special issue. *Journal of Cleaner Production*, *14*(15-16), 1291–1298. doi:10.1016/j.jclepro.2005.11.010

Kauremaa, J., Nurmilaakso, J. M., & Kari, T. (2010). E-business enabled operational linkages: The role of RosettaNet in integrating the telecommunications supply chain. *International Journal of Production Economics*, *127*(2), 343–357. doi:10.1016/j.ijpe.2009.08.024

Kosko, B. (1986). Fuzzy Cognitive Maps. *Journal of Man-Machine Studies*, *24*(1), 65–75. doi:10.1016/S0020-7373(86)80040-2

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Lao, S. I., Choy, K. L., Ho, G. T., Tsim, Y. C., Poon, T. C., & Cheng, C. K. (2012). A real-time food safety management system for receiving operations in distribution centers. *Expert Systems with Applications*, *39*(3), 2532–2548. doi:10.1016/j.eswa.2011.08.105

Lee, C. K. M., Ho, W., Ho, G. T. S., & Lau, H. C. W. (2011). Design and development of logistics workflow systems for demand management with RFID. *Expert Systems with Applications*, *38*(5), 5428–5437. doi:10.1016/j.eswa.2010.10.012

Liu, H., Weiling, K., Wei, K. K., & Hua, Z. S. (2013). The impact of IT capabilities on firm performance: The mediating roles of absorptive capacity and supply chain agility. *Decision Support Systems*, *54*(3), 1452–1462. doi:10.1016/j.dss.2012.12.016

Miorandi, D., Sabrina, S., Francesco, D. P., & Imrich, C. (2012). Internet of things: Vision, applications and research challenges. *Ad Hoc Networks*, *10*(7), 1497–1516. doi:10.1016/j.adhoc.2012.02.016

MiraglIoTta, G., Perego, A., & Tumino, A. (2009). A quantitative model for the introduction of RFID in the fast moving consumer goods supply chain. Are there any profits? *IJOPM, 29*(10), 1049–1082.

Mo, J. P. (2009). Process integration for paperless delivery using EPC compliance technology. *JMTM*, *20*(6), 866–886.

Nam, T., & Yeom, K. K. (2011). Business-aware framework for supporting RFID-enabled applications in EPC Network. *Journal of Network and Computer Applications*, *34*(3), 958–971. doi:10.1016/j.jnca.2010.04.021

Nativi, J. J., & Lee, S. (2012). Impact of RFID information-sharing strategies on a decentralized supply chain with reverse logistics operations. *International Journal of Production Economics*, *136*(2), 366–377. doi:10.1016/j.ijpe.2011.12.024

Niederman, F., Mathieu, R. G., Morley, R., & Kwon, I. W. (2007). Examining RFID applications in supply chain management. *Communications of the ACM*, *50*(7), 92–101. doi:10.1145/1272516.1272520

Pigni, F., & Ravarini, A. (2008). RFID in the fashion industry: Evidences and lessons learnt from an anti-counterfeiting project. In Proceedings of the 14th Americas conference on, *Information Systems*, 1–8.

Pilar, M. L., Juan, P. M. G., Josemaria, M. S., & Juan, C. S. A. (2011). An efficient distributed discovery service for EPCglobal network in nested package scenarios. *Journal of Network and Computer Applications*, *34*(3), 925–937. doi:10.1016/j.jnca.2010.04.018

Saaty, T. L. (1979). A Scaling Method for Priorities in Hierarchy Structures. *Journal of Mathematical Psychology*, *3*, 243–281.

Saaty, T. L. (1980). *The Analytic Hierarchy Process*. New York: McGraw-Hill.

Sarac, A., Absi, N., & Dauzre, P. S. (2010). A literature review on the impact of RFID technologies on supply chain management. *International Journal of Production Economics*, *128*(1), 77–95. doi:10.1016/j.ijpe.2010.07.039

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Srivastava, S. (2007). Green supply-chain management: A state-of the-art literature review. *International Journal of Management Reviews*, *9*(1), 53–80. doi:10.1111/j.1468-2370.2007.00202.x

Srivastava, S. K. (2007). Green supply-chain management: A state-of-the-art literature review. *International Journal of Management Reviews*, *9*(1), 53–80. doi:10.1111/j.1468-2370.2007.00202.x

Stylios, C. D., & Groumpos, P. P. (2001). Fuzzy cognitive maps multi-model for complex manufacturing systems, *Ninth IFAC Symposium on Large Scale Systems: Theory and Applications* (LSS'01).

Surana, A., Kumara, S., Greaves, M., & Raghavan, U. N. (2005). Supply-Chain Networks: A Complex Adaptive Systems Perspective. *International Journal of Production Research*, *43*(20), 4235–4265. doi:10.1080/00207540500142274

Swafford, P. M., Ghosh, S., & Murthy, N. (2008). Achieving supply chain agility through IT integration and responsibility. *International Journal of Production Economics*, *116*(2), 288–297. doi:10.1016/j.ijpe.2008.09.002

Thakur, M., Sorensen, C. F., Bjornson, F. O., Eskil, F., & Hurburgh, C. R. (2011). Managing food traceability information using EPCIS framework. *Journal of Food Engineering*, *103*(4), 417–433. doi:10.1016/j.jfoodeng.2010.11.012

Zhai, L. Y., Khoo, L. P., & Zhong, Z. W. (2010). Towards a QFD-based expert system: A novel extension to fuzzy QFD methodology using rough set theory. *Expert Systems with Applications*, *37*(12), 8888–8896. doi:10.1016/j.eswa.2010.06.007

Zhai, L. Y., Khoo, L. P., & Zhong, Z. W. (2010). Towards a QFD-based expert system: A novel extension to fuzzy QFD methodology using rough set theory. *Expert Systems with Applications*, *37*(12), 8888–8897. doi:10.1016/j.eswa.2010.06.007

Zhu, Q., & Sarkis, J. (2004). Relationship between operational practices and performance among early adopters of green supply chain management practices in Chinese manufacturing enterprises. *Journal of Operations Management*, *22*(3), 265–289. doi:10.1016/j.jom.2004.01.005

Zhu, X., Samar, K. M., & Kurata, H. (2012). A review of RFID technology and its managerial applications in different industries. *Journal of Engineering and Technology Management*, *29*(1), 152–167. doi:10.1016/j.jengtecman.2011.09.011

This research was previously published in the International Journal of Business Analytics (IJBAN), 2(3); edited by John Wang, pages 47-66, copyright year 2015 by IGI Publishing (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

APPENDIX

Table 1. Green inventory status indicator

Inventory status indicator \ Stage	Stage1: Green parts	Stage2: Green product	Stage3: Green & non-green product
Quantity	Δ	Δ	Δ
Location	Δ	Δ	
Eco-efficiency			Δ
Where-used	Δ		

Table 2. Initial version of adjacency matrix W

		Effect								
		I	**II**	**III**	**IV**	**V**	**VI**	**VI**	**VIII**	**IX**
Casual	I			0.17	0.42	0.12			0.14	0.43
	II									
	III	0.17		0.17						0.17
	IV	0.42		0.17	0.13				0.15	0.43
	V	0.12			0.13					0.12
	VI									
	VII									
	VIII	0.14			0.15					
	IX	0.42		0.17	0.43	0.12			0.142	

Table 3. The results of the green inventory status inference process

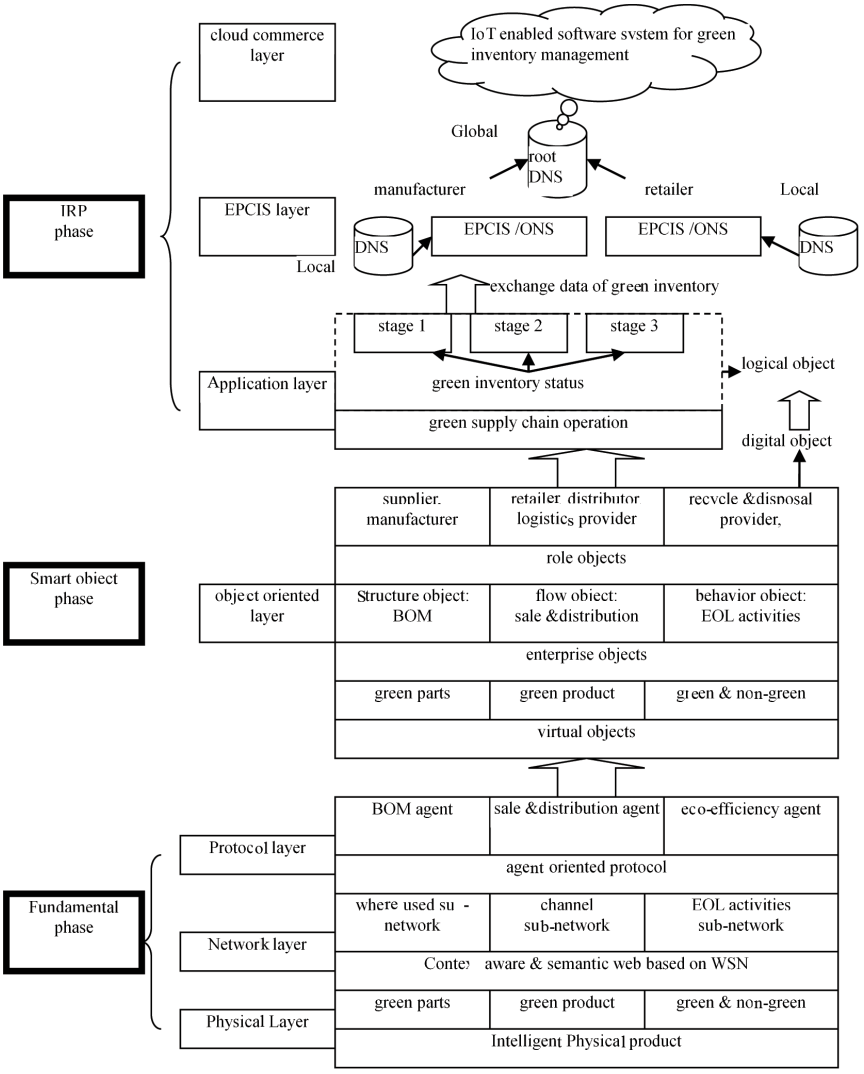
effect factors / indicator /performance / alternatives	Quantity	Where-used	Location	Eco-efficiency
	consistent accuracy	used degree	distributive correction	effective ratio
Visibility	+	+		+
Traceability	+		+	+
Sustainability		+		+

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 4. Total effects of casual path

Casual path	Total effects	Bounded values	Description
path 1:I--> III	a little	0.17	I (Green parts) imparts a little causality to III (green &non-green)
path 2:I--> IV	some	0.42	I (Green parts) imparts some causality to IV (BOM agent)
path 3:I--> V	a little	0.17	I (Green parts) imparts a little causality to V(Sale &distribution agent)
path 4:I--> VIII	a little	0.14	I (Green parts) imparts a little causality to VIII (Stage2)
path 5:I--> IX	some	0.43	I (Green parts) imparts some causality to IX (Stage3)

Figure 1. IoT-enabled system architecture in the green supply chain



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 2. A novel approach of green inventory decision making efficiency

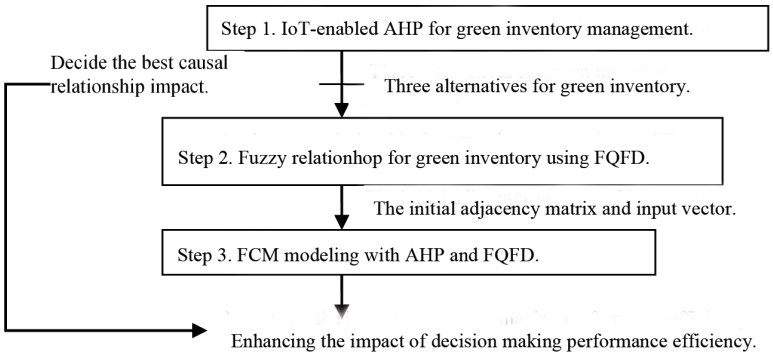


Figure 3. IoT-enabled AHP for green inventory management

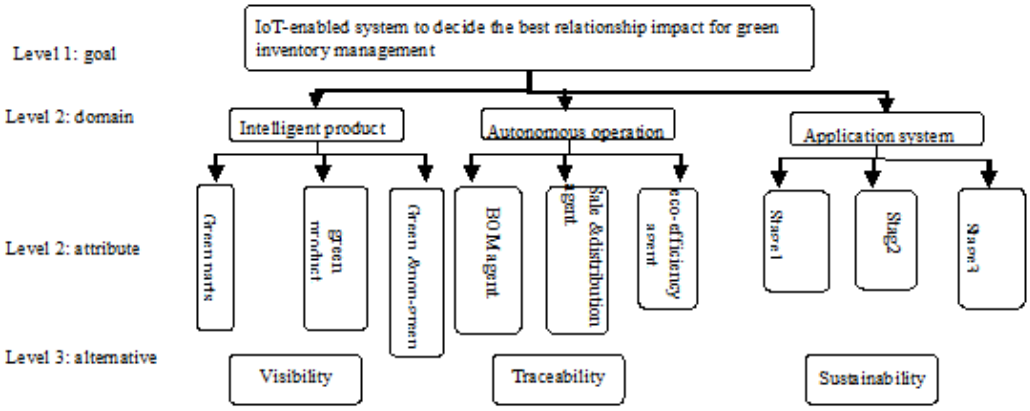
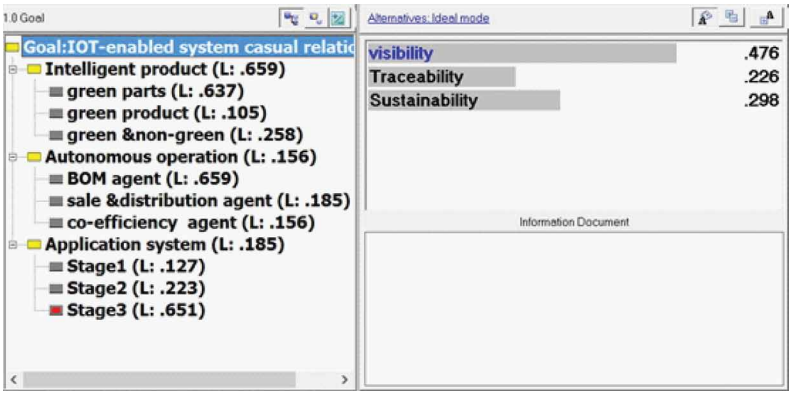


Figure 4. IoT-enabled AHP result



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 5. The fuzzy QFD result

factors / factors	I green parts	II green product	III green &non-green	IV BOM agent	V sale &distribution agent	VI eco-efficiency agent	VII Stage 1	VIII Stage 2	IX Stage 3
I			0.17	0.42	0.12			0.14	0.43
II									
III	0.17			0.17					0.17
IV	0.42		0.17		0.13			0.15	0.43
V	0.12			0.13					0.12
VI									
VII									
VIII	0.14			0.15					0.14
IX	0.42		0.17	0..43	0.12			0.14	

Figure 6. FCM from FQFD

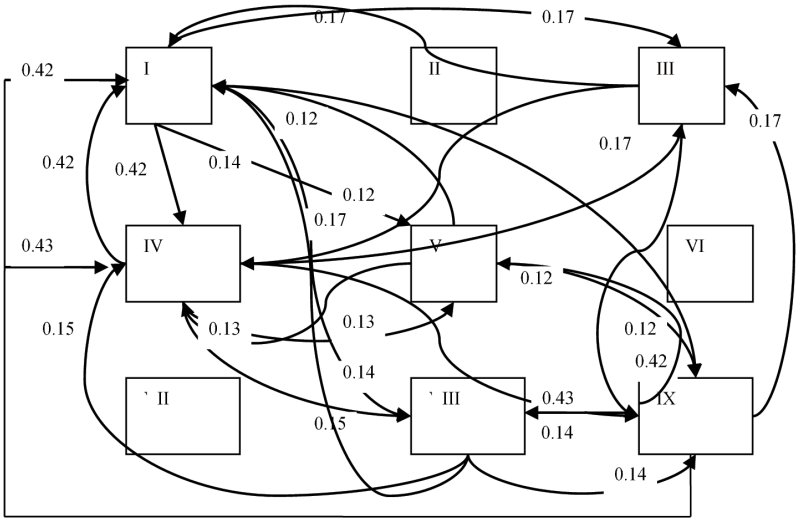
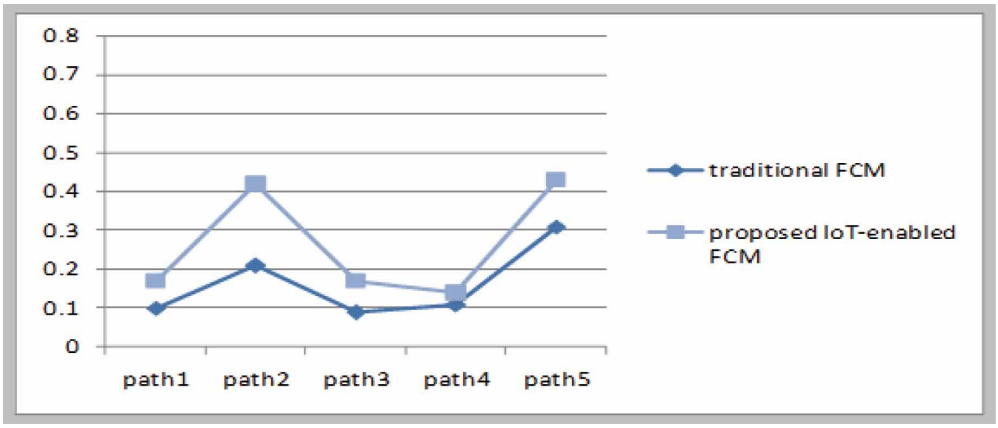


Figure 7. Comparison the total effects with the proposed IoT-enabled FCM and traditional FCM



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 31
Green Information System for a Sustainable Enterprise

Laura-Diana Radu
Alexandru Ioan Cuza University of Iasi, Romania

ABSTRACT

The changes made in the environment as a consequence of massive industrialization led to a change in the vision of mankind on how organizations should interact with the ecosystem. In the same time information system has a key role in their activity. The increasing their use is accompanied by positive effects. This chapter presents the changes necessary for transformation traditional information systems in green information system. The organization's motivations to develop and implement strategies and regulations for environmental protection are varied. They can be the organization's internal drivers, such as reducing delivery costs, increasing efficiency, improving market reputation, and external, such as government legislation or policies, regulations, competition. Changes necessary to implement green information system are presented based on agile model life cycle and in accord with organizations objectives.

INTRODUCTION

The field of environmental sustainability has been studied by marketing researchers, management researchers, operation researchers or business economists (Walker et al., 1998; Bazerman & Hoffman, 1999; Corbett & Kirsch, 2001; King & Lenox, 2001; Midgley & Reynolds, 2004; Collins et al., 2007; Lyon & Maxwell, 2007; White & Lee, 2009). Its benefits have been put to profit from various perspectives, but they have also been criticized mainly due to the way in which they are perceived and implemented. Until 2010, there had been made quite a few studies which presented the way in which environmental sustainability could be engulfed by the information systems (IS) (Melville, 2010). After this year some organizations adopted certain strategies of ecological sustainable development, some important changes came up, in the technical or non-technical fields and currently it is seen as a necessity. In our days *a business that fails to have sustainable development as a top priorities could receive considerable public criticism and subsequently lose market legitimacy* (Du et al., 2013).

DOI: 10.4018/978-1-5225-7915-1.ch031

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

For an organization, "going green" means going through an analysis of the current situation as regards the influence on the environment, identifying the drawbacks on organizational level, then developing models to describe the state which the company aims to reach and turn them into business projects in order to improve the equilibrium between the organizational inputs and outputs and the environment (Beal, 2011).

During the last decades, in some countries, by regulation, education and life conditions there have been made attempts to turn sustainable consumption into a lifestyle. The reduction in the electric energy consumption or the use of alternative sources, less non-renewable resources, diminishing waste and encouraging selective waste collection have been assimilated into the natural behavior of some community members.

The studies have shown that technology, including IT, can help with increasing eco-efficiency, which is the ratio between environmental and economic performance, or, more concretely, between (product or service) value added and environmental impact added by that activity (Hack & Berg, 2014).

In these circumstances an important role is held by the IS of the organization which should be green in its turn in order to meet the demands of the international organizations interested in the field of environment protection, but also of a wide range of consumers. This is how the concept of *green IS* appeared and it expands the meaning of phrases such as green IT, ecoinformatics, green computing etc. and it analyses in real terms how the IS within the organization can contribute to the environment protection and how its negative effects can be diminished.

BACKGROUND

Considering the degree of involvement of organizations in promoting sustainable ecological development, Hart (1997) identifies three objectives: (1) preventing pollution by minimizing the waste and CO_2 emissions, (2) manage the product characteristics after consideration the partners/clients' opinions and optimize the whole life-cycle, (3) sustainable ecological development accomplished by diminishing the influence of the organization on the environment and assuming a vision on long-term ecological research. IT and IS can contribute to the accomplishment of these objectives as object and subject of the ecological sustainable development by reducing their influence on the environment, as well as by improving the influence of products and services on the accomplishment they participate in.

The literature in the field identifies six key points which might lay the basis for the ecological sustainability: (1) prevent pollution; (2) more production with less resources; (3) reduce impact on the environment; (4) clean production; (5) environmental performance; (6) output equals input (Tu and Huang, 2015). These key points apply in the IT as well to prove that green design increase efficiency, produce benefits in companies and reduce environmental pollution. The concept of green IS has appeared as a normal extension of green IT. It was introduced in research and practice in 2008 as a consequence of wider ICT use and becoming aware of their impact on the environment, in the production process and later also during the use and after use.

The aim of replacing IS and IT with those considered green is to intensify the way in which these technologies support sustainable development by and in different organizations. The literature in the field as well the practice present different opinions and these, together with the growing interest for this topic make it quite a challenge to clearly define and delineate this concept. For this reason, at the beginning, there will be clarified the notions of green IT and green IS, as well as the differences and resemblances,

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

based on literature. The following table presents a few definitions, considered relevant by the author for the two concepts (Table 1).

The opinions regarding the resemblances and differences between the two concepts are not unitary. Some authors consider that green IT refers exclusively to the technical part of the field, while others include the economic side as well. At the same time, some authors, such as Dedrick, 2010; Molla, 2013; Sarkis et al., 2013; Esfahani et al., 2015 highlight the close relationship between green IS and green IT, but they do not consider that they have different interests and goals. In their opinion, green IT aims to bring the negative effects of IT on the environment to a minimum by producing, using and discharging the equipment and applications only in ecological terms (Murugesan, 2008; Molla et al., 2011; Molla, 2013). On the other side, green IS refers to the use of IS in organizations in order to support the sustainable ecological development by automatisation and changing the products, processes as well as business relationships and practices (Chen et al., 2008; Melville, 2010; Molla, 2013).

In the opinion of other authors as Watson et al. (2010), green IT is a component of green IS, since the first concept's approach focuses on technology, thus its meaning is limited. They consider green IS the design and implementation of IS that contribute to sustainable business process. The table below shows the differences between green IS and green IT in the opinion of the above-mentioned authors (Table 2).

Table 1. ICT and environment: different approaches

Author	Green ICT (Green computing) is…
Murugesan (2008)	… the designing, manufacturing, using and disposing all ICT equipment with minimal impact on the environment or with no negative impact. These equipment include monitors, printers, storage devices, networking and communication devices.
Molla (2009)	… the interest of the company to apply environmental sustainability criteria (pollution, clean technologies and production, e-waste management etc.) in the processes of product design, production, use and disposal of the IT infrastructure (including equipment, human resources and managerial components).
Andreopoulou et al. (2013)	… the design, construction and information diffusion in order to achieve ecologically sustainable development and to improve the company's operational process by adopting and applying technological innovations from ICT industry.
Author	**Green IS refers to…**
Esty and Winston (2006)	… information system modified and used to monitor environmental practices and outcomes.
Jenkin et al. (2011)	… design, development and use of information system in order to support environmental sustainability initiatives and that has direct or indirect favorable impact on the environment.
Löser et al. (2012)	… all information system components (products, service and business operations) in order to minimize the negative impact on the environment manifested by managerial perspective on the investments in information system, his design, his development and use.

Table 2. Green IS vs. Green IT

Green IS	Green IT
• Using a fleet management system and dynamic routing of vehicle to reduce transportation costs through less energy consumption and the avoidance of the traffic congestion; • Collecting and using information on the environmental impact in the production and in the supply of service; • More effective management of operational emission and waste product; • A better information of the consumers about the influence of the products and the services on the environment. They can make green choices more conveniently and effectively; • Using online communication for teamwork and meeting in the case of companies with offices distributed to the world.	• Designing and using green hardware; • Using thin clients instead of personal computers; • Using cloud computing to run applications and operating systems; • Replacing brown sources of energy with green sources in data centers; • Minimizing energy consumption in data centers; • Minimizing e-waste from computing equipment; • Reduce transportation through online communication and remote computer administration.

(Watson el al., 2008)

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Brooks et al. (2012) offers a complete and correct definition of the concept of green IS considering its technical side, as well as the non-technical side. In these authors opinion, they represent the improving of the energy efficiency and the introducing of more environmentally friendly products and services to decrease negative influences on the environment through initiatives concerning the use of IT infrastructures to change organizational practices and processes. Green IS addresses a wider issue and consequently, it is expected to offer more complex solutions. Their impact on the environment is more favorable than green IT. Green IS make entire activity of the organization more sustainable and this includes the use of IS to increase sustainability across the global economy (Watson et al., 2008) and improving, in this way, efficiency in industries that are major sources of GHG emissions, such as the transportation, manufacturing, and energy sectors (Dedrick, 2010). In another definition, given by Watson et al. (2010) green IS is the investments in design, development, management and use of IS in order to decrease or even to eliminate the negative impact of IS, business operations and its specific products and services on the environment. As it can be seen, in this approach, the authors do not mention IT explicitly, as they are considered an implicit component of IS, thus promoting the more complex and wider role of the latter. However, regardless of the adopted approach, it is clear that the aim remains unchanged, namely: introduce and potentiate some advanced methods and techniques to protect the environment, in agreement with the extended use of ICT.

GREEN IS ADOPTION: MOTIVATIONS FOR ENTERPRISES AND FOR SOCIETY

In order to understand how green IS can be introduced in organizations aiming to support a sustainable ecological development, some authors consider that the starting point could be the concept of environmental technologies. It is defined as product design, acquisition and use of production equipment, methods and procedures, delivery and after-sale service through methods and mechanisms that ensure energy conservation and minimize negative influences on the natural balance and protect the environment (Shrivastava, 1995). Without explicitly mentioning green IS, this definition highlights the way in which they can contribute to the protection of the environment by increasing the efficiency in using the resources associated to procedures, equipment and products destined to the end user. A significant role is played by the management team who should propose strategies to encourage the protection of the environment, if they are interested in this aspect.

Based on this interpretation, the researchers identified three stages in the green IT and IS evolution up to the present day (Löser, 2015). The first stage refers to *reducing the negative impact of IT on the environment, mainly that of CO_2 emissions, by promoting green IT*. In the second stage, green IS takes shape in the *innovation of process* which points to the way in which IS contributes to the reducing of the negative effects caused by other fields of activity, such as transport, production or energy. In the end, there was identified a third stage which considers *the innovation of product* and this is accomplished by developing and putting on the market certain products with smaller negative effect on the environment, in the form of diminishing the consumption of resources, the CO_2 emissions and the e-waste and also by creating a smart or intelligent infrastructure. A previous analysis on the green IT and green IS stage underlined the fact that different organizations are going through different stages since the adoption of these concepts (Radu, 2014, 2015a, 2015b). Also, a significant part does not arouse any interest for the purchase, development and use of ICT in agreement with the protection of the ecosystem.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Fighting the negative impact on the environment by adopting green IS requires a series of actions and decisions among which we consider these are significant: choose the hardware and software suppliers considering their environmental policies, as regards the presence and compliance to the standard (as ISO 14000 series or EMAS), as well as the offer actually present on the market, a rational replacement of the equipment, limited use of IT depending on the organizational needs, policies of eliminating e-waste favorable to the environment and so on. This last aspect is very controversial. The growing countries prove to be the deposit of a great volume of e-waste, even under the conditions of laws in force which actually forbid such practices. The motivations are the following: little awareness on the issue, lack of resources in the hands of the authorities or the presence of corruption. For instance, in China there is exported a great volume of e-waste, although it is legally forbidden since 2000 and 2002 (Li et al., 2006). Approximately 80% of the totals of 40 million tons of e-waste generated yearly is exported to the developing countries (UNEP, 2010). The main importers are China, Pakistan, India, Vietnam, Philippines, Malaysia, Nigeria, Ghana and Peru according to a report of Basel Action Network (Puckett et al., 2005). The presence of contaminants as beryllium or brominated flame retardants as well as dangerous metals such as mercury, arsenic, chromium, cadmium which can be found in e-waste and can affect the population's state of health. Also, an interesting analysis shows that a modern microprocessor requires around 60 elements (more than a half of all existing elements on earth) while in the 1980s, it was produces with 12 chemical elements (Löser, 2015). The responsibility assumed for such practices cannot be found on both parties, whereas finding a solution remains a problem of social consciousness.

Another controversial aspect of this topic is the moment when a piece of equipment is considered e-waste, since sometimes; they are hidden under the form of transactions of functional equipment. In this case, when liability no longer functions as a determining factor in applying the specific green IT practices, the developers end up with the task of finding less invasive solutions for the environment. The positive effects should be spread from the developed countries, which have the proper legal frame and can limit the production of polluting equipment and applications, consuming energy as well, towards the less developed countries which assume mainly the position of consumers, but this status is not given as a rule (China and India for example have important positions on both sides of the market). Another critical aspect is given by the growing purchase of IT equipment in the developing countries which, in a rather short period of time, considering the evolution in the field, will also turn into e-waste and the lack of laws and education in the field of recycling will lead to their improper discharge. According to the estimations, by 2018 the number of computers used in the developing countries will have been greater than in the developed countries (Yu et al., 2010).

Another controversial aspect, specific to IT, is the storage capacity. The increase in the information volume requires more or more efficient storage devices, an increase in the transfer speed, enlarging the access time, hence, more efficient equipment. According to some studies made by IBM, a quantity 2.5 quintillion bytes of data is created daily – this is so huge that 90% of the current volume of data has been created in the last two years (Zikopoulos et al., 2014).

From an organizational perspective, the effects related to the use of IT on the environment suggest the necessity of a holistic approach along the whole life-cycle which actually corresponds to the concept of green IS. The measures currently applied by the organizations interested in the protection of the environment refer to the consolidation and virtualization, intelligent power management functions, dynamically adjustable cooling, separation of hot and cold air flows, and optimized uninterruptable power supplies (USPs), thin clients, mobile instead of desktop computers, power management software, LED displays and multifunction printers, refurbishing, reusing and recycling outdated hardware at the end of life.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The role played by the IS is obvious when it comes to implementing the measures mentioned above. They are able to render the information as well as the necessary instruments so as to engulf the characteristics of the sustainable ecological development within the operations and the decision-making process in the organizations. On the other hand, adopting green IS brings significant economic benefits to the organizations due to the following: *increase competition* (Dao et al., 2011; Chou, 2013), *increase efficiency and effectiveness* (Chen et al., 2009; Molla & Abareshi, 2011) and *reduce costs* (Vykoukal et al., 2009; Way, 2009; Mithas et al., 2010; Marett et al., 2013; Talebi & Chou, 2013; Loock, 2013). They are the result of the important role IS play within the organizations. They are considered the core of the business processes and due to this, they might become the main trigger of organizational changes (Ramirez et al., 2010; Popescul & Georgescu, 2015; Löser, 2015).

As it can be seen, the adoption of green IS brings numerous benefits to the companies as well as to the society. There are also many motivations to take measures in this field, reflected mainly by the environment conditions. Even under the current circumstances of technological progress, there are not enough technologies, methods and initiatives to neutralize the negative effects of ICT on the environment. The influences on the environment appear during all cycles of life and take the shape of using non-renewable resources in the production process, consumption of energy, e-waste, and CO_2 emissions. These are the most important and visible. For this reason, the major investments focus in this direction. Nowadays, there would be needed 1.5 planets to meet the demands of all the people and unless essential changes appear, it is estimated that by the middle of the century, 2 planets will be needed (Maclean et al., 2010). Innovation in green IS is essential in order to restore the natural balance.

From the ethical point of view, the motivations which encourage the companies to get involved in the development and innovation in green IS are the problems of our planet reflected in *global warming, scarce non-renewable resources and pollution.* Nevertheless, in reality, in most situations, they are constrained by *legal regulations*. According to Porter's conclusion, *the regulations which aim getting results and not processes will force the companies to redesign their technology, so that they could increase the efficiency of their activity by cutting costs and increasing the product quality and produce less polluting goods* (Porter, 1991 in Ashford, Hall, 2011). Being open to the legal changes regarding the environment protection as well as anticipating them might offer an advantage of the *temporary monopolies* to the companies and this is similar to any technological innovation, in the ICT field even more, being considered extremely dynamic.

THE CHANGES REQUESTED BY GREEN IS

The motivations which determine the companies to adopt changes in IS are varied. They can be internal as well as external and they are closely related to the objectives and priorities of the organization. Complying IS with the organizational objectives and strategies have been an important concern of the management teams during the last decades, once the important role they play has been identified. On the other hand, any possible failure in this process might lead to the loss of certain opportunities, wasting resources and not meeting the proposed goals (Bush et al., 2009).

In case of most organizations the objectives are of a financial side or are related to the finances. Green IS often requires partial or total replacement of the infrastructure, which means making a significant investment while the profit will be obtained on the long term: green practices can affect system requirements related to hardware, software, and business processes (Beal, 2010). The characteristics which

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

should be included in IS in order to become green can be identified starting from the IS components mentioned by Löser (2015): IT (physical servers, personal and office computers and network devices), shared services (database or storage), business applications (ERP systems), IT human resources (skill and knowledge) and managerial capabilities for organizational process and business transformation related to IS. The first component involves mainly the technical part and it actually represents green IT (Figure 1).

In what follows, starting from the agile life-cycle model, considered the most efficient nowadays, we present the way in which the green concept might be integrated in all stages of the life-cycle of the IS. The model we mention has four main stages (Figure 2)

The interest in green IS might appear from the *project selection and approval stage*. In this stage, a *team of managers, developers and clients agree on the goals, objectives and requirements of the product, they evaluate the alternatives and estimate the risks*. Introducing a new IS, replacing the current one or updating it can have the issue of the influence on the environment as the starting point. Such a decision can be made either by introducing some new regulations or by adopting a protection strategy for the environment or even both. The most visible influences on the environment, from the point of view of the end user, are CO_2 emissions, in direct proportion to the consumption of energy and also the waste generated at the end of the product life. The negative influences are not always visible. For example, a significant quantity from the resources used in the production process (energy, material and chemical substances) will not appear in the final product. Sarkis et al. (2013) considers that an average desktop computer and monitor requires ten times its weight in fossil fuels, water and chemicals as material and

Figure 1. Green IS components

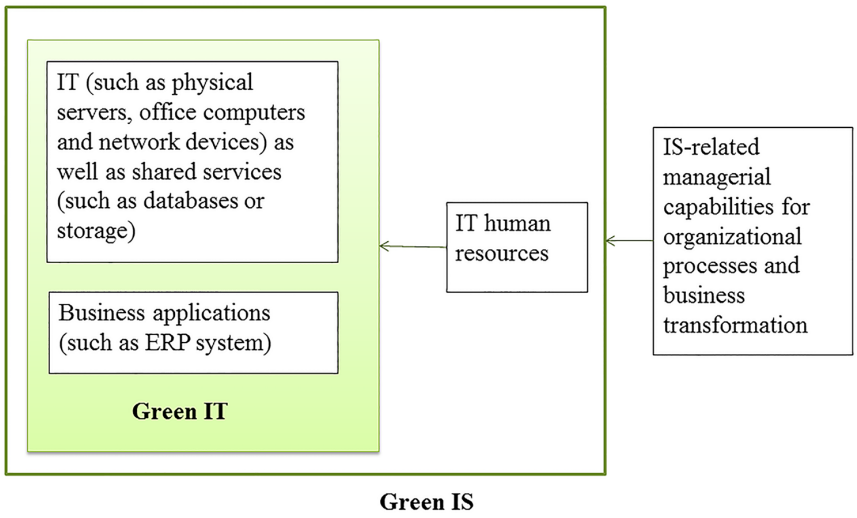


Figure 2. Agile development life-cycle
Source: adapted from Isaias and Issa, 2015



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

resources inputs. In case the environment considerations are different than the approach, the protection principles could be integrated into the requirements of the new system. In this stage there is established the purpose of the new system, there are estimated the necessary resources, there are made feasibility studies and there are described the expected benefits. Regardless of the vastness of the system which will be implemented and of the changes it might bring, the objectives of the new system should be in agreement with the organizational goals. The concern for the environment during the selection and approval stage can be clearly seen in the following:

- Analysis of the opinions and directions adopted by partners and the business environment generally speaking, as regards the world trends on ecology but also the trends specific to the field in which the organization operates.
- Clear definition of the organizational goals considering the environment and the strategies that should be adopted in order to accomplish them.
- Formulation of a set of environmental requirements to be included in the non-functional requirements of the new system.
- Analysis of the regulations on the environment in force in the country in which the company activates or, if it is the case, international regulations for the multinational companies. It would also prove useful to make an analysis of the trends on the long run in this field considering there are a larger and larger number of constraints regarding the use of natural resources, pollution and waste.
- Elaborate a viable proposal for green IS which could highlight the financial benefits as well, not only those specific to the environment protection. The analysis of the cost-benefit proportion should be based on detailed measurements regarding the influence on the environment. From the financial point of view, the main advantage is currently given by saving energy.

During this stage there are also made the feasibility studies. There are analyzed the following types of feasibility: economic, operational, technical, schedule and legal. There is made a list of potential criteria and risks which should be considered when making a decision regarding the continuity of the project depending on the obtained results expressed in key milestones. In the context of an increased importance awarded to the environment, there could be introduced a new analysis of *environmental feasibility* as a distinct component. It will undertake components from other types of studies in order to develop them, for example, the influence of technologies used nowadays or those which are necessary to implement a new system on the environment, identify the most environmental-friendly equipment, the volume of waste as a consequence of replacing the current equipment with a new one required by the functioning of the new system, organize the network so as to generate minimum negative effects, reducing the costs by less energy consumption.

The feasibility study on the environment will bring new elements, such as the analysis of a potential development of *green and sustainable software*. This concept was defined by Naumann et al. (2011) as *software with minimum negative on the environment and on the society effects in all stages of cycle-life (design, development and usage) or software with positive effects on sustainable development*. The above-mentioned authors consider that the direct impact refers to the consumption of resources and energy during the design and production and then use of the software. The indirect impact refers to the effects from the use of the applications in order to accomplish the processes within the organizations and to the systematic effects on the environment on the long run.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

In case the protection of the environment plays a leading role in the development of the new system, the *environmental feasibility* should clearly show the consequences on the environment as well as the benefits the project implementation might bring. This analysis will be continued during the design and development of the system in order to estimate the consumption of non-renewable resources and the level of pollution entailed by the new system. Environmental feasibility has to answer to the following questions (Lopez-Lopez, 2011):

- **Carbon Footprint:** How much CO_2 a software development, management or maintenance phase will emit?
- **Energy:** How much energy is consumed in the development phase?
- **Travel:** How much traveling time is required in the development phase?
- **Waste:** How much resources are consumed in activities that create no visible value to software end users?

Similar to the other types of feasibility, the one specific to the environment will bring the following benefits to the project: it strengthens the general frame as well as the motivation behind accomplishing the proposed system, it contributes to the increase of the success chances due to the detailed analysis of the elements which influence the success of each project, it allows the identification of the business alternatives, it helps in making a decision when choosing one particular project out of several proposals, it offers a detailed documentation on the situation of the company, according to each feasibility category. It will also allow the identification of the internal and external restrictions in the accomplishment of the project, as well as an objective estimation of the success chances.

During the second stage of *project initiation,* there is established the team which will take part in it and contribute to its accomplishment, there are identified the available funds and financial sources, there is designed the initial architecture of the system, there is configured the environment in which the project will be developed, there are purchased the necessary tools and there is estimated a life span of the project based on the abilities displayed by the team, the demands and the initial architecture. The issue of the environment protection could be introduced in this stage, as part of the activity of purchase of the necessary equipment and establish the initial architecture of the system. It can shape in the following:

- Correct evaluation of the equipment and applications used in the company as regards the effects on the environment, estimate the need to replace them or a re-design of the current processes would be enough, hence energy could be saved, CO_2 emissions reduced without increasing the volume of waste. Another important aspect, in this case, is the evaluation of the consequences of the changes required by green IS and to what extent they comply with the organizational goals and could be included in the adopted strategies regarding the environment.
- Identify the changes imposed by the purchase, use and discharge of the current IT resources, including establishing the criteria which should be met by the equipment which is planned to be bought and also be eco-friendly. Very useful in this situation is the eco-labeling of the IT products introduced by the International Organization for Standardization in 1992, at the United Nations Conference on Environment and Development, at Rio de Janeiro, shaped in the standards from the ISO 14000 family.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The third stage, *construction iterations*, actually designates the accomplishment of the project in successive stages. Each of them includes the planning, construction as well as adaptation to the changes required by the interested parties. The efficient communication is essential in the agile model since the final success of the project depends on it. At each iteration the users can formulate requirements on the influence they expect the future system to have on the environment and the developers should consider and include in the project. They can also demand an estimation of the impact on the environment made by specialized companies or require that the created system should comply with the regulations on the environment adopted by the organization.

During this stage, the green and sustainable software concept that was presented earlier can be applied. The problems referring to the environment, presented by Naumann et al. (2011) are specific to fixing errors (bugs) and, in the Greensoft Model, are referring to electrical energy and other resources used by: employees' workstation, IT infrastructure (as networking devices, servers and storages), heating and air conditioning, office lighting, transportation in case of business trip for meetings with customers and even the employees' daily way to work. Also, they propose three categories of sustainability criteria and metrics for software products: *Common Quality Criteria and Metrics, Directly Related Criteria and Metrics, and Indirectly Criteria and Metric* (Naumann et al., 2011) each of them referring to first, second and third-order impacts identified by Berkhout and Hertin. The latter refer to: indirect effects of ICT production and usage over the environment (first order impacts), indirect effects that result from economy structural changes, production processes, the products themselves and the distribution (second order impact) and the indirect effects resulted from stimulating consumption, economic growth as a result of ICT usage („rebound effect") and the impact on the way of life and the value systems (third level impact). According to the mentioned model, each iteration is followed by a review of the impact over the environment. After each application component is created, it becomes quite easy to measure and monitor the energy consumption. The results obtained can then be used to optimize the energy consumption in the next iterations. But the Greensoft Model is not the only software development model that takes into consideration the impact upon the existing environment. Shenoy and Earatta (2011) have proposed another model in which they suggest measures that can be adopted in order to reduce carbon emissions during the software lifetime circles.

Mahmoud and Ahmad (2013) are proposing a green model for sustainable software engineering that offer a full picture over the way software affects the environment, in two stages: how the life-cycle of a software product effects the environment through ICT and how software itself can aid in keeping the environment green or not by monitoring and utilizing resources efficiently, thus contributing to creating a green ICT. They mention the following set of general operational or low-level software goals for satisfying environmental sustainability: use of environmentally approved products for development, reduce transportation means and instead use the Internet for communication, use of cloud computing in terms of IaaS (Infrastructure as a Service), use of service oriented software, sacrificing performance above a limit for energy efficiency, running the system on computers with power profiles, reduce the number unnecessary activities in the system and use of a reusable system (Mahmoud and Ahmad, 2013). As can be observed the essential element in all approaches is to improve energy efficiency. It can be estimated as the ratio of useful work done and used energy (Johann, 2012):

$$Energy\,Efficience = \frac{Useful\,Work\,Done}{Used\,Energy}$$

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Other important aspects that need to be considered during this stage refer to reducing the volume of data to a reasonable and relevant level for the organization, as well as developing and implementing some techniques of organizing the data in a manner that favors the diminishing of negative influence over the environment. Another aspect that can be considered is the possibility of migrating towards cloud computing. The benefits brought by this process are: less energy consumption and CO_2 emission, less equipment needed to run the IS and less e-waste (Kumar & Buyya, 2012; Beloglazov el al., 2012; Elgelany & Nada, 2013).

Finally, the last stage of the agile life-cycle is the *product release*. This stage encompasses two components: final testing of the entire system, as well as any necessary final reworks and documentations and the product is provided to the users in order to maximize operational integration (Isaias & Issa, 2015). During this stage, users can verify if the final product is in agreement with the chosen environmental standards. They can ask for a final report regarding the IS influence over the environment and can request changes. The direct effects of this stage over the ecosystem are similar to those during the iteration construction phase.

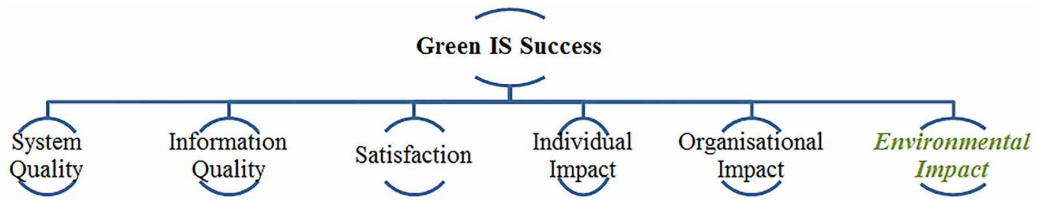
INTEGRATING GREEN IS WITH THE ORGANIZATION'S OBJECTIVES

To have a favorable impact over the organization's activity, IS must be designed to answer the five dimensions proposed through Delone and McLean IS success model (2004), analyzed and developed by Gable et al. (2008) and furthermore by Isaia and Issa (2015). Including environment protection as a priority of IS involves adding it to the mentioned model (Figure 3).

Even the "green IS" name itself makes it impossible to exclude this component from the requirements that the IS, if it is to be successfully implemented and used by organizations. Beyond the particular company traits, it must answer specific general requirements regarding the environment, previously presented in both the agile life-cycle model analysis, and it must also be integrated in the organization's financial and strategic objectives.

Green IS has a key role in both the tactical short-term and in transforming businesses in the longer-term (Sherringham and Unhelkar, 2010). As a result, adopting a green IS must be designed in agreement to the organization's objectives in order for it to be successful. References can be made to both financial objectives (turnover, profit, dividends, stock exchange listing, and cash flow) and to strategic ones (market share, product quality, position at the top, reputation, consumer satisfaction, extending the product diversity).

Figure 3. The conceptual basis for the IS-impact measurement model
Source: adapted from Gable et al., 2008; Isaia and Issa, 2015



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Financially, a green IS can contribute to accomplishing the company objectives by reducing cost through energy economy, recycling equipment, reducing or eliminating environmental taxation by implementing appropriate regulations, resource economy. From a strategic point of view, green IS contribution to accomplishing the company objectives is noted by attracting new customers, increased competitiveness, diversifying the portfolio of products that take the environment into account and increasing the overall company image.

Another essential element is maintaining the company's ability to face technology changes. Due to keeping ICT as an essential element, full or partial IS changes will trigger technology changes. From an environmental perspective, these changes are bi-directional. It was proven that changing hardware generations to newer ones will trigger an increased beneficial environmental relationship, but the same changes trigger an increase in the amount of waste. Another important characteristic is that management-level employees should sustain environmental protection. By their attributions, they can help or hinder the adoption of a green IS.

SOLUTIONS AND RECOMMENDATIONS

Starting from the organization's objectives, the potential of shifting from an IS to a green IS can be appreciated by evaluating the activity and company features on three lanes: the speed of adopting new green IS findings; the interest for direct and indirect effects of these findings to environmental changes and the financial implications. The next table presents the way in which enterprise sustainability can be appreciated in the context of green IS adoption (Table 3).

Table 3. The enterprise sustainability in the context of green IS adoption

Indicators	The Speed in Adopting New Green IS Findings	The Interest for Direct and Indirect Effects of Green IS Findings	Financial Implications of Green IS Findings
Application of environmental standards within the organization	-	Promoting environmental protection and reducing the negative effects on the environment.	The costs of the application of standards and certification.
Participation in trainings regarding the environment and IS potential in this area, organized inside the company	Increased training of employees on green IS; Stimulate involvement in activities with creative potential.	Environmental awareness; Framing environmental protection as a priority in ICT product characteristics	Reducing the time to create own products; Labor productivity growth; Staff training expenses (if committed outside the firm).
Participation in trainings regarding the environment and IS potential in this area, organized by other organizations			Costs of the courses; Growth in labor productivity.
Organization's participation in pro-environmental actions.	Identifying creative ideas for new products development.	Dissemination of environmental values of the company employees; Improving the company's image.	Costs of time allocation; Expenditure on the financing of such actions; Income from improved company image.
Individual participation of employees in pro-environmental actions		Dissemination of environmental values of employees at the firm; Reducing environmental impacts through access to information on measures to protect it.	Expenses related to the financing of participation (if applicable).

continued on following page

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 3. Continued

Indicators			The Speed in Adopting New Green IS Findings	The Interest for Direct and Indirect Effects of Green IS Findings	Financial Implications of Green IS Findings
The existence and use of a system for monitoring energy consumption			-	Minimize negative effect of energy consumption on the environment; Reducing emissions of greenhouse gasses.	Savings from reduced energy consumption.
The diversity of areas of activity of the organization			Increases the innovative potential; Reduce the risks of failure innovations.	Balancing environmental impact through various activities.	Diversified allocation of costs; Balancing profitability between activities.
The novelty of ICT use in firm (generation of hardware / software)			Familiarity with the latest generation of equipment and applications that support innovation and the emergence of new ideas; Better information on the ICT area.	New equipment are less polluting and consume less energy; New applications demand more resources.	Increased acquisition costs; Updating applications trigger, in many cases, the replacement of equipment; Increase work efficiency.
The volume of investments in equipment and applications			-	-	Expenses generated through investment in infrastructure. Additional investments for introducing environmental features of products.
Dissemination of information on green benefits of IS in the company (innovation / adoption)			Familiarity with features that allow employment in green ICT and knowledge of their potential; Expansion of product characteristics by incorporating environmentally friendly characteristics.	Reducing emissions of greenhouse gasses; Lower power consumption; Lower volume due to the trend of waste minimization; Reducing the amount of toxic substances on board.	-
Characteristics of human resources	Employee diversity training areas		-	Increase / decrease of environmental concerns relative to employee culture.	-
	Affiliation	Foreign	Collection of products for which the company acquires ownership.	Increase / decrease of environmental concerns relative to the culture of the employees in other countries.	Differences in relation to local salaries
		Native	Degree of readiness influences the quality of products made; Collection of products for which the company acquires ownership.	-	Bonuses allocated to reward creative ideas
	The degree of training and experience		It positively influences the creative potential in innovation and value realization chances for a higher level of training and / or experience in the field.	Usually supports favorable environmental concerns through a level of culture and civilization in proportion to preparation; Favorably / Unfavorably influences according to the rules of the organizations where they were formed.	Employment costs, usually proportionate to the level of training and experience
The number of abandoned projects in the Green IS on the first failure			Lack of stimulating creativity; Reduces the chances of potential innovative ideas materializing.	Limiting the negative effects in the use of traditional ICT.	Financial security by not assuming additional risks.
The number of green projects in the area continued despite more one or more failures			It stimulates creativity.	Increased negative effects of using traditional IS.	The increase in expenditures for each assumed failure / product.

Evaluating the organization's activity and features on these three lanes can be a trigger of IS change. The result of this evaluation can offer an estimation of the organization's ability to assimilate a new system and to capitalize its benefits over the environment. It must secure a growth of efficiency, calculated as the ratio between effort and effect, but the expected value of this indicator remains an option of the management of each organization.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

FUTURE DIRECTIONS AND CONCLUSION

This chapter explored the necessity and applicability of green IS. Organizations are interested in adopting green technologies regardless if they refer to production processes, parts design or other activities that just secure the proper organization's functioning, as it results from recent studies. Considering these results, it is demanded that the green concept is assimilated in both the development and usage phase. Literature has made it clear that this leads to environmental benefits, but it cannot guarantee that these initiatives will also benefit the organizations that implement green concepts. A long-term return of investment can only be estimated. Even so, green IS should be a social priority.

The criteria proposed for early evaluation of the conditions needed to for green IS implementation can be used in the selection and approval phase of the agile life-cycle project model, in order to identify the organization's ability to adapt to these changes. It would be essential to create a model that allows evaluation of green IS implementation consequences and the way in which it can be aligned to long-term organization strategy.

Green enterprise is a necessity, not a choice, and changing IS in order to comply with environmental protection requests must be a priority due to their important role. They hold a huge potential due to their ability to contribute to entire industry changes (transportation, energy, production). To ensure the environment is protected, green IS must adhere to this tendency in the development phase and also in the lifetime and until its end.

REFERENCES

Andreopoulou, Z., Stiakakis, E., & Vlachopoulou, M. (2013). *E-Innovation for Sustainable Development of Rural Resources During Global Economic Crisis (Practice, Progress, and Proficiency in Sustainability)*. New York: IGI Global.

Ashford, N. A., & Hall, P. R. (2011). The Importance of Regulation-Induced Innovation for Sustainable Development. *Sustainability*, *3*(1), 270–292. doi:10.3390u3010270

Bazerman, M., & Hoffman, A. (1999). Sources of Environmentally Destructive Behavior: Individual, Organizational, and Institutional Perspectives. *Research in Organizational Behavior*, *21*, 39–79.

Beal, A. (2010). The Role of the Business Analyst in Green ICT. In B. Unhelkar (Ed.), *Handbook of Research on Green ICT: Technology, Business and Social Perspectives* (pp. 42–50). New York: IGI Global.

Beloglazov, A., Abawajy, J., & Buyya, R. (2012). Energy-aware resource allocation heuristics for efficient management of data centers for Cloud computing. *Future Generation Computer Systems*, *28*(5), 755–768. doi:10.1016/j.future.2011.04.017

Boudreau, M. C., Chen, A. J., & Huber, M. (2007). Green IS: Building Sustainable Business Practices. In R. T. Watson (Ed.), *Information Systems*. Athens, GA: Global Text Project.

Brooks, S., Wang, X., & Sarker, S. (2012), Unpacking Green IS: A Review of the Existing Literature and Directions for the Future. In Green Business Process Management. Springer Berlin Heidelberg.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Bush, M., Lederer, L. A., Li, X., Palmisano, J., & Rao, S. (2009). The alignment of information systems with organizational objectives and strategies in health care. *International Journal of Medical Informatics*, *78*(7), 446–456. doi:10.1016/j.ijmedinf.2009.02.004 PMID:19307148

Calero, C., & Piattini, M. (Eds.). (2015). *Green in Software Engineering*. Springer International Publishing Switzerland. doi:10.1007/978-3-319-08581-4

Chen, A. J., Watson, R. T., Boudreau, M. C., & Karahanna, E. (2009). Organizational Adoption of Green Is & It: An Institutional Perspective. In ICIS 2009 Proceedings.

Chen, A. J. W., Boudreau, M. C., & Watson, R. T. (2008). Information systems and ecological sustainability. *Journal of Systems and Information Technology*, *10*(3), 186–201. doi:10.1108/13287260810916907

Chou, C. D. (2013). „Risk identification in Green IT practice. *Computer Standards & Interfaces*, *35*(2), 231–237. doi:10.1016/j.csi.2012.10.001

Collins, C., Steg, L., & Koning, M. (2007). Customers Values, Beliefs on Sustainable Corporate Performance, and Buying Behavior. *Psychology and Marketing*, *24*(6), 555–577. doi:10.1002/mar.20173

Corbett, C. J., & Kirsch, D. A. (2001). International Diffusion of ISO 14000 Certification. *Production and Operations Management*, *10*(3), 327–342. doi:10.1111/j.1937-5956.2001.tb00378.x

Dao, V., Langella, I., & Carbo, J. (2011). From green to sustainability: Information Technology and an integrated sustainability framework. *The Journal of Strategic Information Systems*, *20*(1), 63–79. doi:10.1016/j.jsis.2011.01.002

Dedrick, J. (2010). Green IS: Concepts and Issues for Information Systems Research. *Communications of the Association for Information Systems*, *27*(11), 174–184.

Du, W., Pan, S. L., & Zuo, M. (2013). How to balance sustainability and profitability in technology organizations: an ambidextrous perspective. In *Proceedings of IEEE Trans Eng Manag* (vol. 60, pp. 366–385). 10.1109/TEM.2012.2206113

Elgelany, A., & Nada, N. (2013). Energy Efficiency for Data Center and Cloud Computing: A Literature Review. *International Journal of Engineering and Innovative Technology*, *3*(4).

Esfahani, M. D., Rahman, A. A., & Zakaria, N. H. (2015). Green IT/IS Adoption as Corporate Ecological Responsiveness: An Academic Literature Review. *Journal of Software Computing and Decision Support Systems*, *2*(1), 35–43.

Esty, D. C., & Winston, A. S. (2006). *Green to Gold: How Smart Companies use Environmental Strategy to Innovate, Create Value, and Build Competitive Advantage*. John Wiley & Sons Publishers.

Hack, S., & Berg, C. (2014). The Potential of IT for Corporate Sustainability. *Sustainability*, *7*(6), 4163–4180. doi:10.3390u6074163

Hart, L. S. (1997). Beyond Greening: Strategies for a Sustainable World. *Harvard Business Review*, (January-February), 67–79.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Isaias, P., & Issa, T. (2015). *High Level Models and Methodologies for Information Systems*. Springer Science+Business Media New York.

Jenkin, A. T., Webster, J., & McShane, L. (2011). An agenda for Green information technology and systems research. *Information and Organization*, *21*(1), 17–40. doi:10.1016/j.infoandorg.2010.09.003

Johann, T., Dick, M., Naumann, S., & Kern, E. (2012). How to Measure Energy-Efficiency of Software: Metrics and Measurement Results. In *Proceedings of the First International Workshop on Green and Sustainable Software (GREENS)*. 10.1109/GREENS.2012.6224256

King, A. A., & Lenox, M. J. (2001). Lean and Green? An Empirical Examination of the Relationship between Lean Production and Environmental Performance. *Production and Operations Management*, *10*(3), 244–256. doi:10.1111/j.1937-5956.2001.tb00373.x

Kumar Garg, S., & Buyya, R. (2012). Green Cloud Computing and Environmental Sustainability. In S. Murugesan & G. R. Gangadharan (Eds.), *Harnessing Green IT: Principles and Practices* (pp. 76–87). Wiley-IEEE Press. doi:10.1002/9781118305393.ch16

Li, J. H., Tian, B. G., Liu, T. Z., Liu, H., Wen, X., & Honda, S. (2006). Status quo of e-waste management in mainland China. *J. Mater. Cycles Waste Manag*, *8*(1), 13–20. doi:10.100710163-005-0144-3

Loeser, F., Erek, K., & Zarnekow, R. (2012). Towards a Typology of Green IS Strategies: Insights from Case Study Research. *Proceedings Thirty Third International Conference on Information Systems*.

Loock, C. M., Staake, T., & Thiesse, F. (2013). Motivating Energy Efficient Behavior with Green IS: An Investigation of Goal Setting and the Role of Defaults. *Management Information Systems Quarterly*, *37*, 4.

Loos, P., Nebel, W., Gómez, J. M., Hasan, H., Watson, R. T., vom Brocke, J., ... Recker, J. (2011). Green IT: A Matter of Business and Information Systems Engineering? *Business & Information Systems Engineering*, *3*(4), 245–252. doi:10.100712599-011-0165-5

Lopez-Lopez, J. C., Sissa, G., & Natvig, L. (2011). Green ICT: The Information Society's Commitment for Environmental Sustainability. *The European Journal for the Informatics Professional*, *12*(4).

Löser, F. (2015). *Strategic Information Systems Management for Environmental Sustainability. Enhancing Firm Competitiveness with Green IS*. Universitätsverlag der TU Berlin.

Lyon, T., & Maxwell, J. (2007). Environmental Public Voluntary Programs Reconsidered. *Policy Studies Journal: the Journal of the Policy Studies Organization*, *35*(4), 723–750. doi:10.1111/j.1541-0072.2007.00245.x

Maclean, D., Akoh, B., & Egede-Nissen, B. (2010). ICTs, sustainability and the green economy. *Reconect Review*, *2*(3), 161–165.

Mahmoud, S. S., & Ahmad, I. A. (2013). Green Model for Sustainable Software Engineering. *International Journal of Software Engineering and Its Applications*, *7*(4).

Marett, K., Otondo, R. F., & Taylor, G. S. (2013). Assessing the Effects of Benefits and Institutional Influences on the Continued Use of Environmentally Munificent Bypass System in Long-Haul Trucking. *Management Information Systems Quarterly*, *37*(4).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Melville, P. N. (2010). Information Systems Innovation for Environmental Sustainability. *Management Information Systems Quarterly*, *34*(1), 1–21.

Midgley, G., & Reynolds, M. (2004). Systems/operational research and sustainable development: Towards a new agenda. *Sustainable Development*, *12*(1), 56–64. doi:10.1002d.218

Mithas, S., Khuntia, J., & Roy, P. K. (2010). Green information technology, energy efficiency, and profits: Evidence from an emerging economy. In ICIS 2010 Proceedings.

Molla, A. (2009). Organizational Motivations for Green IT: Exploring Green IT Matrix and Motivation Models. *PACIS 2009 Proceedings*.

Molla, A. (2013). Identifying IT sustainability performance drivers: Instrument development and validation. *Information Systems Frontiers*, *15*(5), 705–723. doi:10.100710796-013-9415-z

Molla, A., & Abareshi, A. (2011). Green IT Adoption: A Motivational Perspective. *Proceedings of the 15th Pacific Asia Conference on Information Systems* (PACIS), (pp. 1-14).

Molla, A., Cooper, V., & Pittayachawan, S. (2011). The Green IT Readiness (G-Readiness) of Organizations: An Exploratory Analysis of a Construct and Instrument. *Communications of the Association for Information Systems*, *29*(1), 4.

Murugesan, S. (2008). *Harnessing Green IT: Principles and Practices*. IEEE IT Professional.

Naumann, S., Dick, M., Kern, E., & Johann, T. (2011). The GREENSOFT model: A reference model for green and sustainable software and its engineering. *Sustain Comput Informat Syst*, *1*(4), 294–304. doi:10.1016/j.suscom.2011.06.004

Popescul, D., & Georgescu, M. (2015). Social Networks Security in Universities: Challenges and Solutions. *Scientific Annals of the "Alexandru Ioan Cuza" University of Iaşi Economic Sciences, 62*(SI), 53-63.

Puckett, J., Westerwelt, S., Gutierrez, R., & Takamiya, Y. (2005). *The Digital Dump: Exporting Re-use and Abuse to Africa*. Seattle: Basel Action Network.

Radu, L. D. (2014). The Ecological Behaviour Related to Green Information and Communication Technology in Romanian Organizations. *The Romanian Statistical Review*, *4*, 73–88.

Radu, L.D. (2015a, February). Investments in Technological Innovations: A Literature Review of Organization Determinants. *European Scientific Journal*.

Radu, L.D. (2015b). Green Information Systems: New Trend of Information Systems Development from the Perspective of Sustainability Improvement. *Proceedings of Globalization and Higher Education in Economics and Business Administration*.

Ramirez, R., Melville, N., & Lawler, E. (2010). Information Technology Infrastructure, Organizational Process Redesign, and Business Value: An Empirical Ansalysis. *Decision Support Systems*, *49*(4), 417–429. doi:10.1016/j.dss.2010.05.003

Sarkis, J., Koo, C., & Watson, R. (2013). Green information systems & technologies – this generation and beyond: Introduction to the special issue. *Information Systems Frontiers*, 1–10.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Shenoy, S., & Earatta, R. (2011). Green Software Development Model: An Approach towards Sustainable Software Development. *Proceedings of IEEE Annual India Conference (INDICON)*. 10.1109/INDCON.2011.6139638

Sherringham, K., & Unhelkar, B. (2011). Strategic Business Trends in the Context of Green ICT. In B. Unhelkar (Ed.), *Handbook of research on green ICT: technology, business, and social perspectives* (pp. 66–83). New York: IGI Global. doi:10.4018/978-1-61692-834-6.ch005

Shrivastava, P. (1995). Environmental Technologies and Competitive Advantage. *Strategic Management Journal*, *16*(S1), 183–200. doi:10.1002mj.4250160923

Taleby, M., & Way, T. (2009). Methods, Metrics and Motivation for a Green Computer Science Program. *Proceedings of the 40th ACM technical symposium on Computer science education*, (pp. 362-366). 10.1145/1508865.1508995

Tu, J. C., & Huang, D. S. (2015). Analysis on the Relationship between Green Accounting and Green Design for Enterprises. *Sustainability*, *7*(5), 6264–6277. doi:10.3390u7056264

UNEP. (2010). *Recycling – from E-waste to Resources*. Berlin, Germany: Oktoberdruck AG.

Vykoukal, J., Wolf, M., & Beck, R. (2009). Does Green It Matter? Analysis of the Relationship between Green It and Grid Technology from a Resource-Based View Perspective. *Proceedings of the Pacific Asia Conference on Information Systems*.

Walker, R. H., & Hanson, D. J. (1998). Green marketing and green places: A taxonomy for the destination marketer. *Journal of Marketing Management*, *14*(6), 623–639. doi:10.1362/026725798784867671

Watson, R. T., Boudreau, M. C., Chen, A., & Huber, M. H. (2008). Green IS: Building Sustainable Business Practices. In R. T. Watson (Ed.), *Information Systems*. Athens, GA: Global Text Project.

White, L., & Lee, J. G. (2009). Operational research and sustainable development: Tackling the social dimension. *European Journal of Operational Research*, *193*(3), 683–692. doi:10.1016/j.ejor.2007.06.057

Yu, J., Williams, E., Ju, M., & Yang, Y. (2010). Forecasting Global Generation of Obsolete Personal Computers. *Environmental Science & Technology*, *44*(9), 3232–3237. doi:10.1021/es903350q PMID:20302363

Zikopoulos, P., deRoos, D., Bienko, C., Andrews, M., & Buglio, R. (2014). *Big Data Beyond the Hype: A Guide to Conversations for Today's Data Center*. McGraw-Hill Professional.

KEY TERMS AND DEFINITIONS

Agile Development Life Cycle: It is a set of principles that promotes adaptive planning, evolutionary development, early delivery, and continuous improvement for software development.

Energy Efficiency: Is the goal to reduce the energy consumption of products, services and processes related to ICT field. It has favorable effects on the environment mainly by reducing carbon footprint.

Environment Protection: All actions, regulations and policies that aim the conservation of the natural environment, preserving his current state or, if it is possible, reversing its degradation.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Green Technology: A green technology does not negatively affect the environment (through pollution, energy consumption, increasing the volume of e-waste, etc.) or diminish the negative effects of the similar technologies.

Green: A green company tries to minimize the negative influences of its products, services and business processes on the environment by implementing strict rules and regulations at all levels and across its entire value chain.

Rebound Effect: It is the reduction of the estimated effects of the green ICT or green IS because of consumer behavior or other systemic reactions.

Sustainable: It is a company's ability to remain in business a long time. This concept has three dimensions in present: economic viability, environmental responsibility and social equitability.

This research was previously published in Sustainable Entrepreneurship and Investments in the Green Economy edited by Andrei Jean Vasile and Domenico Nicolò, pages 144-168, copyright year 2017 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 32
Concurrent Design of Green Composites

Muhd Ridzuan Mansor
Universiti Teknikal Malaysia Melaka, Malaysia

S. M. Sapuan
University Putra Malaysia, Malaysia

Mohd Azli Salim
Universiti Teknikal Malaysia Melaka, Malaysia

Mohd Zaid Akop
Universiti Teknikal Malaysia Melaka, Malaysia

M. T. Musthafah
Universiti Teknikal Malaysia Melaka, Malaysia

M. A. Shaharuzaman
Universiti Teknikal Malaysia Melaka, Malaysia

ABSTRACT

This chapter presents the overview of concurrent design process of green composite products with special focus on conceptual design stage of natural fiber composites product development. Design of green composites product especially during the early product development stage requires three main aspects in product design which are materials, design and manufacturing process to satisfy lower cost, high quality and fast development time requirements in order to ensure successful product launch into the market. In this chapter, the concurrent design process of green composite products are discussed involving several main stages in product development such as green composite materials selection for both natural fiber and matrix constituents, conceptual design development and concept design selection of green composite products, and green composites manufacturing process selection. In addition, discussion on life cycle assessment of green composites is also included in order to provide further insight of the sustainability design requirements to the overall product development process.

DOI: 10.4018/978-1-5225-7915-1.ch032

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

INTRODUCTION

Concurrent design is part of the activities in the concurrent engineering (CE) approach for product development whereby it involved integration of various aspects of the product development process. Unlike traditional product development process which implemented sequential work activities, the CE approach utilized parallel process activities especially during the early design stage of the product. Also termed as Simultaneous Engineering, the CE approach removed the existing gap between design and production process in product development which has created issues regarding cost and quality due to miscommunication especially with respect to different goals and requirements between the two sequential activities (Sohlenius, 1992). Through the implementation of the CE approach, both aspects are considered in parallel as early as in the conceptual design stage which helps to produce products which able to satisfy both requirements, thus providing higher end product quality without jeopardizing the design intent, and subsequently reduced the overall product development cost due to eliminating the cost of error and repair due to the mismatch between design and production activities (Sapuan, 2005). The CE approach also helps to secure higher product development competitiveness to the market by bringing down the product development time. For green composites product developments, the CE approach is a very suitable method to be implemented considering the nature of the development process whereby green composite product designers need to consider various aspects of the product requirement such as design, materials and manufacturing process altogether during the early stage of the product development activities (Sapuan & Mansor, 2014).

Green composites products have made notable presence as substitutional materials for synthetic composites in many product applications. One of the most aggressive player using green composites is the automotive manufacturers. Driven by stringent legislations towards environmental performance for new generation of vehicles, the automotive manufacturers have applied green composites in the construction of various components such as dashboard, door trim panels, headliners and seat backs (Bismark et al., 2006). The use of green composites contributed significantly towards gaining high weight reduction, product cost and improved biodegradability of the components at the end of the life cycle (Ashori, 2008). Research in applying green composites for structural automotive components are also increasing due to similar advantages as aforementioned such as towards the development of structural frontal bonnet for buggy vehicle (Alves et al., 2010) and bumper beam (Davoodi et al., 2010).

Based on the impact and advantages of CE approach towards successful product design and development, in this chapter the concurrent design process of green composite products are discussed. Special attention is given towards the conceptual design stage of the green composites product development which involved several main activities such as green composite materials selection for both natural fiber and matrix constituents, conceptual design development and concept design selection of green composite products, and green composites manufacturing process selection. In addition, discussion on life cycle assessment of green composites products is also included in order to provide further insight of the sustainability design requirements to the overall product development process. Finally, to demonstrate the application of concurrent design for green composite products, a case study on the conceptual design development of bicycle frame using green composites is also explained in the end of this chapter.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

CONCURRENT DESIGN PROCESS OF GREEN COMPOSITE PRODUCTS

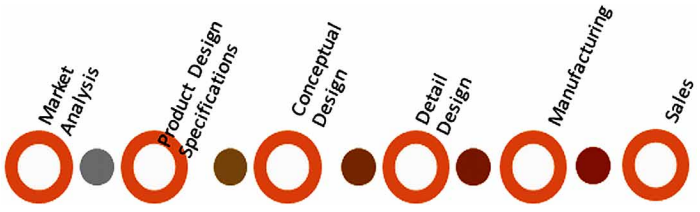
Concurrent design is part of the major activities within the overall product development process. In general, systematic product development process follows Pugh product development model, termed as Total Design, which comprises of market analysis, product design specifications, conceptual design, detail design, manufacturing, and sales (Pugh, 1991). In addition, other product development models also proposed embodiment design stage to be conducted in between the conceptual design and detail design stage such as proposed by Dieter (2000) and Pahl et al. (2007). Figure 1 shows the major activities in product development process.

The product development process starts with market analysis whereby the needs of all stakeholders for the intended product are identified through several systematic methods. The stakeholders involved may comprise of end users or customers, authorities such as government, management within the company as well as internal department groups such as manufacturing, sales and procurements. Careful consideration of their needs is important towards successful development and product introduction to the market. In CE approach, several systematic market analysis tools are available such as the Kano model and Quality Function Deployment (QFD) to determine the voice of the customer in order to tailor the desired product in fulfilling the customer preferences (Lin et al, 2011; Min et al., 2011; Yeh et al., 2011).

Based on the gathered information, the relevant attributes or factors towards successful product launch are analyze and compiled into a design guideline termed as Product Design Specifications (PDS) document. The PDS document served as the main reference which consists of all the necessary attributes that need to be considered by the new product during the whole development process. In Pugh Total Design model, the specific PDS requirements can be further group into specific elements such as cost, performance, weight and as well as standards and regulations. Similar case is applied in green composites product development whereby based from market analysis, specific PDS document are developed for the product which may includes similar elements such as cost, weight and technical performance as well as end of life requirements (recyclable and safe for disposal) and aesthetic appearance.

In the next stage of the product development process, conceptual design of the new product is developed based on the specific PDS requirements. Several tools are available within the CE approach to assist product designers in both idea brainstorming and idea generation such as the Ishikawa method or fishbone diagram method (Chandrasegaran et al., 2013), Ten Golden Rules for Ecodesign(Luttropp & Lagerstedt, 2006), Ecodesign Strategies Wheel (Brezet & Van Hemel, 1997) and Design for Assembly (DFA) (Chiu & Okudan, 2014). The design concept developed in this stage served as the founding model for the end product prior to detailed optimization process in the later stage. Information obtained at the end of the conceptual design stage are such as the overall geometry of the product, list of potential candidate materials for the embodiment of the product, the principles of operation and product work-

Figure 1. Major activities in product development process



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

ing mechanism. Incorporation of decision support system are the essence of modern conceptual design activities towards getting the correct design and decision as early as possible in the overall product development process (Ghazilla et al., 2013).

In the subsequent stage termed as detail design, the rough idea and solution for the particular product is further refined towards optimizing the end product in achieving the PDS requirements more specifically such as detail product drawing with specific dimensions and tolerance, target operational performance (maximum allowable stress and deformation), safety, cost, assembly method, packaging method and end product weight. In this stage, more CE tools are applied especially with the assistance of computerized modeling and simulation applications such as Computer Aided Design (CAD), Computer Aided Analysis (CAE) and rapid prototyping method. Extensive testing and modifications of the new product are conducted to determine the prototype performance and durability in meeting the design specifications.

After the product detail design stage, the optimized product is then brought to the manufacturing stage whereby the product is produced in high volume. Similarly with the previous stage, there are many CE tools applied to ensure highest quality, lower production cost and quick time to market are achieved for the product such as through the implementation of Lean Manufacturing method, Six Sigma (Wang & Chen, 2010) as well as Failure Mode and Effect Analysis (FMEA) (Yen & Chen, 2005). Finally, the end product produced is introduced to the market which comprise of activities such as sales, marketing and after-sales. The successful launch of the product to the market is the ultimate goal for any product to achieve highest customer acceptance and subsequently contribute to higher profits and larger market share compared to other product competitors.

CONCURRENT CONCEPTUAL DESIGN OF GREEN COMPOSITE PRODUCTS

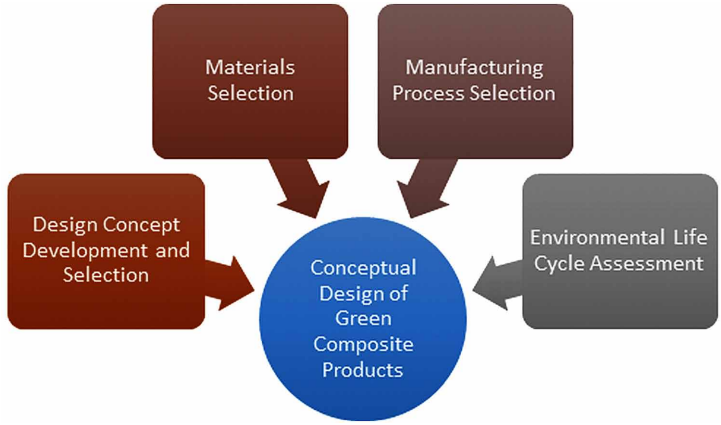
As noted in the earlier section, this chapter is focused on describing the conceptual design stage of green composite product development using the CE approach. Ulrich & Eppinger (2004) stated that, despite only 5% of total product development cost and 15% of total development time is inflicted during the conceptual design stage, the same conceptual design activities contributed to almost 70% of the total manufacturing cost of the end product. Thus, the conceptual design stage has a very significant effect to the success of the product, especially to achieve the aim of CE approach which is lower cost and faster time to market with high product quality. Decisions made during the conceptual design stage will greatly influence the subsequent product development process, and using systematic concurrent conceptual design approach, optimized and justified decisions can be made to ensure that all the PDS requirements are fulfill and the final product is able to launch successfully into the market.

Concurrent conceptual design of green composite products involved several major activities which are design concept development and selection, materials selection, and manufacturing process selection. Due to the recent environmental awareness towards product sustainability, environmental life cycle assessment is also incorporated into the conceptual design stage of the product. Figure 2 shows the major activities associated with the concurrent conceptual design of green composite products.

Under the CE approach, there are many available tools to support the implementation of all the activities in the concurrent conceptual design stage. However, for green composites product application, available literature reviews in the conceptual design stage is still limited. This is due to several factors such as the green composites itself is fairly a new explored field with respect to product development compared to synthetics composites in particular and conventional engineering materials (metals, ceram-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 2. Major activities in the concurrent conceptual design of green composite products



ics, plastics) in general. Apart from that, due to the inherent limitation of green composites properties especially structural properties (such as strength, elastic modulus, dimensional stability and thermal resistance) compared to synthetic composites, current product application of green composites are limited to non-structural products with low load bearing capability. However, by using systematic concurrent conceptual design process, it is highly possible to break the design barrier and apply green composites to products with higher load bearing requirements. In return, more environmentally sustainable product can be developed for new markets such as automotive, aerospace, building and construction using green composites to reduce the current consumption of less environmentally favorable synthetic composites. The following sections will discuss the activities related to concurrent conceptual design process of green composite products.

DESIGN CONCEPT DEVELOPMENT AND SELECTION OF GREEN COMPOSITE PRODUCTS

Design concept development and selection is conducted to obtain potential solutions in term of geometry for the green composite products. As we are aware of, green composites is inherently weak in term of structural strength and stiffness compared to synthetic composites which is made from synthetic fibers such as glass, carbon and aramid. Therefore, in order to directly substitute the use of synthetic composites with green composites, the original product geometry needs to be altered to cater for the materials property limitation. Among the possible solution is by enlarging the initial product geometry such as thickness and surface area, adding stiffeners such as ribs and wedges to the main structure, or reducing the stress concentration areas by using larger value of fillet radius and chamfer size to product sharp corners. However, these alternatives to enhancing the original green composites product structural performance is applicable at the detail designs stage of the product, while the original issue still lies in the conceptual design stage as to create the initial form of the product. In addition, the geometrical design of green composite products are more challenging due to their unidirectional force tolerance of the fibers as compared to homogenous materials such as metals which has almost equal load absorption capacity at all force direction.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

In general, there are two main activities under the concurrent conceptual design approach which relates to the design concept development and selection. First is the design concept development whereby initial form of the green composites product is produced and then followed by selection of the possible design concept developed to obtain the best of final design concept for the green composites product. The following sections described both major activities related to the design concept development and selection stage.

Design Concept Development of Green Composite Products

In the design concept development process, possible solution in term of geometry for the intended product is developed. The development process normally covers idea generation and idea development. In the idea generation, based on problem statement or design requirements, possible solutions is generated which is able to address all the design intents. There are many methods available for design concept development for green composites products such as Theory of Inventive Problem Solving (TRIZ), Morphology Chart and biomimetic. One of the most important advantages of the aforementioned methods is that they provide a systematic idea generation process for users in generating ideas for the intended green composites products, which is a valuable alternative to the inherent creative thinking and experiences of the designer themselves. All the methods served as a guideline for users in producing solutions for the green composites products.

One of the available design concept development method under the concurrent design approach is the Theory of Inventive Problem Solving method (or originally term as Teoriya Resheniya Izobretatelskikh Zadach in Russian language) which is a systematic problem solving method based on study of patents. Developed in 1940s by Russian patent officer name GenrichAltshuller, the TRIZ method proposed several algorithms to identify the problem and create the final solutions based on the available solution model. The TRIZ method is reported to excel in solving problem with contradictions, which is defined as the problem which has both improving and worsening characteristics for the selected solution. The TRIZ method is able to address the worsening effect while still able to keep the improving effect both simultaneously by solving the contradiction. Among the solution model in TRIZ is the trimming tool, 40 Inventive Principles, and 76 Standard Inventive Solutions (San et al., 2009).

Among the initiative in applying TRIZ for green composites product design was the integration of TRIZ-Morphological Chart-AHP method for the development of hybrid natural fiber composites automotive parking brake lever design (Mansor et al., 2014b). The new integrated method has provided an all-round tool for composite product designers to execute many aspects of product design such performing problem identification, idea generation, concept design development and concept design selection using a single integrated and systematic approach. Apart from that, conceptual design of automotive rear spoiler component was also developed using TRIZ method which encompassed the use of kenaf fiber composites as the construction material (Mansor et al., 2015). For other product developments areas, the TRIZ method was also reported to be applied for conceptual design of notebook casing product (Yeh et al., 2011), eco-friendly bottle casing (Chen et al., 2012), vacuum cleaner (Yen & Chen, 2005) and washing machine (Yamashina et al., 2002) by integrating the TRIZ method with other CE tools such as QFD, FMEA, Eco-design and axiomatic design.

Another design concept development method under the concurrent design approach is the Morphology Chart which is a systematic idea generation method based on the function of the product. Products are in general comprised of multiple components whereby all the components are design to perform different

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

functions. By analyzing the product functions, alternatives method to serve the functions are brainstorm and arranged into a simple matrix. Finally, the potential solutions or the potential design concepts for the product are developed by combining the individual function alternatives listed in the matrix. The advantage of this method is that it provided visual solution to aid users in developing the potential ideas for their products as well as expanding the richness of potential solutions created (Silvester et al., 2013). Despite the usefulness of the method, very limited report on the application of the morphology chart for composite product development purpose was available. One notable application was for the development of polymer composites automotive pedals (Sapuan, 2006). The morphological chart was employed to generate ideas based on the sub-functions of the component. Among the sub-functions included are pedal movement control method, cylinder or cable actuation method, geometry of the pedal pad, pedal profile, rib reinforcement pattern and location of the pivoting shaft of the component. Apart from that, the Morphological Chart was also employed by integrating it with the TRIZ method for hybrid natural fiber composites automotive parking brake lever design (Mansor et al., 2014b).The combination of TRIZ and Morphological Chart method utilized in the report was also found able to effectively produce many innovative conceptual designs using green composites as the construction material to develop the product, which can be further applied in other green composites related product for various applications

Alternatively, the biomimetic or biomimicry concept is also part of the available concept development method in concurrent design. The biomimetic concept is an idea generation model which is inspired by nature. The term was introduced by Otto Schmitt in the 1950s. Despite the recent introduction of the method, the informal application of the model for product design purpose was documented since long ago such as by Leonardo da Vinci in his idea of a mechanical flying contraption which is based on bat physical characteristics (Yurtkuran et al., 2013). The biomimetic model was revitalized by Benyus (1997) through her publication on the concept of harnessing natures inherent patterns and strategies into solution for modern products.

In general, there are two approaches in implementing biomimetic for idea generation and development in product design. First approach is termed as problem-based approach or top-down approach whereas the second approach is termed as solution-based approach or bottom-top approach (Versos & Coelho, 2011). In the problem based approach, designers seek solution for the nature characteristics, and apply relevant traits from the nature to achieve the intended product goal and design requirements. There are six (6) recommended steps associated with the implementation of the biomimetic problem-based approach which are:

1. Problem definition,
2. Reframing the problem,
3. Searching for biological solution,
4. Defining the biological solution obtained,
5. Extracting the principles or method from the biological solution and finally
6. Applying the principles to the intended design.

On the other hand, application of the biomimetic method using the solution-based approach is started the other way around whereby the designers first identify the principles of solution from nature and later apply the principles to address the design problem. The second approach is solution driven and offered the advantages of obtaining new possible applications for the nature's principle identified aside from the

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

intended initial design requirement. In the solution-based approach, there are seven (7) implementation steps involved which started from:

1. Identification of the biological solution,
2. Defining the biological solution,
3. Extracting the principles from the biological solution,
4. Reframing the solution to explore the possible application for the biological solution principles,
5. Searching for suitable design problems relevant to the biological solution principles,
6. Defining the design problem and finally
7. Applying the biological solution principles to solve the design problem (El-Zeiny, 2012).

There are several reported case studies on the implementation of the biomimetic model for idea generation of composite products. By mimicking the cross-section of a lily plant leaf using scanning electron microscopy, designers obtained design ideas for composite sandwich panels for improved structural performance (Easterling, 1990). Furthermore, the initial compressive strength for composite laminates was also reported able to be improved by adopting nature's bamboo bast fiber structure which incorporate double helical configuration to the new composite laminates design. Similar report also found that the interlaminar shear strength of composite laminates may also be enhanced by mimicking the bamboo's inherent interlaminar transition zone model to the new composite laminates design (Li et al., 1995). In addition, another report also identified that by using biomimetic concept, the composite joining strength was able to be increased by implementing similar T-joint configuration principles occurred during growth of tree brunch (Burns et al., 2012b). The bio-inspired T-joint principle was also reported able to improve the ductility and damage tolerance of structural joint performance for aerospace composites (Burns et al., 2012a).

Design Concept Selection of Green Composite Products

After the design concept development process, normally more than one (1) possible design solutions are able to be created for the intended product. The next stage involved is to determine which solution that is most suitable to carry out the product function and selected as the final design concept. The final design concept will be the reference for the final product when it is launch into the market after enduring the optimization process later on during the detail design stage. The final design concept evaluation is conducted based on the previously determined PDS. There are many concurrent design tools for design concept selection applicable for this purpose. Among them are the Pugh concept selection method (Pugh, 1991) and the weighted objective method (Cross, 1994). For design concept selection process which involved more advanced decision making capability, the use of multi criteria decision making (MCDM) methods such as Analytic Hierarchy Process (AHP) and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) may also be employed to obtain the final decision. Mansor et al. (2014b) reported the application of the AHP method for design concept selection process of automotive parking brake lever made from hybrid green composites. Furthermore, Davoodi et al. (2011) also reported on the application of the TOPSIS method for the design concept selection process of automotive bumper beam component using hybrid green composites. In addition, the design concept selection of similar automotive bumper beam component using synthetic composites was also carried out using the AHP method as reported by Hambali et al. (2009a).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

MATERIALS SELECTION OF GREEN COMPOSITE PRODUCTS

Materials selection is another important activity in the concurrent design of green composite products. Green composite materials are comprised of two main constituents, which are the reinforcing natural fibers (such as kenaf, oil palm empty fruit bunch, jute, sisal, hemp and pineapple leaf fibers) and the matrix or resin which acts as to hold all the fibers together giving the final shape to the composite materials as well as distributing the load evenly to the whole composite structure. Thus, major concern within the materials selection activity of green composite product development is to decide on the best type of natural fibers and type of matrix material to be selected to produce the green composite material (Shah, 2013). Materials selection for green composites are often challenging considering the vast amount of option available for both fiber material and matrix material, and also by the introduction of newer class of fiber and matrix materials into the market due the recent advancement in research on green composites worldwide. For instance, the green composites matrix can be choosen from two categories of polymers, which are thermosetting matrix and thermoplastic matrix. Both categories can be further diversified into matrix derived from petroleum resource and matrix material derived from natural resources such as thermoplastic starch (Hamma et al., 2014) and poly-lactic acid (PLA) (Fiore et al., 2014).

The complexity of deciding on the best fiber and matrix material are also inflicted due to the multiple stakeholder requirements that need to be satisfied simultaneously during the product development process. Among the stakeholders which have direct requirements for decision makers to fulfill in the materials selection process are the customer, product designer and product manufacturing engineer, and in most cases, their preference for the materials to be selected are conflicting between each other (Sapuan, 2010). Thus, to address this complexity, the multi criteria decision making (MCDM) method is employed during the concurrent design process to aid decision makers in getting the optimized decision for materials selection. The use of MCDM method enabled all the selection criteria from various stakeholders and pool of potential materials with varying attributes between them to be analyzed simultaneously in a systematic and quantitative ways (Behzadian et al., 2012).

On the other hand, aspects that are considered in materials selection for green composite product can be group into three (3) main categories namely functional, sensorial and intangible properties. The functional aspect is related to the functionality and technical performance of the material to suit the intended application such as mechanical properties, thermal properties and acoustic properties. Secondly is the sensorial aspect of the material which involved consideration such as visual (i.e. colour intensity and colorfulness), tactual (i.e softness-hardness), weight (heavy–light), olfactory (i.e. odorless–fragrant) and auditory (i.e. loudness-quietness) (Baxter et al., 2015). The third aspect involved is the intangible properties such as perceived values and cultural meanings, emotions, trends of the material (Karana et al., 2008). The consideration of all the mentioned aspects is crucial towards successful green composite product development whereby the material selected will also provide meaningful experience of the end product itself to the customers and acts as a linked between the user with the end product as highlighted in the Meaning of Material (MoM) model for materials selection process proposed by Karana et al. (2010).

In general, the materials selection process for green composites product can be divided into two (2) main stages, which are the screening and ranking stage (Jahan et al., 2010). The screening stage is performed to narrow down possible alternative materials to a manageable quantity based on the product design general requirements. Among the screening methods applied in materials selection are the Ashby chart (Shah, 2014), ternary diagram using three bi-dimensional factors (specific strength, specific stiff-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

ness and cost per weight) (Koronis et al., 2013) and knowledge-based system (using IF-THEN rule based technique) (Sapuan & Abdalla, 1998).

The ranking process is later performed to analyze in detail the list of potential candidate materials and select the best alternative material which is able to successfully meet all the selection criteria. In green composites materials selection, the selection criteria is extracted from the PDS developed for the intended product. In most cases, the ranking process by the majority of the available MCDM ranking methods is started by determining the weight of the selection criteria or the magnitude of preference between the selection criteria involved using method such as Digital Logic (DL) method and Analytic Hierarchy Process (AHP). However, Attri & Grover (2013) reported that there are MCDM methods which do not need the information of the weight for the selection criteria such as Preference selection index (PSI) method (Maniya & Bhatt, 2010), VlsekriterijumskaOptimizacija I KOmpromisnoResenje(VIKOR) method (Girubha & Vinodh, 2012) and Grey Relational Analysis (GRA) method (Chan & Tong, 2007). The weight ratings are quantified based on individual preference or from group preference involving the product stakeholders. For group decision making, the average value for their preferences is calculated using either arithmetic mean or geometric mean method and applied for the respective selection criteria (Wu et al., 1998).

The next process involved during the ranking stage is analyzing the score of every candidate materials based on the respective attributes with respect to the selection criteria and weight of the criteria as defined in the previous process. Finally, the rank for every candidate materials are determined based on the individual total score value obtained whereby highest score value represents the best candidate material to fulfill the intended design requirement. In overall, selection of the MCDM method to be applied also depends on the user's preference with consideration of computational time, amount of mathematical calculation required and level of complexity of the algorithm involved (Attri & Grover, 2013). Among the ranking methods which are available for materials selection process including for green composites are Analytic Hierarchy Process (AHP) method (Akadiri et al., 2013; Mansor et al., 2013), Preferences by Similarity to the Ideal Solution (TOPSIS) method (Anupam et al., 2014; Mansor et al., 2014a), Preference Ranking Organization Method for Enrichment Evaluation (PROMETHEE) method (Çalişkan et al., 2013; Peng & Xiao, 2013), ELimination Et Choix Traduisant la REalité (ELECTRE) method (Shanian & Savadogo, 2006) and weighted property index method (Findik & Turan, 2012).

MANUFACTURING PROCESS SELECTION OF GREEN COMPOSITE PRODUCTS

Another important aspect involved in concurrent conceptual design stage is the green composite product manufacturing process selection. Similarly with the previous section, MCDM methods are normally employed to perform the selection process due to the presence of multiple selection criteria and multiple manufacturing process alternatives which needs to be analyzed concurrently. In general, the manufacturing process selection criteria for green composites product is determined based on the final composites product architecture which are the volumetric composition of the green composites in term of intended fiber volume fraction and porosity), reinforcement geometry in term of fiber length and fiber orientation, and the type of matrix chosen, whether it is thermoset or thermoplastic matrix (Shah, 2013). In addition, the criteria for the manufacturing process selection also includes end product quality and low labor cost (Singh et al., 2011). Furthermore, the manufacturing process flexibility, good precision to reach the required dimensional tolerance, low cost, low scrap and rapid production capability are also desirable

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

traits for selection of green composites manufacturing process (Jahazi & Hossein-Nejad, 2004). Hambali et al. (2009b) demonstrated the application of MCDM method for automotive bumper composites manufacturing process selection using AHP method. In their report, among the selection criteria applied were cost (tooling, labor and equipment), production characteristics (production quantity, rate of production and processing time), geometry of the final composite product design (such as shape, wall thickness and weight), type of materials used, ease of maintenance and availability of the equipment and labor.

LIFE CYCLE ASSESSMENT OF GREEN COMPOSITE PRODUCTS

Due to the increase of awareness from consumers on the product they consumed especially on its effect to the environment, product designers are now incorporating design for sustainability tools for new product being developed. The growing trend isalso now applied for products which used green composites as the raw material. In the concurrent conceptual design stage, one of the tool applied is the life cycle assessment (LCA) method which served as to determine the potential environmental impact of the product throughout its entire life cycle (Finkbeiner & Hoffmann, 2006). The implementation of the LCA method in the conceptual design stage helps product designers especially the one dealing with green composites to quantify the resulting potential environmental burden throughout the whole product life cycle starting from raw materials extraction, production and up to the its end of life of stage. Apart from that, the LCA method will also yield quantitative measures to assess "how green" is the green composites product itself as targeted during the initial product development process. Furthermore, the information obtained through LCA method also help designers to identify key product life cycle stages which contributes to the highest environmental burden so that correction action can be undertaken as early as possible such as during the conceptual design stage of the product (Joshi et al., 2004).

There are many reported studies on the implementation of LCA method for green composites product development. Wötzel et al. (1999) applied LCA method using Eco-indicator 99 impact assessment method to assess the environmental impact of automotive side panel component developed using hemp/epoxy green composites. Schmehl et al. (2008) also reported the application of LCA method to measure the potential environmental impact of hemp/PTP thermoset green composites for passenger bus body component casing product design. Moreover, Luz et al. (2010) utilized the LCA method to assess the potential environmental burden of sugarcane bagasse/polypropylene green composites for interior component of passenger vehicle. They also analyzed the environmental performance of the similar component constructed using talc/polypropylene composites and later compared both materials in term of the environmental performance throughout the component life cycles.

CONCEPTUAL DESIGN OF GREEN COMPOSITES PRODUCT: CASE STUDY ON GREEN COMPOSITES BICYCLE FRAME DESIGN

Bicycle is among the earliest form of road transportation created by men. Among the main component of a bicycle is the frame which acts as the main load bearing structure of the vehicle which holds all the other components together to make it functional. Currently, steel is the most used material to construct the frame component due to its high strength and stiffness properties required for safe and reliable operation to the user. Synthetic composites were also used to construct the frame component especially

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

carbon fiber composites to gain better lightweight properties compared to steel for higher cycling performance while maintaining the structural requirements for safe and functional operation. However, despite the lightweight gain by using carbon fiber composites, trade-offs were made in term of higher material cost, which limits the carbon fiber composites bicycle frame to high-end users such as competitive racing cyclists, maintaining the domination of steel for bicycle frame design. On the other hand, green composites, made from natural fiber such as kenaf, sugar palm and pineapple leaf reinforced in either thermoplastic or thermoset matrices is gaining wider attentions nowadays especially as the most potential candidate materials to replace the use of synthetic composites such as carbon fiber composites and steel for various structural applications. Green composites offer the cost and lightweight solution to synthetic composites and steel, respectively. Furthermore, green composites which used fibers made from natural resources also provide better sustainability performance such as renewable and recyclable compared to synthetic fiber made from petroleum resource. However, green composites still lag behind synthetic composites and steel especially in term of structural performance, henceforth seeing the application of green composites material to be concentrated to non-structural products. In order to gain the potential of green composites as substitution material to construct the bicycle frame, other solution to address its inherent low structural performance must be worked out, and among the solution is through applying CE approach of the product during its development process. In this case study, the integrated TRIZ-Morphological Chart method is selected to assist in developing innovative design solutions during the concurrent conceptual design stage for the new bicycle frame using green composites material. The development process of the new bicycle frame conceptual design using green composites material is divided into three stages and the explanation are described as below.

Stage 1: Problem Identification

In the first conceptual design stage, problem identification of the project was first determined using the TRIZ method. The aim of the case study was to utilize green composites for bicycle frame construction to improve the product cost, sustainability and lightweight performance compared to the current frame material, which is steel. However, applying green composites also reduced the structural performance, which is crucial to guarantee functional and safe operation of the product. Thus, a contradiction occurred in which by improving one parameter of product, another parameter worsened in the same time. According to the TRIZ method, the contradiction occurred is classified as engineering contradiction due to the type of the parameter involved. Next, the specific problem statement is matched with TRIZ 39 engineering parameters to convert it to general problem statement. TRIZ engineering parameter number 2 (weight of stationary object) was selected to represent weight of the green composites bicycle frame as the improving parameter in the design while engineering parameter number 11 (stress) was selected to represent the reduce of structural performance due to lower stress that can be absorbed by the green composites bicycle frame.

Stage 2: Solution Generation

In the second stage of the conceptual design process, solutions to solve the known contradiction were generated. Again by applying TRIZ method, general solutions were obtained using the TRIZ contradiction matrix based on the identified improving and worsening parameters as shown in Table 1. In this particular case, four potential inventive solution principles were suggested based on the contradiction

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 1. Contradiction matrix for the green composites bicycle frame based on the TRIZ 39 Engineering Parameters

Improving Parameter	Worsening Parameter	TRIZ 40 Inventive Solution Principles
#2. Weight of stationary object	#11. Stress	#10. Preliminary action (prior action – "do it in advance") #13. The other way around #18. Mechanical vibration/oscillation #29. Pneumatics and hydraulics

(San et al., 2009)

matrix which are number 10 (preliminary action or prior action – "do it in advance"), number 13 (the other way around), number 18 (mechanical vibration/oscillation) and number 29 (pneumatics and hydraulics). The proposed solution principles served as guidelines in brainstorming the potential idea to solve the problem.

The next step taken was to analyze each of the general solution principles obtained from the contradiction matrix to determine relevant general solution associated with the product. Based on the conducted analysis, the principle number 10 and number 13 were found to provide the most suitable solutions to solve the problem faced in the design. Thus, specific solution strategies relevant to the green composites bicycle frame were later devised based on the general solution selected. Table 2 summarizes the overall specific solution strategies based on the TRIZ general solution principles identified to be applied to the new green composites bicycle frame.

Stage 3: Conceptual Design Development

In the final stage, the classical Morphological Chart method was applied to refine the previously identified TRIZ specific solutions strategies into appropriate alternative system elements. The integration of Morphological Chart with TRIZ method enabled further identification of possible specific design features related to the recommended TRIZ principles, which in return also enhanced the effectiveness of the TRIZ method. Furthermore, the integrated TRIZ-Morphological Chart method also provided a

Table 2. Specific solution strategy for the green composites bicycle frame based on the TRIZ solution principles

TRIZ General Solution Principles	Solution Descriptions	Specific Solution Strategy
#10. Preliminary action (prior action – "Do it in advanced")	1. Perform the required change of an object (either fully or partially) before it is needed 2. Pre-arrange objects such as that they can come into action from the most convenient place without losing time for their delivery	• Add ribbing pattern as reinforcements on the bicycle frame to increase structural strength and stiffness (Imihezri et al., 2005) • Change from multiple section frame to single piece frame to increase strength and stiffness by eliminating concentrated stress using joints as well as ease of frame manufacture using green composites material)
#13. The other way around	1. Invert the action used to solve the problem 2. Make movable parts fixed, and fixed parts movable 3. Turn the object 'upside down'	• Change from straight shape frame to arch shape frame to increase static vertical load bearing capability • Change from tubular-shape frame cross-section to beam-shape frame cross-section such as I-beam shape design to increase stiffness as well as ease of frame manufacture using green composites material (Imihezri et al., 2006)

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

quick way for designers to systematically translate the general TRIZ solutions into specific design idea and generate more solution ideas for the desired conceptual design. In addition, the designer may also visualize the solution idea more clearly prior to combining them together to generate new conceptual design of the product. Figure 3 shows the developed Morphological Chart for the green composites bicycle frame design.

Note: Example for development of concept design 1= Rib pattern (X) + single frame + frame shape (flat) + frame cross-section (I-shape).

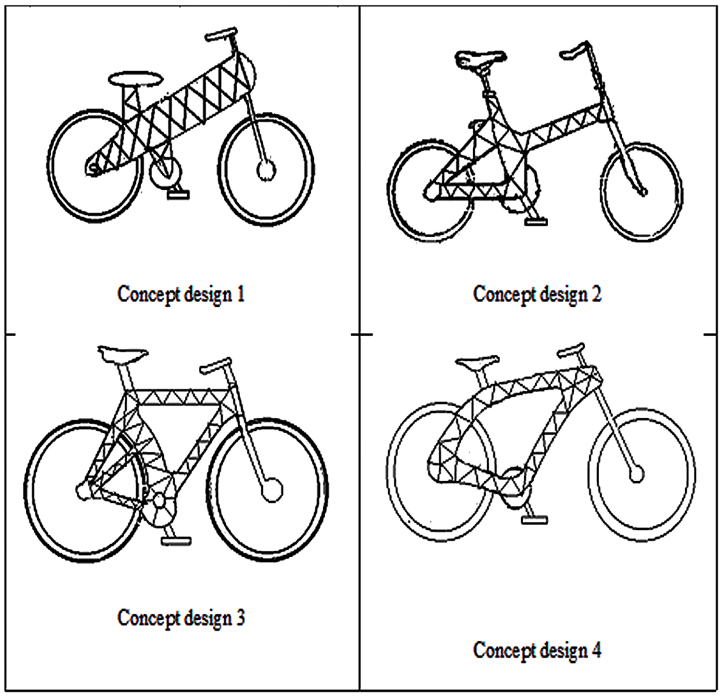
Using the Morphological Chart developed in Figure 3 as guideline, four (4) new conceptual designs of the green composites bicycle frame were developed as shown in Figure 4. Each of the new conceptual designs combined individual elements related to the design feature listed in the chart. For example, concept design 1 was developed using the combination of X-type ribbing pattern as the frame reinforcements and was based according to single frame construction as opposed to the multiple frame for the current steel bicycle frame. The single frame construction design was permitted due to the capability of producing single piece component using polymer composites manufacturing technology such as injection molding and resin transfer molding process. Moreover, concept design 1 also retained the straight shape frame design for design simplification and an I-shape frame cross-section to replace the tubular steel frame cross-section applied in current bicycle frame design. The I-shape frame cross-section also helped to enhance the structural rigidity of the green composites structure while in the same time reduced the volume of material used for lightweight purpose. Utilization of the solution strategies identified using the TRIZ method for the development of new green composites bicycle frame conceptual designs have allowed innovative and practical design solutions for structural purpose to be achieved despite the initial limitation on mechanical properties of the green composite material.

Figure 3. Morphological chart for green composites bicycle frame design

TRIZ solution principles and specific solution strategy	Design feature	Conceptual Design Solution			
		1	2	3	4
#10. Preliminary action (prior action – "Do it in advanced") i) Add ribbing pattern as reinforcements on the bicycle frame ii) Change from multiple section frame to single piece frame	Rib pattern	I	V	X	
	Single frame	Yes	No		
#13. The other way around i) Change from straight shape frame to arch shape frame ii) Change from tubular-shape frame cross-section to beam-shape frame cross-section	Frame shape	Flat	Arch	Mixed	
	Frame cross section	I-shape	T-shape	Rectangle	

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 4. New conceptual designs of green composites bicycle frame developed using integrated TRIZ-morphological chart method



CONCLUSION

The know-how of materializing green composites into workable and acceptable products both for non-structural and structural applications as substitution to conventional engineering materials and synthetic composites is an important feature required to product designers. Despite the challenging task faced due to the limitation on the structural properties of green composites, the inherent inadequacy can be addressed successfully through implementation of systematic CE approach especially during concurrent conceptual design process. Without compromising the functional requirements such as structural strength and safety, innovative solutions and optimized decision can be developed for the green composite products which also able to provide better sustainable advantages to consumers throughout the product entire life cycle especially when compared to synthetic composite products. Many CE tools are applicable to handle the product development process involving idea generation and development as well as MCDM for materials, process and design selection for green composites. The potential of success was made available for reference to designers and practitioners in the green composites field through the case study shown in the previous section using systematic CE approach during the conceptual design stage of the product.

ACKNOWLEDGMENT

The authors wish to express sincere gratitude to Universiti Teknikal Malaysia Melaka for the warm support provided throughout the preparation of this publication.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

REFERENCES

Akadiri, P. O., Olomolaiye, P. O., & Chinyio, E. (2013). Multi-criteria evaluation model for the selection of sustainable materials for building projects. *Automation in Construction*, *30*(0), 113–125. doi:10.1016/j.autcon.2012.10.004

Alves, C., Ferrão, P. M. C., Silva, A. J., Reis, L. G., Freitas, M., Rodrigues, L. B., & Alves, D. E. (2010). Ecodesign of automotive components making use of natural jute fiber composites. *Journal of Cleaner Production*, *18*(4), 313–327. doi:10.1016/j.jclepro.2009.10.022

Anupam, K., Lal, P. S., Bist, V., Sharma, A. K., & Swaroop, V. (2014). Raw material selection for pulping and papermaking using TOPSIS multiple criteria decision making design. *Environmental Progress and Sustainable Energy*, *33*(3), 1034–1041. doi:10.1002/ep.11851

Ashori, A. (2008). Wood–plastic composites as promising green-composites for automotive industries. *Bioresource Technology*, *99*(11), 4661–4667. doi:10.1016/j.biortech.2007.09.043 PMID:18068352

Attri, R., & Grover, S. (2013). Application of preference selection index method for decision making over the design stage of production system life cycle. *Journal of King Saud University -. Engineering and Science*, *27*(0), 207–216.

Baxter, W. L., Aurisicchio, M., & Childs, P. R. N. (2015). (in press). Materials, use and contaminated interaction. *Materials & Design*, *0*(0). doi:10.1016/j.matdes.2015.04.019

Behzadian, M., Otaghsara, S. K., Yazdani, M., & Ignatius, J. (2012). A state-of the-art survey of TOPSIS applications. *Expert Systems with Applications*, *39*(17), 13051–13069. doi:10.1016/j.eswa.2012.05.056

Benyus, J. M. (1997). *Biomimicry: Innovation Inspired by Nature*. New York: HarperCollins Publisher Inc.

Bismarck, A., Baltazar-Y-Jimenez, A., & Sarlkakis, K. (2006). Green composites as Panacea? Socio-economic aspects of green materials. *Environment, Development and Sustainability*, *8*(3), 445–463. doi:10.100710668-005-8506-5

Brezet, H., & Van Hemel, C., & the United Nations Environment Programme. Industry and Environment (Paris), Rathenau Institute (TheHague), Delft University of Technology (Delft). (1997). Ecodesign: A promising approach to sustainable production and consumption. UNEP.

Burns, L. A., Mouritz, A. P., Pook, D., & Feih, S. (2012a). Bio-inspired design of aerospace composite joints for improved damage tolerance. *Composite Structures*, *94*(3), 995–1004. doi:10.1016/j.compstruct.2011.11.005

Burns, L. A., Mouritz, A. P., Pook, D., & Feih, S. (2012b). Strength improvement to composite T-joints under bending through bio-inspired design. *Composites. Part A, Applied Science and Manufacturing*, *43*(0), 1971–1980. doi:10.1016/j.compositesa.2012.06.017

Çalişkan, H., Kurşuncu, B., Kurbanoĝlu, C., & Güven, Ş. Y. (2013). Material selection for the tool holder working under hard milling conditions using different multi criteria decision making methods. *Materials & Design*, *45*(0), 473–479. doi:10.1016/j.matdes.2012.09.042

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chan, J. W. K., & Tong, T. K. L. (2007). Multi-criteria material selections and end-of-life product strategy: Grey relational analysis approach. *Materials & Design*, *28*(5), 1539–1546. doi:10.1016/j.matdes.2006.02.016

Chandrasegaran, S. K., Ramani, K., Sriram, R. D., Horváth, I., Bernard, A., Harik, R. F., & Gao, W. (2013). The evolution, challenges, and future of knowledge representation in product design systems. *Computer Aided Design*, *45*(2), 204–228. doi:10.1016/j.cad.2012.08.006

Chen, H., Tu, J., & Guan, S. (2012). Applying the Theory of Problem-Solving and AHP to develop eco-innovative design. In M. Matsumoto et al. (Eds.), Design for Innovative Value Towards a Sustainable Society (pp. 489–494). Dordrecht: Springer Science+Business Media. doi:10.1007/978-94-007-3010-6_93

Chiu, M. C., & Okudan, G. (2014). An investigation on the impact of product modularity level on supply chain performance metrics: An industrial case study. *Journal of Intelligent Manufacturing*, *25*(1), 129–145. doi:10.100710845-012-0680-3

Cross, N. (1994). *Engineering Design Methods: Strategies for Product Design*. Chichester, UK: John Wiley & Sons.

Davoodi, M. M., Sapuan, S. M., Ahmad, D., Aidy, A., Khalina, A., & Jonoobi, M. (2011). Concept selection of car bumper beam with developed hybrid bio-composite material. *Materials & Design*, *32*(10), 4857–4865. doi:10.1016/j.matdes.2011.06.011

Davoodi, M. M., Sapuan, S. M., Ahmad, D., Ali, A., Khalina, A., & Jonoobi, M. (2010). Mechanical properties of hybrid kenaf/glass reinforced epoxy composite for passenger car bumper beam. *Materials & Design*, *31*(10), 4927–4932. doi:10.1016/j.matdes.2010.05.021

Dieter, G. E. (2000). Engineering Design: A Materials and Processing Approach (3rd ed.). Boston: McGraw-Hill.

Easterling, K. E. (1990). *Tomorrow's Materials*. London: The Institute of Materials.

El-Zeiny, R. M. A. (2012). Biomimicry as a problem solving methodology in interior architecture. *Procedia: Social and Behavioral Sciences*, *50*(0), 502–512. doi:10.1016/j.sbspro.2012.08.054

Findik, F., & Turan, K. (2012). Materials selection for lighter wagon design with a weighted property index method. *Materials & Design*, *37*, 470–477. doi:10.1016/j.matdes.2012.01.016

Finkbeiner, M., & Hoffmann, R. (2006). Application of life cycle assessment for the environmental certificate of the Mercedes-Benz S-Class (7 pp). *The International Journal of Life Cycle Assessment*, *11*(4), 240–246. doi:10.1065/lca2006.05.248

Fiore, V., Botta, L., Scaffaro, R., Valenza, A., & Pirrotta, A. (2014). PLA based biocomposites reinforced with Arundo donax fillers. *Composites Science and Technology*, *105*(0), 110–117. doi:10.1016/j.compscitech.2014.10.005

Ghazilla, R. A. R., Taha, Z., Yusoff, S., Rashid, S. H. A., & Sakundarini, N. (2013). Development of decision support system for fastener selection in product recovery oriented design. *International Journal of Advanced Manufacturing Technology*, *70*(5-8), 1403–1413. doi:10.100700170-013-5373-3

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Girubha, R. J., & Vinodh, S. (2012). Application of fuzzy VIKOR and environmental impact analysis for material selection of an automotive component. *Materials & Design*, *37*(0), 478–486. doi:10.1016/j.matdes.2012.01.022

Hambali, A., Sapuan, S. M., Ismail, N., & Nukman, Y. (2009a). Application of Analytical Hierarchy Process in the design concept selection of automotive composite bumper beam during the conceptual design stage. *Scientific Research and Essays*, *4*(4), 198–211.

Hambali, A., Sapuan, S. M., Ismail, N., & Nukman, Y. (2009b). Composite manufacturing process selection using Analytical Hierarchy Process. *International Journal of Mechanical and Materials Engineering*, *4*(1), 49–61.

Hamma, A., Kaci, M., Ishak, Z. A. M., & Pegoretti, A. (2014). Starch-grafted-polypropylene/kenaf fibres composites. Part 1: Mechanical performances and viscoelastic behaviour. *Composites. Part A, Applied Science and Manufacturing*, *56*(0), 328–335. doi:10.1016/j.compositesa.2012.11.010

Imihezri, S. S. S., Sapuan, S. M., Ahmad, M. M. H. M., & Sulaiman, S. (2005). A study of the comparison of `V' and `X' ribbing in a composite pedal using mold flow analysis software. *Materials & Design*, *26*(2), 157–166. doi:10.1016/j.matdes.2004.05.011

Imihezri, S. S. S., Sapuan, S. M., Sulaiman, S., Hamdan, M. M., Zainuddin, E. S., Osman, M. R., & Rahman, M. Z. A. (2006). Mould flow and component design analysis of polymeric based composite automotive clutch pedals. *Journal of Materials Processing Technology*, *171*(3), 358–365. doi:10.1016/j.jmatprotec.2005.06.077

Jahan, A., Ismail, M. Y., Sapuan, S. M., & Mustapha, F. (2010). Material screening and choosing methods – A review. *Materials & Design*, *31*(2), 696–705. doi:10.1016/j.matdes.2009.08.013

Jahazi, M., & Hossein-Nejad, S. (2004). The development of an optimum manufacturing and material selection process for the fabrication of labyrinth seal strips. *Journal of Materials Processing Technology*, *152*(3), 272–275. doi:10.1016/j.jmatprotec.2003.11.035

Joshi, S., Drzal, L., Mohanty, A., & Arora, S. (2004). Are natural fiber composites environmentally superior to glass fiber reinforced composites? *Composites. Part A, Applied Science and Manufacturing*, *35*(3), 371–376. doi:10.1016/j.compositesa.2003.09.016

Karana, E., Hekkert, P., & Kandachar, P. (2008). Material considerations in product design: A survey on crucial material aspects used by product designers. *Materials & Design*, *29*(6), 1081–1089. doi:10.1016/j.matdes.2007.06.002

Karana, E., Hekkert, P., & Kandachar, P. (2010). A tool for meaning driven materials selection. *Materials & Design*, *31*(6), 2932–2941. doi:10.1016/j.matdes.2009.12.021

Koronis, G., Silva, A., & Fontul, M. (2013). Green composites: A review of adequate materials for automotive applications. *Composites. Part B, Engineering*, *44*(1), 120–127. doi:10.1016/j.compositesb.2012.07.004

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Li, S. H., Zeng, Q. Y., Xiao, Y. L., Fu, S. Y., & Zhou, B. L. (1995). Biomimicry of bamboo bast fiber with engineering composite materials. *Materials Science and Engineering C*, *3*(0), 125–130. doi:10.1016/0928-4931(95)00115-8

Lin, C.-S., Chen, L.-S., & Hsu, C.-C. (2011). An innovative approach for RFID product functions development. *Expert Systems with Applications*, *38*(12), 15523–15533. doi:10.1016/j.eswa.2011.06.007

Luttropp, C., & Lagerstedt, J. (2006). EcoDesign and The Ten Golden Rules: Generic advice for merging environmental aspects into product development. *Journal of Cleaner Production*, *14*(15-16), 1396–1408. doi:10.1016/j.jclepro.2005.11.022

Luz, S. M., Caldeira-pires, A., & Ferrão, P. M. C. (2010). Environmental benefits of substituting talc by sugarcane bagasse fibers as reinforcement in polypropylene composites: Ecodesign and LCA as strategy for automotive components. *Resources, Conservation and Recycling*, *54*(12), 1135–1144. doi:10.1016/j.resconrec.2010.03.009

Maniya, K., & Bhatt, M. G. (2010). A selection of material using a novel type decision-making method: Preference selection index method. *Materials & Design*, *31*(4), 1785–1789. doi:10.1016/j.matdes.2009.11.020

Mansor, M. R., Sapuan, S. M., Hambali, A., Zainudin, E. S., & Nuraini, A. A. (2015). Conceptual design of kenaf polymer composites automotive spoiler using TRIZ and Morphology Chart methods. *Applied Mechanics and Materials*, *761*(0), 63–67. doi:10.4028/www.scientific.net/AMM.761.63

Mansor, M. R., Sapuan, S. M., Zainudin, E. S., Nuraini, A. A., & Hambali, A. (2013). Hybrid natural and glass fibers reinforced polymer composites material selection using Analytical Hierarchy Process for automotive brake lever design. *Materials & Design*, *51*(0), 484–492. doi:10.1016/j.matdes.2013.04.072

Mansor, M. R., Sapuan, S. M., Zainudin, E. S., Nuraini, A. A., & Hambali, A. (2014a). Application of integrated AHP-TOPSIS Method in hybrid natural fiber composites materials selection for automotive parking brake lever component. *Australian Journal of Basic and Applied Sciences*, *8*(5), 431–439.

Mansor, M. R., Sapuan, S. M., Zainudin, E. S., Nuraini, A. A., & Hambali, A. (2014b). Conceptual design of kenaf fiber polymer composite automotive parking brake lever using integrated TRIZ – Morphological Chart – Analytic Hierarchy Process method. *Materials & Design*, *54*(0), 473–482. doi:10.1016/j.matdes.2013.08.064

Min, S. H., Kim, H. Y., Kwon, Y. J., & Sohn, S. Y. (2011). Conjoint analysis for improving the e-book reader in the Korean market. *Expert Systems with Applications*, *38*(10), 12923–12929. doi:10.1016/j.eswa.2011.04.087

Pahl, G., Beitz, W., Feldhusen, J., & Grote, K. H. (2007). Engineering Design: A Systematic Approach (3rd ed.). London: Springer-Verlag London Limited.

Peng, A. H., & Xiao, X. M. (2013). Material selection using PROMETHEE combined with analytic network process under hybrid environment. *Materials & Design*, *47*(0), 643–652. doi:10.1016/j.matdes.2012.12.058

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Pugh, S. (1991). *Total Design: Integrated Methods for Successful Product Engineering*. Wokingham, UK: Addison-Wesley Publishing.

San, Y. T., Jin, Y. T., & Li, S. C. (2009). *TRIZ: Systematic Innovation in Manufacturing*. Selangor: Firstfruits Sdn Bhd.

Sapuan, S. M. (2005). Concurrent design and manufacturing process of automotive composite components. *Assembly Automation*, *25*(2), 146–152. doi:10.1108/01445150510590514

Sapuan, S. M. (2006). Using the morphological chart technique for the design of polymeric-based composite automotive pedals. *Discovery and Innovation*, *18*, 311–317.

Sapuan, S. M. (2010). *Concurrent Engineering for Composites*. Serdang: UPM Press.

Sapuan, S. M., & Abdalla, H. S. (1998). A prototype knowledge-based system for the material selection of polymeric-based composites for automotive components. *Composites. Part A, Applied Science and Manufacturing*, *29*(7), 731–742. doi:10.1016/S1359-835X(98)00049-9

Sapuan, S. M., & Mansor, M. R. (2014). Concurrent engineering approach in the development of composite products: A review. *Materials & Design*, *58*, 161–167. doi:10.1016/j.matdes.2014.01.059

Schmehl, M., Mussig, J., Schonfeld, U., & Von Buttlar, H.-B. (2008). Life cycle assessment on a bus body component based on hemp and PTP. *Journal of Polymers and the Environment*, *16*(1), 51–60. doi:10.100710924-008-0103-x

Shah, D. U. (2013). Developing plant fibre composites for structural applications by optimising composite parameters: A critical review. *Journal of Materials Science*, *48*(18), 6083–6107. doi:10.100710853-013-7458-7

Shah, D. U. (2014). Natural fibre composites: Comprehensive Ashby-type materials selection charts. *Materials & Design*, *62*, 21–31. doi:10.1016/j.matdes.2014.05.002

Shanian, A., & Savadogo, O. (2006). A material selection model based on the concept of multiple attribute decision making. *Materials & Design*, *27*(4), 329–337. doi:10.1016/j.matdes.2004.10.027

Silvester, S., Beella, S. K., Van Timmeren, A., Bauer, P., Quist, J., & Van Dijk, S. (2013). Exploring design scenarios for large-scale implementation of electric vehicles: The Amsterdam Airport Schiphol case. *Journal of Cleaner Production*, *48*(0), 211–219. doi:10.1016/j.jclepro.2012.07.053

Singh, M., Khan, I. A., & Grover, S. (2011). Selection of manufacturing process using graph theoretic approach. *International Journal of System Assurance Engineering and Management*, *2*(4), 301–311. doi:10.100713198-012-0083-z

Sohlenius, G. (1992). Concurrent engineering. *CIRP Annals-Manufacturing Technology*, *41*(2), 645–655. doi:10.1016/S0007-8506(07)63251-X

Ulrich, K. T., & Eppinger, S. D. (2004). Product Design and Development (3rd ed.). Boston: McGraw-Hill Irwin.

Versos, C. A. M., & Coelho, D. A. (2011). Biologically inspired design: Methods and validation. In D. A. Coelho (Ed.), *Industrial Design – New Frontiers* (pp. 101–120). Rijeka, Croatia: InTech. doi:10.5772/20326

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Wang, F.-K., & Chen, K.-S. (2010). Applying Lean Six Sigma and TRIZ methodology in banking services. *Total Quality Management & Business Excellence*, *21*(3), 301–315. doi:10.1080/14783360903553248

Wötzel, K., Wirth, R., & Flake, M. (1999). Life cycle studies on hemp fibre reinforced components and ABS for automotive parts. *Die Angewandte Makromolekulare Chemie*, *272*(1), 121–127. doi:10.1002/(SICI)1522-9505(19991201)272:1<121::AID-APMC121>3.0.CO;2-T

Wu, W., Chiang, C., & Lin, C. (1998). Comparing the aggregation methods in the analytic hierarchy process when uniform distribution. *WSEAS Transactions on Business and Economics*, *5*(3), 82–87.

Yamashina, H., Ito, T., & Kawada, H. (2002). Innovative product development process by integrating QFD and TRIZ. *International Journal of Production Research*, *40*(5), 1031–1050. doi:10.1080/00207540110098490

Yeh, C. H., Huang, J. C. Y., & Yu, C. K. (2011). Integration of four-phase QFD and TRIZ in product R&D: A notebook case study. *Research in Engineering Design*, *22*(3), 125–141. doi:10.100700163-010-0099-9

Yen, S. B., & Chen, J. L. (2005). An eco-innovative tool by integrating FMEA and TRIZ methods. In *Proceeding of the 4th International Symposium on Environmentally Conscious Design and Inverse Manufacturing* (pp. 678–683). Tokyo, Japan: IEEE.

Yurtkuran, S., Kırlı, G., & Taneli, Y. (2013). Learning from nature: Biomimetic design in architectural education. *Procedia: Social and Behavioral Sciences*, *89*(0), 633–639. doi:10.1016/j.sbspro.2013.08.907

KEY TERMS AND DEFINITIONS

Composites: Made of different parts or materials.

Conceptual Design: Outline of solutions to a design problem.

Concurrent Design: Design activities which exist, happen, or done at the same time.

Life Cycle Assessment: A tool for the systematic evaluation of the environmental aspects of a product or service system through all stages of its life cycle.

Morphological Chart: A graphical representation based on the function analysis for idea generation purpose.

Natural Fiber: Textile fibre made from natural resources as opposed to synthetic materials.

TRIZ: A structured problem solving method. It is a Russion acronym for "Teoriya Resheniya Izobretatelskikh Zadatch" which means 'Theory of Inventive Problem Solving'.

This research was previously published in Green Approaches to Biocomposite Materials Science and Engineering edited by Deepak Verma, Siddharth Jain, Xiaolei Zhang, and Prakash Chandra Gope, pages 48-75, copyright year 2016 by Engineering Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 33
Cloud Computing Technology for Green Enterprises

Prachi Chaturvedi
Madhav Institute of Technology and Science, India

ABSTRACT

Computing technology acting a very vital role in our day to day activities. Later the associated high volume of energy consumption has become a major concern every economically and environmentally. Green computing is associate rising application in computing effectively that leads to very important greenhouse gas reduction. In toughened computing has become an important half that has got to be thought of seriously by ordered generation data and communication technology designers. Green computing is to use computer and connected resources in atmosphere, friendly ways in which. Such practices embrace the implementation of energy-efficient central method unit (CPU), servers and peripheral any as finding innovative ways in which of reducing resource consumption and proper disposal of electronic waste. Many IT manufacturers and vendors endlessly invest in designing energy economical computing devices, reducing the use of dangerous material, and galvanizing the recyclability of digital devices and printing papers.

INTRODUCTION

The field of "green technology" encompasses a broad range of subjects — from new energy-generation techniques to the study of advanced materials to be used in our daily life. Green technology focuses on reducing the environmental impact of industrial processes and innovative technologies caused by the Earth's growing population. It has taken upon itself the goal to provide society's needs in ways that do not damage the natural resources. This means creating fully recyclable products, reducing pollution, proposing different technologies in numerous fields, and making a middle of economic activity around technologies that profit the atmosphere. The massive quantity of computing factory-made worldwide contains a direct impact on atmosphere problems, and scientist's area unit conducting varied studies so as to scale back the negative impact of computing technology on our natural resources. A central purpose of analysis is testing and applying different non-hazardous materials within the products producing method.

DOI: 10.4018/978-1-5225-7915-1.ch033

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

HISTORY OF GREEN COMPUTING

In 1992, the U.S. Environmental Protection Agency launched Energy Star, a voluntary labeling program that is meant to push and acknowledge energy potency in monitors, climate management instrumentation, and different technologies. This resulted within the widespread adoption of sleep mode among shopper physics. The term "green computing" was in all probability coined shortly when the Energy Star program began; For a computer disposal, it's necessary to grasp everything there's to grasp so as to be concerned inexperienced computing. Basically, the full Green side took place quite an few years back once the news that the atmosphere wasn't a natural resources extremely move and other people started realizing that that they had to try and do their half to guard the atmosphere. Basically, the economical use of com putters and computing is what Green computing all is concerning. The triple bottom line is what's necessary once it involves something Green and therefore the same goes for Green Computing. This considers social responsibility, economic viability and therefore the impact on the atmosphere. Several businesses imply target a bottom line, instead of an Green triple bottom line, of economic viability once it involves computers. The thought is to create the full method encompassing computers friendlier to the atmosphere, economy, and society. This suggests makers produce computers in an exceedingly manner that reflects the triple bottom line completely. Once computers area unit sold-out businesses or individuals use them in an exceedingly Green manner by reducing power usage and doing away with them properly or utilization them. The thought is to create computers from getting down finishing a Green product.

BACKGROUND

Governments Go Green

Many governments worldwide have initiated energy-management programs, like Energy Star, a global commonplace for energy economical equipment that was created by thus Environmental Protection Agency in 1992 and has currently been adopted by many different countries. Energy Star reduces the number of energy consumed by a product by mechanically change it into ——sleep mode once not in use or reducing the number of power employed by a product once in ——standby mode. Amazing, standby——leaking, the electricity consumed by appliances once they area unit changed, will represent the maximum amount as 12% of a typical household's electricity consumption. In Australia, standby power may be a primary issue for the country's increased greenhouse emission emissions — quite five megatons (CO2 equivalent) annually.

Green Computing

Green computing is that the study and follow of exploitation computing resources expeditiously. The goals area unit like green chemistry; that's cut back the utilization of unsafe materials, maximizes energy potency throughout the product's period, and promotes recyclability or bio-degradability of defunct merchandise and manufacturing plant waste. Taking into thought the popular use of knowledge technology business, it's to guide a revolution of types by turning Green during a manner no business has ever done before. Its price action that this Green technology should not be on the subject of sound bites to impress activists however concrete action and structure policy. Opportunities belongs Green technology

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

like never before in history and organizations area unit seeing it as the simplest way to form new profit centers whereas making an attempt to assist the environmental cause.

In the arrange towards Green IT ought to embody new electronic merchandise and services with optimum potency and every one attainable choices towards energy savings. Modern IT systems rely on an advanced mixture of folks, networks and hardware; in and of it, a green computing initiative should be general in nature, and address progressively subtle issues. Components of like answer might comprise things like user satisfaction, management restructuring, restrictive compliance, disposal of electronic waste, work, virtualization of server resources, energy use, skinny shopper solutions, and come on investment (ROI). As twenty first century belongs to computers, gizmos and electronic things, energy problems can get a significant ring within the returning days, because the oral presentation on carbon emission, heating and temperature change gets hotter.

Taking into thought the popular use of knowledge technology business, it's to guide a revolution of types by turning green during a manner no business has ever done before (Info-tech, 2009; (Depavath Harinath, 2008). Green Computing is that the term accustomed denote economical use of resources in computing. This term typically relates to the utilization of computing resources in conjunction with minimizing environmental impact, maximizing economic viability and making certain social duties. Green Computing is extremely a lot of associated with different similar movements like reducing the utilization of environmentally unsafe materials like CFCs, promoting the utilization of utile materials, minimizing use of non-biodegradable elements, and inspiring use of property resources. One among the spin-offs of Green Computing is EPEAT or Electronic merchandise Environmental Assessment Tool. EPEAT merchandise serves to extend the potency and lifetime of computing merchandise. Moreover, these merchandise area unit designed to reduce energy expenditures, minimize maintenance activities throughout the lifetime of the merchandise and permit the re-use or usage of some materials.

The first manifestation of the Green Computing movement was the launch of the ENERGY STAR program back in 1992 and ENERGY STAR served as a sort of voluntary label awarded to computing merchandise that succeeded in minimizing use of energy whereas maximizing potency, so ENERGY STAR has been applied to products like monitors, TV sets and temperature management devices like refrigerators, air conditioners, and similar things. One of the primary results of Green Computing is that the Sleep mode perform of PC monitors that place a consumer's equipment on standby mode once a pre-set amount of your time passes once user activity isn't detected because the idea activity isn't detected because the idea developed, Green Computing began to cover skinny shopper solutions, energy accounting, virtualization practices, and E-Waste.

Green Computing Practices

Some common Green Computing practices embody turning off the monitor once it's not in use or exploitation a lot of energy economical monitors like LCDs rather than ancient CRT monitors, volunteer computing or file sharing practices, virtualization of servers, exploitation a lot of energy economical and fewer droning cooling systems (like exploitation liquid cooling systems rather than the traditional heat sinks and fans), temperature maintenance and regulation to scale back thermal shock wear and tear to pc components, and increased on-line security measures through the utilization of firewalls, anti-spyware and anti-virus programs to scale back the increasing quantity of E-Waste on the web and on different networks.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

WHY GREEN COMPUTING?

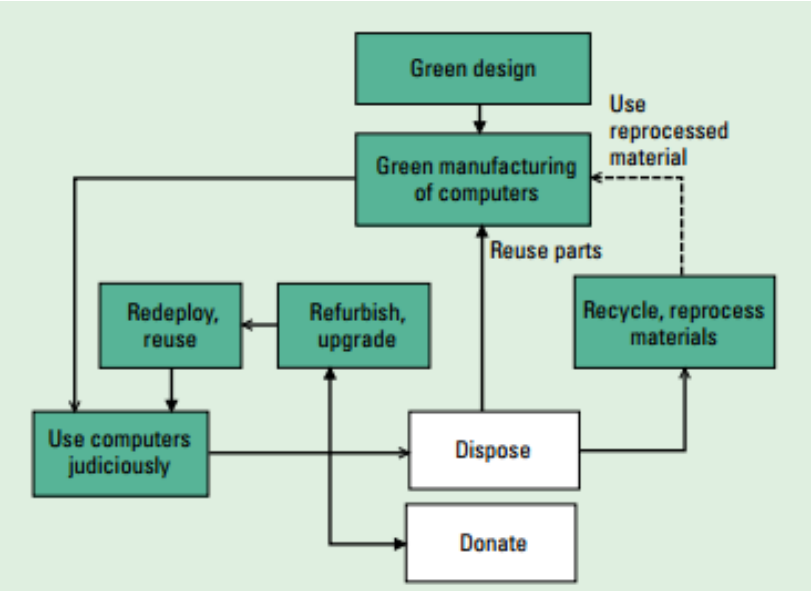
In a world wherever business is transacted 24/7 across each potential channel obtainable, corporations ought to collect, store, track and analyze huge volumes of knowledge—everything from click stream data and event logs to mobile decision records and a lot of however this all comes with a price to each businesses and also the surroundings. Knowledge warehouses and also the sprawling knowledge centers that house them dissipate an enormous quantity of power, each to run legions of servers and to cool down them simply however much? A large sixty one billion kilowatt-hours of electricity, at associate degree calculable value of $4.5B annually (Info-tech, 2009). The IT business has begun to deal with energy consumption within the knowledge center through a range of approaches as well as the employment of a lot of economical cooling systems, virtualization, blade servers and cargo area networks (SANs). However a elementary challenge remains. As knowledge volumes explode, ancient, appliance central knowledge reposting approaches will solely still throw a lot of hardware at the matter. This can quickly negate any inexperienced gains seen through higher cooling or a lot of tightly packed servers. (Info-tech, 2009) to reduce their hardware footprint, organizations conjointly ought to shrink their "data footprint" by addressing what quantity server area and resources their info analysis needs within the initial place.

A mix of latest info technologies expressly designed for analysis of huge quantities of knowledge and reasonable, resource-efficient, open-source software system will facilitate organizations economize and become greener (Info-tech, 2009).

Organizations (Figure 1) will do therefore within the following 3 key areas: reduced knowledge footprint, reduced reading resources, and reduced in progress management and maintenance (Info-tech, 2009). This technology is useful as it:

- Scale back energy consumption of computing resources throughout peak operation Save energy.
- Throughout idle operation Use eco-friendly sources of energy.

Figure 1. Green computing design



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- Scale back harmful effects of computing resources.
- Scale back computing wastes

Global warming and also the drawback of minimizing environmental impact from fossil-fuel emissions have raised to the highest of worldwide public policy agenda. As a result, businesses and customers alike have begun to embrace environmentally property merchandise that provide low-carbon solutions that may not solely scale back their international gas (GHG) emissions, however will do therefore by a lot of economical energy consumption and lower prices. Sensible readying of a lot of economical computing resources, beginning with Green PCs, has become a key focus for several businesses and customers trying to scale back their own energy consumption and carbon footprint. this is often fueled by a rise publicly awareness of the consequences of global climate change, recognition by businesses and customers that reducing energy usage will save prices and by government regulation covering everything from energy potency to power management and reduction of dangerous materials to e-waste disposal.

EXISTING WORKS IN GREEN COMPUTING

Today all manufactures corporations try to determine such knowledge center that area unit low cost and use low energy/power. In America in 1992 introduced an energy star program. Its main aim was given awarded to those computing merchandise that use minimum energy and provides most potency in its operating. In Energy star program were enclosed such product as laptop monitor, TV sets, white goods, Air conditioning and other physical science devices of these merchandise could also be friendly Green computing (Depavath Harinath, 2008).

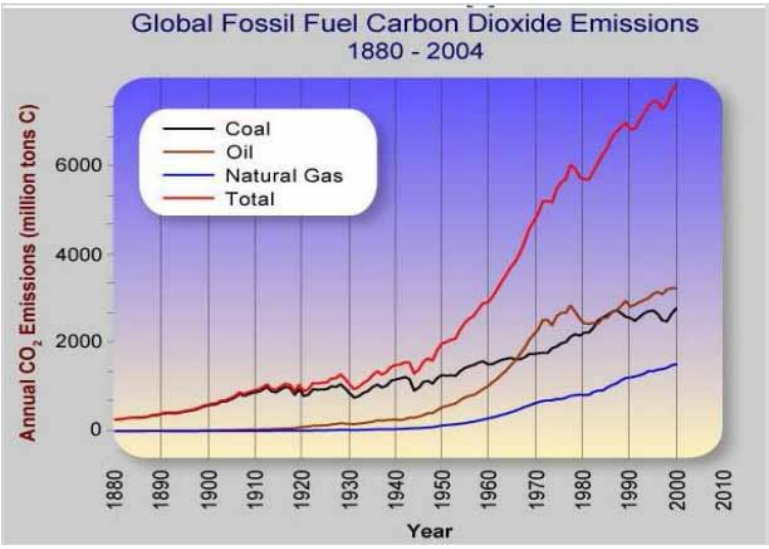
EPEAT (Electronic merchandise Environmental Assessment Tool) check the product's normal. All products that area unit registered area unit higher to guard human health and these items will be simply upgraded and recycled. This merchandise has reduced the proportion of lead, mercury and metallic element. These merchandise area unit a lot of efficient in energy and scale back the environmental impact.

IBM additionally has additionally contributed these problems. IBM has helped the purchasers to buy the merchandise consistent with green computing. Consistent with the analysis of the IBM in 1990, He saved 4.6 billion KWh of electricity and additionally prevented 3 million metric tons of greenhouse gas emission.

Google is making an attempt to determine its knowledge Centre building on Oregon's river to faucet electricity power. Microsoft Company is additionally making an attempt to determine its knowledge Centre building close to Washington for electricity power money services company (HSBC) is making ready its building of information Centre close to Niagara Falls for cooling and low energy consumption. In knowledge centre the servers evolve an outsized quantity of warmth therefore for his or her cooling company establishes totally air-con equipment's. The lot of powerful instrumentation of servers and so a lot of cooling needed from warming and secure operating accurately. Consistent with the report of employee scientists Jonathan Koomey of Lawrence Berkeley National Laboratory and AMD that was free in 2005 to chill and power the servers one.2% of total USA electricity is needed. In 2010 consistent with Gartner the 2000 world companies can pay a lot of energy on knowledge centers on servers than hardware's of the computers. Kumar says that energy prices is currently 100% of the common IT budget of the planet can increase five hundredth in next few years. The percentage of greenhouse gas is increasing terribly quickly. The annual rise of the greenhouse gas in air is given in Figure 2.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 2. Annual rise of greenhouse gas in air
(Taruna, 2014)



**For a more accurate representation see the electronic version.*

The graph shows that annual emission of greenhouse gas in past years, the black, blue and brown lines show the rise of greenhouse gas owing to cool, fossil fuel and oil severally and therefore the line shows the whole emission of greenhouse gas including all such factors that additionally includes physical science.

If we tend to see the energy consumption throughout the particular use of the merchandise and through the standby mode, we tend to observe that in the standby mode the energy consumption quantitative relation is a lot of. e.g. Ink jet printer use twelve watts during use whereas printing and take five watts throughout idle state. Table 1 shows the facts and figure clearly.

Different physical science merchandise use completely different energy consumption. during this table it's seen that if we tend to switch off the merchandise once victimization, we will save an outsized quantity of energy which might be utilized different functions. By this way, we will decrease our budget annually and supply higher setting to the planet. Intel printed a report regarding green computing within which they showed that elements of laptop use energy especially monitor or show consumes an outsized quantity of energy.

Table 1. The annual power wastage and price

Appliance	Hours per Day	Watt When on	Annual Cost of Use	Watt on Stand by	Annual Cost on Standby	% Wasted
TV	2	75	$ 7.12	14	$ 14.61	67%
VCR	1	15	$0.07	8	$9.07	99%
Computer	2	60	$5.69	13	$13.57	70%
Micro wave	25	1700	$20.17	24	$27.05	57%
Battery Charger	6	12	$ 3.41	10	$3.79	53%
Total cost			$ 49.36		$ 104.50	

(Priya Rana (2010))

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

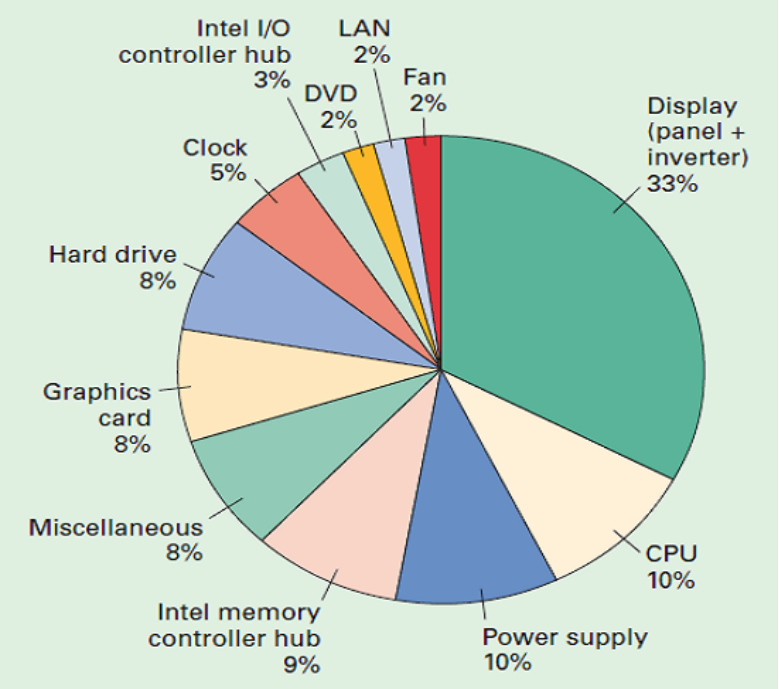
If we tend to turn off of the portable computer once it's idle state. we will save energy and cash. The PC architecture try to line up such style within which show unit consume less energy/power. within the figure two it has been seen that in portable computer all elements consume energy however show unit consume abundant energy that is one third (1/3) of the whole energy consumed by a portable computer. Most a part of the energy is wasted throughout process within the kind of heat that is the loss of energy and sources.

In Figure 3 it's clear that show unit of the portable computer is intense abundant energy that's thirty third of the total energy consumed by a portable computer. It's been that the portable computer is incredibly stunning however its battery charging efficiency isn't smart. The performance of the CPU depends upon the battery of the portable computer.

PRESENT SCENARIO

These days with fast increase in technology, electronic merchandise square measure used for brief span and older merchandise square measure drop often. One reason is replacement is way cheaper than repairing of electronic gadgets. in keeping with North American nation environmental protection agency several electronic products that don't seem to be in used i.e. regarding 3/4th in quantity were thrown away either drop in waste, unused, aggressive land i.e. Landfills or destroy by burning or exported to completely different countries like Asian countries.

Figure 3. Power Consumption of average lap top
(Willium & Curtis, 2008)



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

If drop in unused lands, then the virulent chemicals made by this electronic product either unleash within the atmosphere or get combine into soil and water. In European countries measures are taken to forestall such style of electronic waste disposing. By burning chemicals like lead, mercury, cadmium-ashes square measure combining in air that is such a lot harmful that it unwell impact organic phenomenon. As, whereas burning PVC plastic that is gift in creating laptop and in several physical science elements produces dioxins and frame that once more is dangerous.

Another methodology followed by developing countries currently is to export their e-waste to developing countries usage that is happening over this electronic waste may be a smart factor, however a lot of that the unsatisfactory purpose is that the method the raw materials from this merchandise square measure processed and handled, which might hurt the employees World Health Organization square measure handling this merchandise whereas usage moreover as is harmful to surroundings.

The distinction between the usage method in developed and developing countries is that, in developed countries like Europeans elements, a number of the e-waste like plastics don't seem to be reprocessed to evade brominates furans and dioxins being discharged, whereas in developing countries there's no such steps condemned usage. During a survey of 2005, eighteen Europeans seaports were inspected and it's found that regarding 475 of e-waste was tried to export lawlessly. this is often conjointly a serious concern that violation of law of nations are happening to urge eliminate e-waste to such associate degree extent that in UK alone a minimum of twenty 3,000 metric tons was lawlessly shipped to Republic of India, continent and China (Taruna, 2014). In this method, in North American nation conjointly it's found that 50-80% of the waste ought to be used for usage in their country.

It is lawlessly exported, China tried to solved this major drawback by prohibition the import of e-waste, however these laws don't seems to be operating as still tones of e-waste is foreign lawlessly (Figure 4). A best example is GUIYA of GWANGDONG province, Republic of India conjointly facing this e-waste trade drawback. Several scrap yards may be seen in metropolis, Mumbai, Bangalore, Firozabad, Meerut, were thousands of employees square measure leading perished life as a result of they're thinking to earn for these days discarding the thought that what is going to happen to them tomorrow.

If they still board between dangerous chemicals. Now, why developed countries square measuring selling, exportation their e-waste in developing countries, answer is that the low value of usage. To

Figure 4. Landfills due improper disposal of computers



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

recycle a glass of monitor in North American nation it'll value ten times a lot of then in any developing countries, and why developing countries square measure mercantilism these e-waste answer is –recycling of this e-waste will extract substance like copper, nickel, iron, gold, silicon-by mercantilism these metals scraps recyclers will create cash.

It is cheaper to own the arduous labor of pull apart and melting down items done place aspect the country although which means the useless scraps and alternative dangerous materials can litter that space (Wikibooks, 2002). And in developing countries in contrast to developed countries laws, are in abdicate. individuals square measure taking job in their scrap yards as a result of it offers them tight wages to measure and infrequently kids square measure seizing their jobs, that square measure terribly dangerous for his or her health. Surroundings in developed countries is paying a lot of specialize in priority over the profit drawing specially in business and economy, and innovation in own hometown than social control of laws. It's not higher to ship developed countries electronic waste to alternative countries for disposal rather than- proper strategies ought to be created to recycle most element utilized in producing and usage of minimum dangerous chemicals and last although to dispose their e-waste, disposal should be complete 100% eco-friendly method.

It will be higher to use completely different chemical composition for brand new discovery in order that single chemical won't reside in atmosphere in abundance, as a result of the abundance presence of specific component will cause major dangerous effects.

One way that EU has adopted, that is kind of spectacular conjointly is- once producing associate degree instrumentality, manufacturer is accountable financially or physically for his or her instrumentality, until their survivability- that arises a competitive encouragement for corporations to set up greener merchandise (Wikibooks, 2002).

The strategies, operations that China, Republic of India and Islamic Republic of Pakistan has adopted- that's the e-waste usage and discarding square measure extraordinarily polluting and is extremely unhealthy for humans. Examples as well as open burning of plastic waste, exposure of virulent solders, stream selling of acids, and widespread general selling.

In developing countries stakeholders customers square measure probing for smart facility however cheaper product. In keeping with Basel Action Network administrator Jim Pockett- once associate degree electronic waste is taken for recycler, eightieth of that material is loaded in instrumentality ship, aiming to countries like Republic of India, China, Pakistan, wherever the worst happens to that (Wikibooks, 2002).

In developing countries stakeholders /customers square measure probing for heaper smart facility profitable product, once a budget word comes means that comprising with the weather utilized in the manufacture of product, as star merchandise square measure very little expensive however a lot of surroundings friendly ;this a good drawback as in developing countries versus developed countries price of currencies encompasses a large distinction that also plays a key role in selecting the merchandise, moreover as makes a good gap within the non-public sector businesses.

POLICIES IN DEVELOPED COUNTRIES

Many government programs round the world nowadays centered on environmental property, are exploring technology initiatives for reducing greenhouse gases. As an example, the ministry of science, technology and innovation, of Denmark's efforts for Green IT institution and another example is from

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

the ministry of economy, trade and business of Japan- that established Green IT initiative, which give a robust model of Green innovation policy.

The two organizations people example USA Department of Energy (DOE) and therefore USA Environmental Protection Agency (EPA) has also initiated within the field of Green ICT. Technology is also necessary to in also necessary to Green innovation however strategic public policy is crucial. To encourage clean energy projects, the USA administrations has dedicated $71 billion US to scrub energy funding with a supplementary people $20 billion for loan assurance and tax input (Araya, 2010).

The temperature change at (2008) sets a wrongfully binding objective for diminish kingdom greenhouse gas emission by eightieth from 1990 levels by 2050 (Porritt, 2010).

In Australian Government's ICT property set up 2010-15 Tony Chan pointed plans and actions for the agencies to reduce their unharnessed (Chan, 2010).

The ROHS (Restriction of the utilization of bound venturesome Substances in Electrical and Electronic equipment) laws (directive 2004/95/EC), operative since thirteen February 2003, is marked because the initial law within the world that limits the utilization (2004/95/EC), operative since thirteen February 2003, is marked because the initial law within the world that limits the utilization of venturesome substances in electrical and equipment.

Six nephrotoxic substances are constricted: lead, mercury, cadmium, hexavalent atomic number 24, poly brominates biphenyls (PVV) and poly brominates diphenyl ethers (PEDS). For metallic elements, the most worth that is been set is 0.01%, that is Associate in Nursing exception case and for others it's been thought about the worth shouldn't exceed 0.1%.

The WEEE (Waste Electrical and electronic equipment) legislation (directive 2002/96/EC) has conjointly are available in force on thirteen February 2003.This regulation is regarding assortment, utilization and return of electronic merchandise. It's supported take back system wherever the used product will be came back by the shoppers that are freed from price and also the authority is given to the assembly team for managing e-waste properly (Hanne, 2011). Green grid pool may be a tremendous initiative. It is a world association of corporations devoted to developing and endorses standards, measuring methodology, processes and new technologies that lead to energy potency in information centers (The Green Grid, 2010).

POLICIES IN DEVELOPING COUNTRIES

In Kobenhavn summit, Republic of India has committed to reduce IT emission by 20-25% as compared to the 2005 emission levels. For Green Republic of India, Government of Republic of India, ministry of environment and forest (2011) has conjointly initiated few steps beneath National Action set up on Climate Change (NAPCC). They need projected tentative action set up for implementation of Green Republic of India mission throughout 2011 to 2012 (Kavita Suryawanshi, 2012).

To control Associate in nursing increasing downside in Africa, Safaricom has initiated Associate in nursing e-waste theme in African nation, in conjunction with African nation. In Africa, most of the utilization is finished on a straightforward go, casual, free basis typically in wild ungoverned dumpsites or landfills. The problem is that the majority African countries don't however have policies in situ to support the established of e-waste plants. Republic of Zambia alone has regarding ten million mobile users, the estimation is given by the Republic of Zambia info and Communication Technology Authority (ZICTA) that is that the regulator of states medium sector. Most of the countries are counterfeit devices

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

from China that simply last many months and are disposal of carelessly. AS compared to different regions the usage of electrical Associate in nursing equipment isn't to it extent high however still it's increasing in an unpleasant part (Malakata, 2014).

MAIN PROBLEM AND ISSUES

As we all know that these days the most issue is that the manufactures are making ready such devices that are however additional economical and correct however they use additional energy and evolve terribly toxics, dangerous gases and chemicals. Several physical science firms particularly in pc use lead, mercury, metal and different toxics chemicals. It's been calculated that in producing of computers will four to eight pounds of lead alone.

According to a replacement analysis it's calculable that computers and different physical science devices form up two-fifth of all lead in land-fills on the planet. Thanks to this reason pollution is increasing terribly quickly. Information center servers use fifty times additional the energy per sq. ft. as in workplace. Information centers are the most energy consumption sources. In a survey in America energy consumed by information center in USA and every one over the globe are going to be doubled in next few years.

DISTINCTIVE FEATURES OF A GREEN COMPUTER

Green pc options facilitate in crucial whether or not the pc users obtain is actually green or not. Most computer makers have introduced a series of green PCs, however don't investigate the subsequent options to establish however green their computers are.

- **Low Use of Risky Elements:** Plenty of risky substances are utilized in the assembly of a pc starting from the additional deadly ones like metal, lead, chromium, and mercury to the comparatively less risky ones like flame retardants, pesticides, and chlorinated plastics. A Green PC parts ought to ideally be fully freed from these deadly substances; so IEEE environmental performance criteria needs the makers of green computers to expressly declare the share composition of those substances on the merchandise. As for the less risky substances, the main focus is on reduction of their use, since their elimination might not be fully doable.
- Energy potency is one among the options of Green Computers that pleases not solely the environmental enthusiasts however conjointly the budget-conscious purchaser. Each Green PC can have associate energy star rating on that, and therefore the additional the celebrities the additional energy economical the pare going to be. Some Green computers are accessible with the choice of running them on renewable energy like solar power that the makers can provide with all the desired accessories.
    - **Recycled Materials Used for Manufacturing:** A really Green PC can have most of its parts, particularly the plastic ones, made from recycled materials. So, the makers are needed to declare of recycled material utilized in the assembly of the PC and it ought to be with minimum thresholds at 10 percent. However, it's additional environmentally friendly to decide on a PC designed with quite twenty-five % of recycled material. Ideally, computer circuit boards are the sole things which will not contain recycled material.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- **Finish of Life Recovery:** The Green computers are designed in such how that at the tip of their life their parts is simply reused, disassembled, or recycled. A minimum of sixty fifth of the components of the pc ought to be useful or reusable. Apparently, a number of the higher brands of Green computers guarantee a minimum of ninetieth reusable or useful components. Also, the components that are risky ought to be marked consequently for straight forward identification and skilled handling.
- **Use of Renewable and Bio-Based Materials:** Another of the necessary inexperienced pc feature is that the accumulated use of renewable or bio-based materials. once more a minimum of 10% of such materials ought to be utilized in the production of the Green PC parts, and therefore the same should be declared.
- **Longer Life:** Green computers are available standard and upgradeable styles with the thought of extending their life cycle. The makers are needed to produce a minimum of three years warrant or guarantee, and that they should conjointly ensure that the replacement components are going to be created accessible to all or any patron's up to a minimum of 5 years and this is often definitely an honest reason to shop for a Green PC.
- **Finish of Life Take-Back Facility:** Each Green PC comes with a take back policy, whereby the manufacturer provisions to require back the pc at the tip of its life and provide the customer a replacement purchase at a competitive worth. Hence, it's obligatory to verify the complete of Green PC in shopping for or taking back.
- **Manufacturer's Certification:** Before decide on a selected complete of inexperienced computers, should make sure that its manufacturer has ISO-14001 certification, that is that the clean minimum for a manufacturer to qualify as environmental policy compliant.
- **Packaging Material:** More the question of the fabric utilized in useful packages too necessary. Therefore, checking the packaging material details is essential to check that the fabric used is totally non-toxic and a minimum of ninetieth of it's useful. It'll be even higher if the packaging is formed of recycled material.
- **EPEAT Ratings:** Before creating the ultimate call of the acquisition slightly of analysis on WWW.epeat.net, wherever all Green computers and laptops are allotted a rating and. Clearly tell however green the pc is and with this the buyer can notice careful reports on however every of those computers score on the various environmental criteria.

WORK IN GREEN COMPUTING

Today computers play important role in our lives. Computers are the wealth of data of internet. It's in no time in communication and to share alternative peoples. These are its smart qualities however it takes plenty of energy to form, package, and store and move knowledge from one place to alternative once technology changes then the computer are drop during lowland. It's a significant downside and it produces pollution. Once Manufacturer Company prepares computers, then these use lead, cadmium, mercury and alternative cytotoxic materials. It's been calculable that four to 8 pound of lead alone is employed during a single pc. Computers and alternative physics create (2/5) of all lead in lowland, because of this reason it's realizing that Green PC ought to introduce. Within the starting in computers it had been given attention their speed, worth and price. However currently it's tried that these devices use less and less energy. Currently such material is developed that is a lot of green and cytotoxic material is exchange by

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

them. It has been guessed that carbonic acid gas emission, heating and climate changes are becoming hotter to hotter. It is calculable that out $250 billion power per annum is spent within which V-day of that power is spent on computing. Faster processor use a lot of energy and slower or inefficient processor may additionally use double power that is that the wastage of energy in style of heat that produce pollution in the environment. The waste heat conjointly causes reliability issues in central processing unit because it might crash because of abundant temperature. Equally he facility offer that are used in PC are inefficient. It has been calculable that these are forty seventh of total offers. However currently power offer technology has been changed, as a result of it's accepted that each one components of pc rely upon power offer. That the economical and low energy consumption is introduced. Currently eightieth offer are a lot of economical. Software package that manage power are also facilitate the PC to sleep or log of or hibernate once computer isn't in use.

GREEN COMPUTING, PROBLEMS AND ADVANTAGES

1. In engineering virtualization is an incredibly vital effective tool. It's value effective, Green energy and efficient computing. During this tool the most servers is split into multiple virtual machines that facilitate the server to run completely different applications. By exploitation this system corporations will enhance their server utilization rates.
2. The businesses ought to manufacture such processors that use low energy. Intel, Sun and Advance small Devices (AMD) are currently attempting to manufacture such processor. Sun has designed multicore processors that are terribly economical regarding fuel.
3. In computers power choice setting is additionally useful, within which sleep mode is active, once the system isn't working. It's an honest follow. These features are often set through PC's control board. It takes PC's in standby mode and switch off the monitor, once laptop is in idle mode.
4. It's conjointly determined that flat monitor use less energy than electron beam tube (CRT) monitor. Liquid display (LCD) uses terribly low energy than typical monitor.
5. Disk drives take less power than alternative physical components of PC. Currently solid state drives as flash memory or DRAM is accustomed store knowledge. They take less energy as a result of they need no moving half, so the energy consumption could also be reduced as compared to the disk.
6. We must always use print paper only if we'd like. We will browse soft copy. If we wish textual matter (print copy), we ought to use such variety of printers that have the capability to print the paper each aspect. It reduces paper consumption and energy consumption. Recycled used ink in powder type and toner of the printer are often used again.
7. Screen savers are active once system is in idle state, if we have a tendency to permit the monitor to travel to standby mode throughout idle state of the PC. It'll conjointly decrease energy consumption.
8. PC manufacturer ought to design such a variety of pcs which might be battery-powered from non-typical sources of energy like Sun energy, air energy, pedaling a motorbike, turning a hand crank etc.
9. In pc some devices also are vital. Video card, graphic card, 3D performance software package take a really great amount of energy. If we have a tendency to use older video card, these cards use very little power. In these cards, there is not a heat sink or fan. Green Computing will facilitate United States of America to secure and safe place for United States of America within the world. If every

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

person attempts to save the atmosphere, then our mother earth can healthy and happy for survival. Here are given some advantages of Green computing, it helps United States of America to scale back the quantity of pollution in air or close. It saves the facility consumption and reduces the quantity of warmth that evolved the merchandise. It conjointly reduces the pressure on paper trade that could be a main issue. Renewable resources are inspired to use once more Green Computing facilitate to market the effective utilization of natural resources. It conjointly promotes United States of America to avoid such merchandise that destroys green computing.

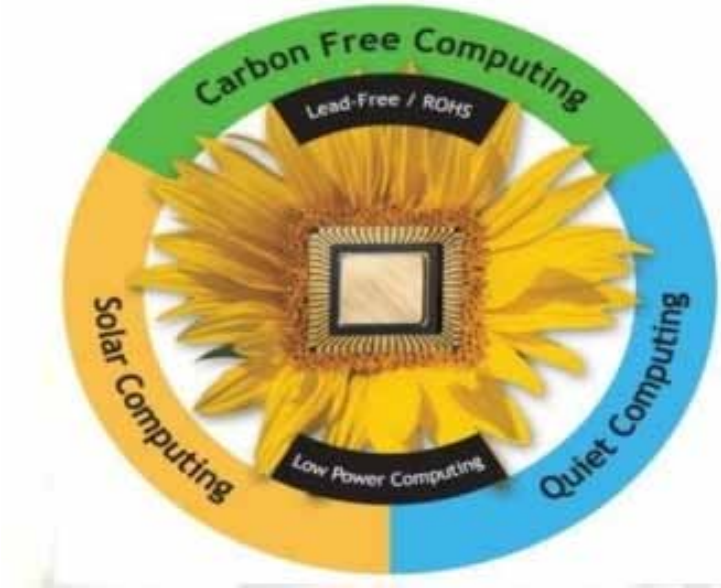
AN EXAMPLE OF VIA TECHNOLOGIES GREEN COMPUTING

VIA Technologies, a Taiwanese company that manufactures motherboard chipsets, CPUs, and alternative element, introduced its initiative for "green computing" in 2001. With this green vision, the corporate has been that specialize in power potency throughout the look and producing process of its merchandise. Its environmentally friendly merchandise area unit factory-made employing a vary of fresh computing ways, and also the company is endeavor to coach markets on the advantages of green computing for the sake of the setting, additionally as productivity and overall user expertise.

Carbon-Free Computing

One of the VIA Technologies' concepts is to scale back the "carbon footprint" of users — the number of greenhouse gases created, measured in units of dioxide (CO_2). Greenhouse gases naturally blanket the planet and area unit answerable for its additional or less stable temperature. A rise within the concentration of the most greenhouse gases – dioxide, methane, inhalation general anesthetic, concentration of

Figure 5. Green computing



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

the most greenhouse gases — dioxide, methane, inhalation general anesthetic, and fluorocarbons — is believed to be answerable for Earth's increasing temperature, that could lead on to severe floods and droughts, rising ocean levels, and alternative environmental effects, touching each life and the world's economy. When the 1997 city Protocol for the international organization Framework Convention on Climate amendment, the globe has finally taken the primary step in reducing emissions. The emissions area unit mainly a results of fossil-fuel-burning power plants. (In the us, such electricity generation is answerable for thirty-eight PC of the country's dioxide emissions.) VIA aims to supply the world's 1st laptop merchandise certified carbon free, taking responsibility for the amounts of greenhouse gas they emit. The corporate works with environmental consultants to calculate the electricity used by the device over its life, typically 3 years. From this information, one will conclude what quantity carbon dioxide the device can emit into the atmosphere throughout its operation. This estimate can serve as associate degree indicator, and also the company can pay regional organizations for the – sequestering, or offsetting, of the emissions. Counteractive dioxide are often achieved in numerous ways in which, one way is to plant trees that absorb greenhouse gas as they grow, within the region within which the processors were purchased. The necessary quantity of trees per processor is described by VIA's Tree Mark scoring system. VIA promotes the employment of such energy sources as solar energy, thus power plants would not go to bum the maximum amount fossil fuels, reducing the number of energy used. Wetlands conjointly offer a good service in sequestering a number of the dioxide emitted into the atmosphere through they create up solely four to PC of the Earth's terra firma, wetlands area unit capable of interesting twenty-five PC of the atmospheric dioxide. VIA is functioning closely with organizations answerable for protective wetlands and alternative natural habitats, et al United Nations agency support intensive use programs for ICT equipment. The numbers paid to those organizations are described by a proportion of the carbon free product's worth. Carbon-emissions management has been key issues for several corporations United Nations agency have expressed a firm commitment to property. Dingle could be a ideal of an organization with an inexperienced image, known for its free worldwide product-recycling program. Dell's Plant a Tree on behalf of me project permits customers to offset their carbon emission by paying an additional $2 to $4, counting on the merchandise purchased. AMD, a world chip manufacturer, is additionally operating toward reducing energy consumption in its merchandise, reducing on unsafe waste and reducing its eco-impact. The company's use of silicon-on-insulator (SOI) technology in its producing, and strained semiconductor capping films on transistors (known as dual stress liner technology), have contributed to reduced power consumption in its merchandise.

Solar Computing

Amid the international race toward alternative-energy sources, VIA is setting its eyes on the sun, and also the company's star Computing initiative could be a vital a part of its green-computing comes. For that purpose, VIA partnered with Motech Industries, one among the most important producers of star cells worldwide. Solar cells match VIA's power economical semiconductor, platform, and system technologies and alter the corporate to develop totally solar powered devices that area unit nonpolluting silent, and extremely reliable. star cells need little or no maintenance throughout their life, and once initial installation price area unit lined, they supply energy at just about no price. Worldwide production of solar cells has raised chop-chop over the previous couple of years; and as additional governments begin to acknowledge the advantages of solar energy, and also the development of electrical phenomenon technologies goes on, costs are expected to still decline. As a part expected to still decline. As a part

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

of VIA's ——pc-1 initiative, the corporate established the first-ever solar-powered cyber civic center within the Pacific, powered entirely by star technology.

Quiet Computing

A central goal of VIA's green-computing initiative is that the development of energy-efficient platforms for low-power, small-form issue (SFF) computing devices. In 2005, the corporate introduced the VIA C7-M and VIA C7 processors that have a most power consumption of a pair of0W at 2.0GHz and a median power consumption of 1W. These energy-efficient processors turn out over fourfold less carbon throughout their operation and may be expeditiously embedded in solar- powered devices. VIA isn't the sole company to handle environmental concerns: Intel, the world's largest semiconductor maker, disclosed eco-friendly merchandise at a recent conference in London. The company uses virtualization computer code, a method that allows Intel to mix many physical systems into a virtual machine that runs on one, powerful base system, so considerably reducing power consumption. Earlier this year, Intel joined Google, Microsoft, and alternative corporations within the launch of the Climate Savers Computing Initiative that commits businesses to fulfill the Environmental Protection Agency's Energy Star tips for energy-efficient devices. Kevin Fisher, Intel's EU standards director, says that whereas the corporate is devoted to its green-computing plans, it's vital to not blame the IT business alone for carbon emissions worldwide. He argues that the business conjointly helps in saving vast amounts of power thanks to the web, enabling, as an example, on-line looking and asking. Worldwide, standby power is calculable to account for the maximum amount as one PC of worldwide greenhouse emissions. Most of the energy utilized by merchandise on standby doesn't result any helpful perform. A small amount are often required for maintaining memory or an enclosed clock, remote-control activation, or alternative features; however most standby power is wasted energy. Energy Star–enabled merchandise minimizes this waste.

STEPS TO GREEN COMPUTING

1. Develop a property inexperienced computing set up. See the business leaders the weather that ought to be factored into such a concept, as well as structure policies and checklists. Such a concept ought to embrace utilization policies, recommendations for disposal of used instrumentation, government pointers and proposals for buying proposals for buying green PC instrumentation. Green Computing best practices and policies ought to cowl power usage, reduction of paper Consumption, in addition as recommendations for brand spanking new instrumentation and utilization recent machines. Organizational policies ought to embrace communication and implementation.
2. Recycle Discard used or unwanted equipment in a very convenient and environmentally accountable manner. Computers have poison metals and pollutants that may emit harmful emissions into the setting. ne'er discard computers in a very lowland. Recycle them instead through manufacturer programs like HP's Planet Partners utilization service or utilization facilities in your community. Or give still-working computers to a non-profit agency.
3. Create environmentally sound purchase choices. Purchase Electronic Product Environmental Assessment Tool registered product. EPEAT could be a procurance tool promoted by the non-profit-making in experienced physical science Council to:

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

a. Facilitate institutional purchaser's measure, compare and choose desktop computers, notebooks and monitors supported environmental attributes.
b. Give a transparent, consistent set of performance criteria for the planning of product.
c. Acknowledge manufacturer efforts to scale back the environmental impact of product by reducing or eliminating environmentally sensitive materials, planning for longevity and reducing packaging materials.

4. Scale back Paper Consumption. There square measure several simple, obvious ways that to scale back paper consumption: email, electronic archiving, and use the ——track changes feature in electronic documents, instead of separate corrections on paper. after you do print out documents, make certain to use either side of the paper, recycle frequently, use smaller fonts and margins, and by selection print needed pages.
5. Conserve energy close up your pc after you understand you won't use it for associate degree extended amount of your time. Activate power management options throughout shorter periods of inactivity. Power management permits monitors and computers to enter low-power states once sitting idle. By merely striking the keyboard or moving the mouse, the pc or monitors awakens from its low power sleep mode in seconds. Power management techniques will save energy and facilitate shield the setting.

SUSTAINING THE LONGER TERM

- The greatest challenges for businesses making an attempt to be eco-responsible square measure very understanding what that basically means that, and then creating changes that square measure property over time, whereas adding business worth.
- Another challenge is leveling the requirements of assorted stakeholders United Nations agency every have completely differently ideas of what changes ought to be created. Some environment non- governmental organizations would really like sure flame retardants far from electronic product, whereas the fireplace safety community thinks. About removing or dynamical flame retardants in physical science. One drawback is that the substitute replacements square measure fairly new, they need not been essentially assessed with identical rigor applied to the first materials.

SOLUTIONS TO BE ADOPTED

As E-waste square measure originating day by day in developed countries and even turning into issues for everybody, thus currently it's time to scale back the impact of e-waste and to require a necessary steps towards Green Computing to create our surroundings clean and free from all this sort of nephrotoxic chemicals. One amongst the solutions concerning this be in and of itself the countries particularly focusing towards the developing countries should ought to undergo the policies strictly or to adopt this policy seriously that the govt. are secure.

The developing countries should conjointly avoid into take a waste from the developed countries at low cost. Victimization them for producing of another product that price them low cost as doing so. Another resolution may be with the contribution of voters in addition because the manufacturers/producers. The voters or customers may contribute towards this by creating their desirable option to buy

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

those electronic products which might be recycled or it may be use and conjointly those that contains a less nephrotoxic chemicals.

In academic institutes create Green IT subject a required one instead of associate degree nonobligatory one, in order that new ideas may be developed by students, supported green IT and there upon on innovation during this field that would create product a lot of cheaper and fewer venturesome and may have the skills to draw in a lot of customers than traditional product. By introducing in academic establishments is that the solely thanks to invite a lot of project and ideas. Awards, scholarships ought to be created to extend a lot of and a lot of contribution during this field. Awareness among public is needed however what if cheaper healthy product square measure launched in market positively individuals can get drawn to get them. Like on each health venturesome product warning is come back same approach on electronic gadgets it ought to be written weather it's green product or not. Government ought to charge further tax on those corporation that aren't following Green ICT rules as well as not manufacturing green ICT product.

CONCLUSION

Green computing represents an accountable thanks to address the problem of worldwide warming. By adopting green computing practices, business leaders will contribute completely to setting stewardship—and shield the environment whereas conjointly reducing energy and paper prices.

REFERENCES

Araya, D. (2010). ICTs and the Green Economy.

Chan, T. (2010). Inside the Australian Govt. ICT sustainability plan 2010-2015.

Depavath, H. (2008). Emerging trends in Green IT.

Hanne, F. Z. (2011). Green IT: Why Developing Countries Should Care. *International Journal of Computer Science Issues*, *8*(4).

Info-tech. (2009). Green IT: Why Mid-Size Companies Are Investing Now.

Malakata M. (2014). Safari.com to tackle Kenya's growing e-waste problem.

Porritt, J. (2010). Green IT a global benchmark".

Rana, P. (2010). Green Computing Saves Green. *International Journal of Advanced Computer and Mathematical Sciences*, *1*(1), 45–51.

Suryawanshi, K. (2012). Green ICT implementation at Professional Education Institutions.

Taruna, S. (2014). Green Computing in Developed and Developing Countries.

The Green Grid. (2010). About the green grid. Retrieved from http:/www.the greengrid.org/about-thegreen-grid

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Wikibooks. (2002). The computer revolution/computers and environment/disposal/recycling. Retrieved from http://en.wikibooks.org/wiki/The_Computer_Revolution/Computers_and_Environment/Disposal/Recycling

Williams, J., & Curtis, L. (2008). Green: The new computing coat of arms? *IT Professional Magazine*, *10*(1), 12.

This research was previously published in Cloud Computing Technologies for Green Enterprises edited by Kashif Munir, pages 200-223, copyright year 2018 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 34
Green Specifications:
A Concrete Example

Thomas Schulze
University of Mannheim, Germany

Colin Atkinson
University of Mannheim, Germany

ABSTRACT

Green specifications provide a foundation for reducing the environmental impact of computing applications and improving the consumption behavior of users by providing a clear and precise specification of the environmental impact of specific services. They can either be used to specify the actual behavior and environmental impact of existing services or to define the requirements that a to-be-built service must fulfill. Green specifications describe the properties of a service from distinct viewpoints such as a structural viewpoint which describes the data types and external components that the service uses, a functional viewpoint which describes the effects of the service's operations using pre- and post- conditions and a behavioral viewpoint which describes the externally visible states and transitions exhibited by the service. These are augmented with non-functional information describing the environmental properties of, or constraints on, the service. In this chapter we provide an introduction to green specifications and give a concrete example of their use to specify a Video on Demand (VoD) service.

INTRODUCTION

With the growing impact of computing on global warming, it is imperative that the environmental cost of IT services be reduced and that the consumption behavior of users be moderated. Green specifications (Atkinson & Schulze, 2013; Atkinson, Schulze & Klingert, 2014) provide the foundation for these improvements by providing clear and widely-understandable descriptions of the environmental cost of computing services in relation to what they do. They can either be used to describe the as-is properties of an existing service, or the required properties of a yet-to-be-built service. Only when both of these elements are unified (i.e. provided functionality and environmental impact) is it possible for service providers to arrive at optimal tradeoffs and for users to make the most informed consumption choice.

DOI: 10.4018/978-1-5225-7915-1.ch034

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The goal of this chapter is to provide a concrete example of green specifications applied to the specification of a realistic service, and to show how they can be used to reduce the impact of consumption of the service on the environment. The chosen example, a Video on Demand (VoD) service is a highly relevant one because a recent study by Sandvine stated that the two video streaming services Netflix and YouTube account for about 50% of all North American downstream traffic. In this chapter we therefore use green specifications to describe the required properties of an exemplary, yet-to-be-built VoD system which we call SoftFlix. Although exemplary, we have strived to make the functionality and environmental costs of the service as realistic as possible.

The concept of green specifications is a general one, and in principle any existing specification technique can be enhanced to make it "green". However, to have maximum impact green specifications need to be understandable by the largest possible range of stakeholders in IT services, not just the service providers and system implementers. The green specification approach we apply in this chapter is therefore based on a simple yet comprehensive specification technique specifically developed to support widely-understandable specifications – the KobrA method (Atkinson., Bayer & Muthig, 2000). This makes extensive use of graphical UML diagrams and tables to describe the required properties of services from various different viewpoints.

In the next section we provide the necessary background needed to understand the green specifications described in this chapter. In particular we describe the relevant features of the KobrA development method, the concept of GreenSLAs, which provide a stepping stone to the notion of green specifications, and other existing optimization techniques which are used today to improve the efficiency of IT service. In section 3 that follows, we then introduce the SoftFlix VoD example and show how it can be specified using the standard KobrA approach. Section 4 continues by showing how the standard KobrA models from section 3 can be enhanced into green specifications by adding appropriate environmental impact constrains. In section 5 we then present some scenarios in which the information in the green specifications is used to enhance the eco-efficiency of the SoftFlix VoD service. In section 6 and 7 we provide an outlook on future work and conclude with some closing remarks.

BACKGROUND

In the past decade many optimization methods have been developed and applied to reduce the energy consumption and environmental impact of computing services. Green specifications make it possible to maximize the effect of some of them. In the following we will therefore provide the necessary background to understand why certain measures of green specifications lead to a reduction of the environmental impact. Furthermore, we will describe the KobrA approach in short, which is used in our example to specify the SoftFlix VoD service.

Existing Optimization Techniques

Recently developed optimization techniques operate at different levels of abstraction. The first, and most straight forward approach is to optimize the infrastructure. In data centers this includes the optimization of ESFs (Energy Storage Facilities) and HVAC (heating, ventilation, and air conditioning) systems as well as the actual servers. Especially since the invention of the PUE (power usage effectiveness) metric, the

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

focus has narrowed towards the reduction of the energy consumption of the first. Free Air Cooling and other energy efficient HVAC systems make it possible to save large amounts of energy. The separation of cold and hot air in different isles enables further reductions. Furthermore, the development of new more energy efficient yet more robust server hardware allows higher room temperatures. In addition ice storage facilities can be installed in data centers to support HVAC systems during times where less renewable energy is available. By introducing these measures huge amounts of energy (i.e. 50 per cent and more) can be saved.

However, all of these approaches have one thing in common: They require large investments in new infrastructure equipment. Therefore, other approaches have been developed which focus on optimizing the utilization of the already existing infrastructure. The most prominent example is the technique of virtualization. By arranging for multiple user instances to share the same hardware infrastructure fewer servers are needed. In the European Union project FIT4Green (Basmadjian et al., 2010) for instance the framework plug4green was developed which consolidates virtual machines to fewer servers and dynamically switches off unneeded ones. On average these techniques led to savings of more than 20 per cent in a cloud data center. As well as maximizing resource utilization, virtualization allows computing tasks to be shifted in time or space to better fit the availability of renewable energy. As renewable energy sources like solar or wind are not always available, shifting utilization times can have a dramatic effect on CO_2 emissions. The two European Union Projects All4Green (Basmadjian et al., 2013) and DC4Cities (DC4Cities, 2014) are developing approaches to maximize the ability to use these techniques. However, virtualization is just one way to optimize utilization. Frequency scaling is another way to reduce the energy consumption in times of low utilization. Here, the frequency of the CPU or GPU is lowered. In addition, stand by modes have been developed that significantly reduce the time needed to startup servers. This means that they can be switched to standby mode in situations where they would normally have been kept switched on and kept operating in idle mode.

Even in data centers where all of the above mentioned optimization techniques are applied, it is possible to further reduce the energy consumption or environmental impact. Service Level Agreements (SLAs) are contracts between the data center provider and the customers specifying the rights and duties of both sides. One example is the guarantee term of an availability of 99.99 per cent which means that the service must be running 99.99 per cent of the time. While SLAs grant the customer a certain quality of service at the same time they restricts the data center in their range of possible optimization techniques. GreenSLAs have been proposed as a way to make SLAs more environmental friendly, by introducing more flexibility and environmental constraints. By using GreenSLAs, a customer can for instance define a lower availability during weekend and night times, which leads to reduced energy consumption. This frees the provider from having to guarantee continuous higher availability which would mean that more redundant infrastructure needs to be available therefore consuming more energy. The monetary gains derived by the data center can be partially forwarded as a reward to the customer as an incentive to provide the data center with these flexibilities in the first place. This leads to a win-win situation. GreenSLAs operate on the same service independent level as traditional SLAs. They do not normally focus on application dependent aspects. Green specifications build on the idea of GreenSLAs but apply them on an application dependent level thereby further extending the benefits of this technique.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

KobrA

The KobrA method (Atkinson., Bayer & Muthig, 2000) was defined in 2001 at a time when component-based development and model driven development were emerging as promising new technologies to provide developers with a means for describing the former (components) using the latter (UML models). Its solution was to adopt an inherently view-based approach to component specifications by strictly prescribing how different UML diagrams and tabular operation specifications should be used to model the properties of components from distinct perspectives. KobrA's basic strategy for doing this is illustrated schematically in Figure 1 which shows a system (i.e. service) containing three components, the second of which is contained within the first and the third of which is contained in the second. The system and the components are represented by the three cubes and the views of them by the artifacts surrounding them.

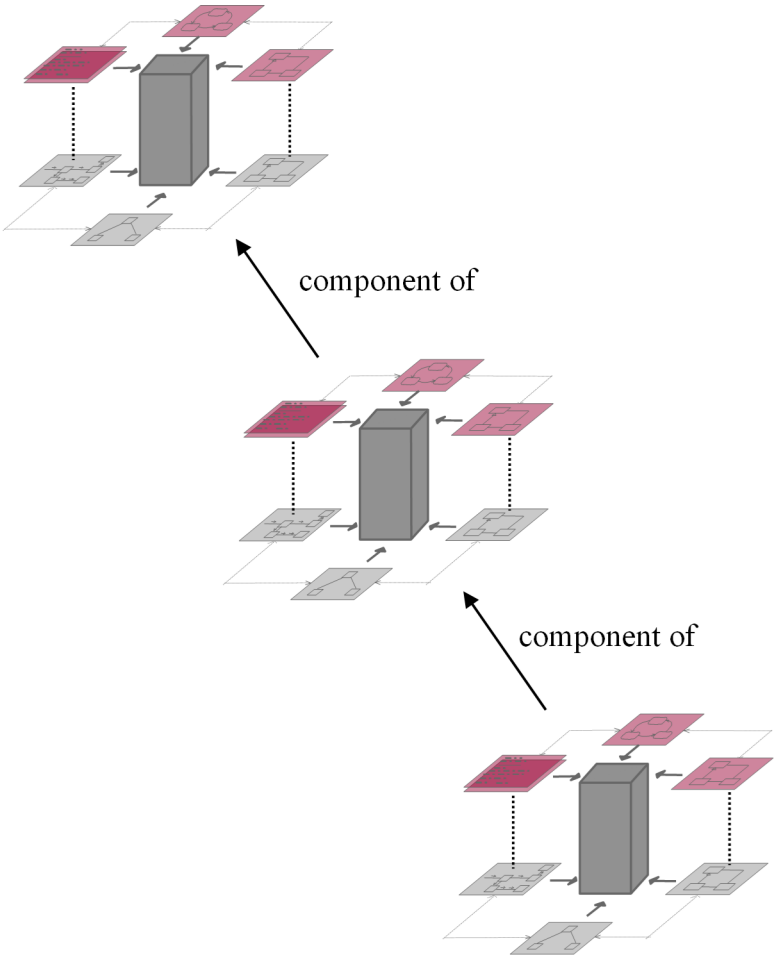
KobrA defines four basic principles by which UML diagrams and operation specifications should be used to describe the properties of a system or component:

- **Uniformity.** The principle of uniformity states that all stable, behavior-rich objects (i.e. architectural components) in a system should be modeled in the same basic way. This is the principle that dictates that a complete system (which in a sense is just a large component) be modeled in the same way as a simple data structure (e.g. a Hashtable). This is shown in Figure 1 by the fact that the top cube (representing the system) has the same constellation of views surrounding it as the other cubes (representing nested subcomponents).
- **Encapsulation.** The principle of encapsulation requires that all components be modeled from two perspectives – an external, black-box perspective from the viewpoint of clients of the component, and an internal, white-box perspective from the viewpoint of implementers of the component. The former viewpoint is called the specification of the component and the latter is called the realization of the component. In Figure 1 the upper set of views of a component (i.e. a cube), represent the specification views and the lower set of views represent the realization views. For the purposes of system or component specification, only the upper, purple views are relevant.
- **Locality.** The principle of locality, which is perhaps the most unusual and idiosyncratic principle of KobrA, requires that every view must be of a component or operation comprising the system (the subject of the view) and if it is explicitly represented in the view as a model element, that element must be specially labelled as being the "subject" of the view. Other components and operations may be modeled in the view, but only one component or operation can be the subject. Note that in Figure 1, every view points to a particular component (i.e. cube), which is the subject of the view.
- **Parsimony.** The principle of parsimony requires every view to contain exactly the right amount of information (i.e. model elements) needed to describe the properties of the subject from the perspective of that viewpoint – no more and no less. KobrA provides an extensive list of guidelines prescribing what type of UML elements, or textual elements should be used in each kind of view, and what information should be shown using them.

As mentioned previously, the views that are of relevance for specifying the externally visible properties of a component or system are the upper (purpose) specification views. As can be seen from Figure 1, KobrA specifications are made up of three kinds of specification views –

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 1. KobrA component hierarchy



- **Structural View.** The structural view describes the externally visible types and external components (e.g. services) which the system uses to deliver its own functionality, and takes the form of a UML class diagram. These external components are often called required services in other component models. Because of the principle of parsimony, model elements are only included in the view if they are needed for an understanding of the subject of the component. Moreover, that component/system is included in the view with a special label (i.e. stereotype) "subject" to indicate that it is the focus of the view. The other services/components that are acquired by the subject (i.e. so that it can use their services) are only shown from the perspective of the subject. In other words, only the attributes and methods of the acquired components that are used by the subject are included.
- **Operational View.** The operational view describes the functionality of the component. It is actually composed of a set of tabular operation specifications, each describing the effects of one operation of the component in terms of pre and post conditions. The original KobrA notation used a semi-formal style where the pre-and post-conditions were described in natural language, but with strict references to the information in the structural and behavioral views. A more formal form of

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

operation specifications is also available which uses OCL expressions to define the pre and post conditions. In addition to the precondition (called "assumes") and post condition (called "result"), other possible rows in operation specification tables include a receives clause (the input parameters), a read clause (the referenced global data) and a changes clause (the referenced global data).

- **Behavioral View.** The behavioral view describes the externally visible states and state transitions visible to external users of the component/system and takes the form of a UML state diagram. The transitions in the state diagram correspond to invocations of the operations offered by the service, while the states correspond to situations where different sets of operations can be invoked.

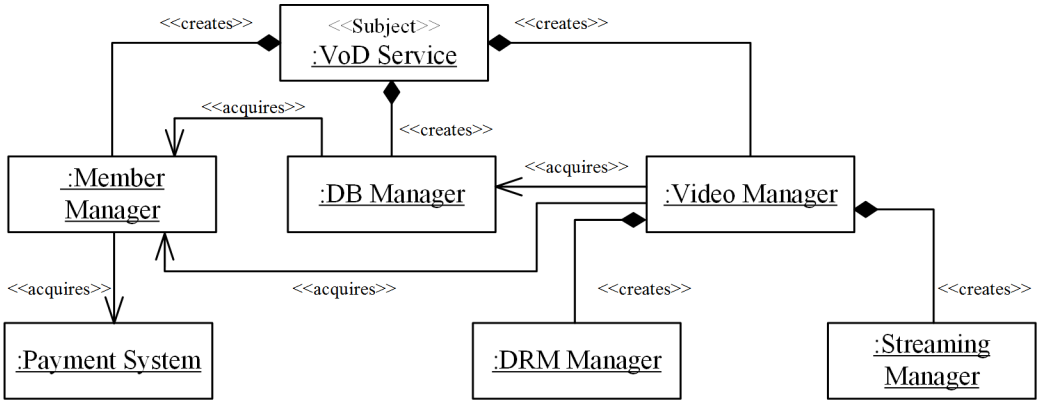
As expressed by the principle of parsimony each of these views should contain only the minimum information necessary to characterize the properties of the components/system from the corresponding viewpoint. In addition KobrA defines a strict set of consistency rules which ensure that the information conveyed in the different views is consistent.

A KOBRA SPECIFICATION OF THE SOFTFLIX VOD SYSTEM

As mentioned previously, the example we will use to illustrate green specifications is a VoD service which we refer to as SoftFlix. More specifically, we focus on specifying the backend of the VoD service. In this section we show the normal KobrA specification for the component. The enhancement of these specification models to create a green specification is then demonstrated in the following section.

Figure 2 shows a high-level component model of the service. It is composed of three high-level components – The Member Manager, the DB Manager and the Video Manager. The Member Manager is responsible for all actions related to the user account like logging in and out, buying videos, as well as creating, modifying or removing information. It acquires the Payment System to handle the purchase of videos and the DB Manager to have access to the database. The DB Manager handles all read, write and query requests, and hides the details of the underlying implementation of the database. The Video Manager manages all actions related to the video itself like adding, removing or querying videos, but also playing or stopping videos. For the latter actions, the subcomponents DRM Manager and Streaming

Figure 2. High-level component model of a VoD service



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Manager are used. The first is responsible for enacting all digital right management actions, whereas the latter handles the streaming of the video to the user. In general, it is not essential to use a component diagram in KobrA. However, we have decided to include it here, as it helps to clarify the context for the diagrams provided in the next sections.

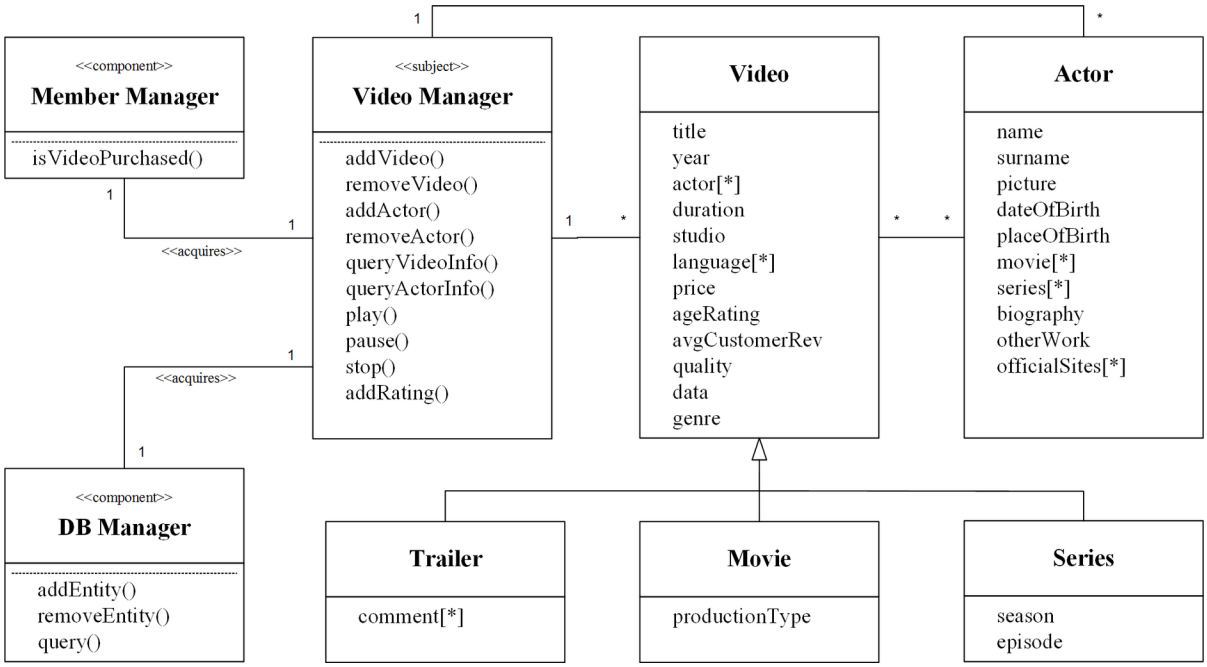
The Structural View

When specifying a software service it is important to characterize the information that is conveyed to the user in a specific context (i.e. the data types passed over its interface). As explained earlier KobrA uses UML class diagrams for this purpose.

Figure 3 shows the structural view specifying the Video Manager component. The Video Manager class is tagged with the stereotype <<subject>> explicitly marking the component for which the structure is described. It therefore sets the context and focus on the video manager. As indicated before, the principle of parsimony in KobrA requires that as little information as necessary is included in the structural specification. This means that nothing is contained in the diagram that does not directly belong to context of the Video Manager and is not visible from the outside. A method, for instance, which converts the video data into the correct format to be stored in the database is not externally visible and therefore not of relevance in the specification. The Video Manager offers ten externally visible methods to add, remove and query videos as well as actors, and provides the possibility to play, pause, stop and rate a video. The exact specification of each method is contained in the operational view described below.

All externally visible information relevant in the context of the video manager is provided and structured into the five classes, Video, Actor, Trailer, Movie and Series, where the latter three are subtypes

Figure 3. Structural view of a KobrA specification on the video manager



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

of Video. The information concerning an actor therefore comprises the name, a picture, the date and place of birth, a biography, other work like theatre plays for instance, a list of official websites as well as a list of movies and a list of series they appeared in.

Furthermore, the two components Member Manager and DB Manager are acquired by the video manager. Again, due to the principle of parsimony only methods that are used in the context of the video manager are represented within this view. Thus, only the method isVideoPurchased() is shown here, even though, as we will show later, the member manager provides much more functionality.

The Operational View

As well as describing the data structures and services used by a service it is important to specify the exact functionality the service provides. In KobrA this is done in a tabular format through so called operation specifications. The most important attributes that are specified are the following:

- **Name:** The name of the operation
- **Description:** A short textual description of what the operation does
- **Receives:** The input parameters
- **Returns:** The output parameters
- **Assumes:** The pre-condition that must be met in order to guarantee the post-condition
- **Result:** The post-condition
- **Constraints:** Restrictions that limit the realization/implementation

For each operation specified in the structural view a functional description should be provided. Operation specifications only contain information that is visible to the outside, i.e. only describe what the operation does and not how it is done.

Table 1 shows the operation specification of the play operation located in the video manager. As explained in the description compartment, it retrieves the video from the database, then enacts DRM methods, namely watermarking and encryption, then encodes it to make it more fault tolerant and finally streams it. Note that even though the play operation actually consists of many steps (i.e. check,

Table 1. A KobrA operation specification for the play operation of the video manager

Name	**play**
Description	The operation checks if the video was purchased, retrieves the video from the database, enacts DRM methods, encodes the video and streams it to the client
Receives	**name**: the name of the video which is supposed to be played **sessionID**: the session ID of the member who wants to watch the video
Returns	A protected and encoded video stream
Assumes	The VoD service has been started and a member has logged in
Result	• It was checked that the video was purchased by the member and was located in the database, • if the video was purchased and was located in the database, it has been retrieved from the database, • the watermark has been included into every frame of the video, • the video has been encrypted, • encoded, and • has been streamed

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

query, apply watermark, encrypt, encode and stream), it is perceived as one operation from the outside. It is, however, plausible to additionally have operation specifications for each of the different steps. For example the operation isVideoPurchased is part of the member manager which is acquired by the video manager (cf. Figure 7). For this method a separate operation specification should be defined. However, it is also used in the first step of the play operation. In terms of implementation, this will therefore be a simple method call in the play method.

The inputs specified in the receives row (Table 1), i.e. sessionID and the name of the video, are used on the one hand to check if the video was purchased and on the other hand to retrieve the video from the database. In case of a successful execution of the operation a protected and encoded video stream is returned as indicated by the return statement. However, in order to be able to execute the operation in the first place, two pre-conditions must be met: (1) the VoD service must have been started and (2) the member must be logged in. This is specified in the assumes row. Finally, the post-conditions are specified, i.e. what happened or has become true on completion of the operation that was not true before.

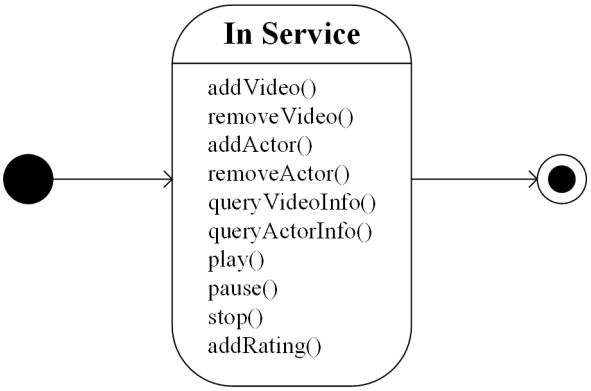
The Behavioral View

The third important topic to address during the specification of the software service is how the system behaves to certain events. The result of each event must be externally visible. In KobrA this is done using UML state chart diagrams.

Figure 4 shows the behavioral specification of the video manager. The state chart consists of only one state: In Service. When the service is in this state each of the ten operations contained within it can be executed. It is possible to add and remove videos and actors, query both video and actor information, play, pause and stop a video and furthermore add a rating to each video. After the execution of each operation, the video manager is again in the In Service state. Note, that every operation specified within the state chart must also be included in the structural specification (Figure 3) and should be specified in an operation specification (see e.g. Table 1).

Noticeably the state chart in Figure 4 is kept very simple. KobrA does not directly specify how detailed the specification should be. In general the rule of thumb is to include as little detail as possible but as much detail as necessary. In the example of the video manager, one could for instance introduce three other states called Video Available, Actor Available and All Available (cf. Figure 5). The intention

Figure 4. Behavioral specification of the video manager



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

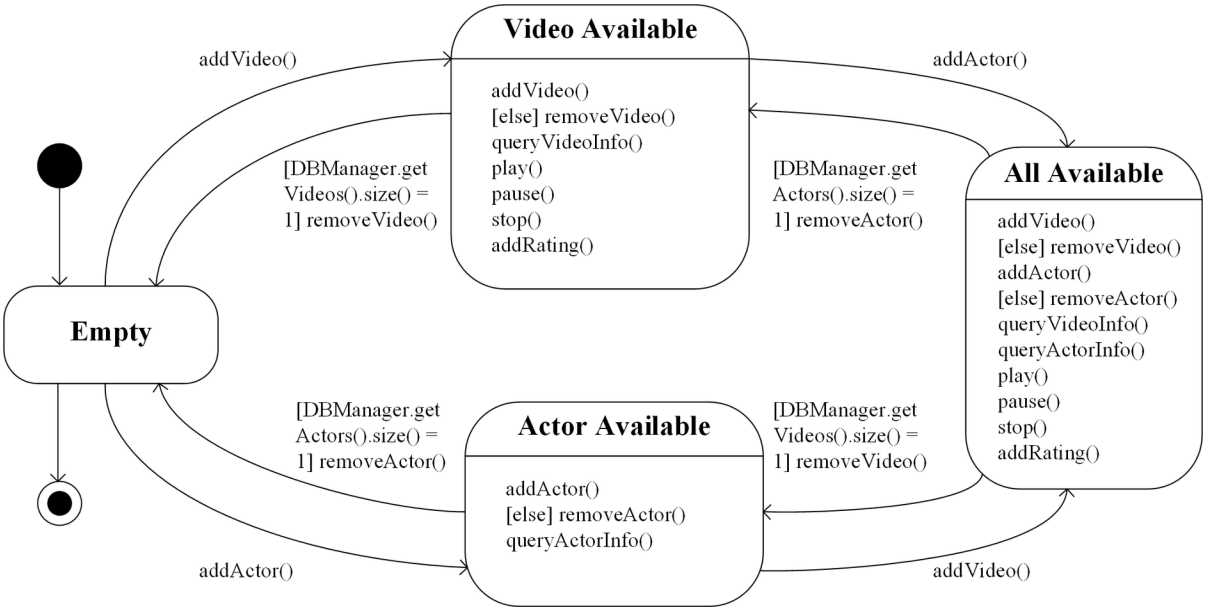
behind this is to explicitly specify that there are states during the first initialization of the VoD service in which not all operations are available due to missing entries in the data base. If there is no video or actor stored (state: Empty), the only possible operations are adding a video or an actor. If a video was added the video manager changes its state to Video Available. In this state it is possible to add another video, query video information, play, pause and stop the video, add a rating and also remove the video. If only one video is available in the data base at the point in time when the operation removeVideo is executed, the state changes to Empty again. In addition it is possible to add an actor. When adding an actor while in the Video Available state, the state changes to All Available, while if the current state is Empty, the state changes to Actor Available. In the latter state, it is only possible to execute operations related to an actor, namely add, remove and query actor information, or to add a video. If a video was added the state again changes to All Available.

It is difficult to give a general answer to the question whether the specification in Figure 5 is better than the one in Figure 4. This depends on the personal assessment of the involved stakeholders concerning the importance of the topic of an empty database. However, normally such a situation should only occur once during the initial setup phase and is therefore typically not of high relevance. The behavioral specification in Figure 4 should therefore meet the needs of a typical situation.

THE GREEN SPECIFICATION OF THE SOFTFLIX VOD SYSTEM

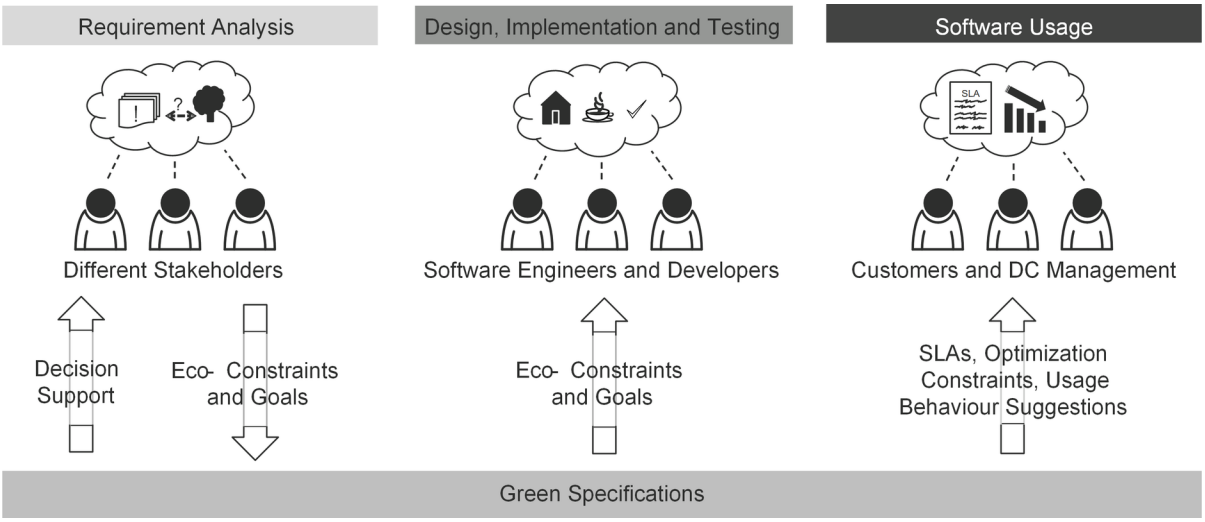
In the following, we will use the KobrA specification described in the previous section as a basis for our green specification of our SoftFlix VoD System. As explained previously, green specifications can be used for two basic purposes. They can be used to describe the as-is properties of an already implemented

Figure 5. More detailed behavioral specification of the video manager



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 6. Impact of green specifications on the different service live-cycle phases



service and they can be used to described the requirements of a yet-to-be built services. In this section we focus on the latter.

Figure 6 shows the impact of green specifications on the different live cycle phases of the service. First green specifications can act as decision support during the requirement analysis. As we will illustrate later in this section, green specifications make it possible to anticipate the effects of the service on the environment based on the consumer's consumption choices. That means on the one hand that the awareness of green concerns is raised and on the other hand that the consumer's ability to balance the benefits of service consumption with the likely effects on the environment is raised. Second, green specifications are used to define constraints and SLA guarantee terms within the requirement process to which the developers and data center personnel have to adhere later in the design, implementation, testing and usage phase. It is for instance possible to limit the amount of energy used by a certain component by inserting the corresponding constraint in the green specification. The developers then have to adhere to this constraint by developing the component in a way that ensures its compliance. Furthermore, it is for example possible to define availability constraints for certain operations or components, i.e. SLA constraints and guarantee terms which have to be taken into consideration by the responsible data center personnel while the service is in use. Even though they are similar to regular GreenSLAs, the inclusion of such SLA terms within a green specification allows a significantly finer level of detail which as we will show shortly increases opportunities to reduce the environmental impact of services.

The Green Structural View

The structural view of the KobrA specification of the video manager (cf. Figure 3) is used as a basis for the structural view of the green specification. In order to be useful for developing green software the model is enriched with eco-efficiency constraints. Hence, the model is annotated with the stereotype <<env>> (cf. Figure 7) which specifies an environmental constraint the developer has to adhere to when implementing the service. Green specifications do not prescribe how this information is represented. It

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

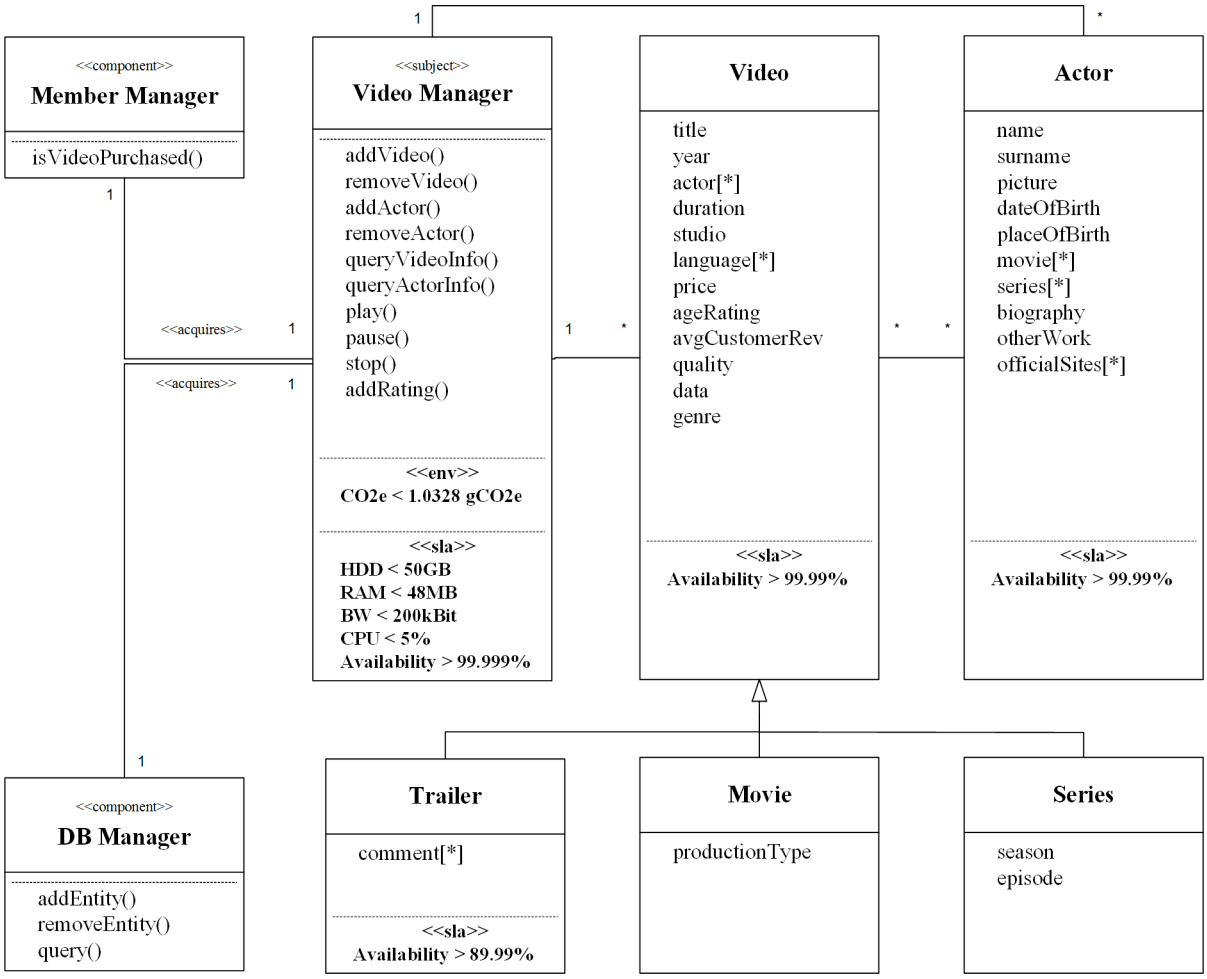
is for instance possible to use the CO2 emissions or the power consumption if the focus is on optimizing these values. We have used the unit CO2 equivalents (CO2e) in our model, which is both dependent on the energy consumption and the energy source mix. CO2e is more generic than CO2 emissions. It expresses the amount of CO2 emissions that would have the equivalent global warming effect. Therefore, it also includes other greenhouse gases like methane for instance. In general, the constraint is provided as an upper bound, i.e. execution of the service should never cause more than x amount of CO2e units of emission. Nevertheless, it is also possible to provide an average value. In this case, the execution should on average cause no more than x amount of CO2e units. The latter is, however, much more difficult to grasp for the developer and more difficult to monitor later on. This is mainly because the energy consumption of the software service is dependent on the energy consumption of the underlying hardware infrastructure. As the relationship between utilization and energy consumption is typically not linear and the assumption of exclusive usage rights for the component is normally not valid, it is much harder to know the average value during the implementation phase in comparison to an absolute maximum value.

The intention of adding the ecological constraints is to add a restriction on the CO2e units of the overall component. This is expressed by the constraint within the class labeled with <<subject>>. For the given example the overall maximum CO2e units of the video manager is therefore 1.0328gCO2e per month and user. This number must always be greater or equal to the sum of the CO2e units caused by all operations (green operational view) weighted with the probability of execution (green behavioral view) multiplied by the average number of times the user accesses the service.

As mentioned before it is also possible to additionally provide guarantee terms for a corresponding service level agreement (SLA). Like the ecological constraints, this information is added using a stereotype, i.e. <<sla>>. These terms guarantee the user of the service a certain quality of service (QoS) or quality of experience (QoE), respectively. Therefore, as shown in Figure 7, the availability of a video for instance must be greater or equal to 99.99%. Availability constraints put on data types refer to their existence. Only one of the three subtypes trailer, movie and series has been enriched with an additional SLA constraint. However, this does not mean that they are not subject to any kinds of SLA constraints. As is familiar from object-oriented programming, all attributes of a parent are passed on to its children. Therefore, the SLA constraint defined for a video is inherited by trailer, movie and series as well. However, the attribute availability is then overwritten for the class trailer to be only 89.99%. The SLA terms within the video manager itself again refers to the whole video manager service. As with the ecological constraints the SLA constraints specified in the structural view restricts the developer's implementation choices. It also restricts the service provider to a certain extent. The more fine grained these restrictions are specified the more freedom is given to the service provider. Consider the availability constraint of a trailer for instance. For a customer it may not be important to have continuously access to a trailer. The reduced availability level of 89.99% does not require a complete, redundant infrastructure and as a result, fewer resources are needed, which again results in fewer CO2e units of emission. Therefore, the overall CO2e constraint for the video manager is lower than it would be otherwise. Of course the actual impact depends on the estimated number of trailers. In traditional SLAs as commonly used today, only the availability of the whole service is defined. As the user is, however, not willing to sacrifice any availability objective when it comes to movies or series, the availability of the whole service would be defined as 99.99% and a great deal of optimization potential would be lost. Thus, in comparison to the traditional approaches of defining SLAs, green specifications provide much more scope for exploiting optimization techniques, since they provide much more detail about possible flexibility.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

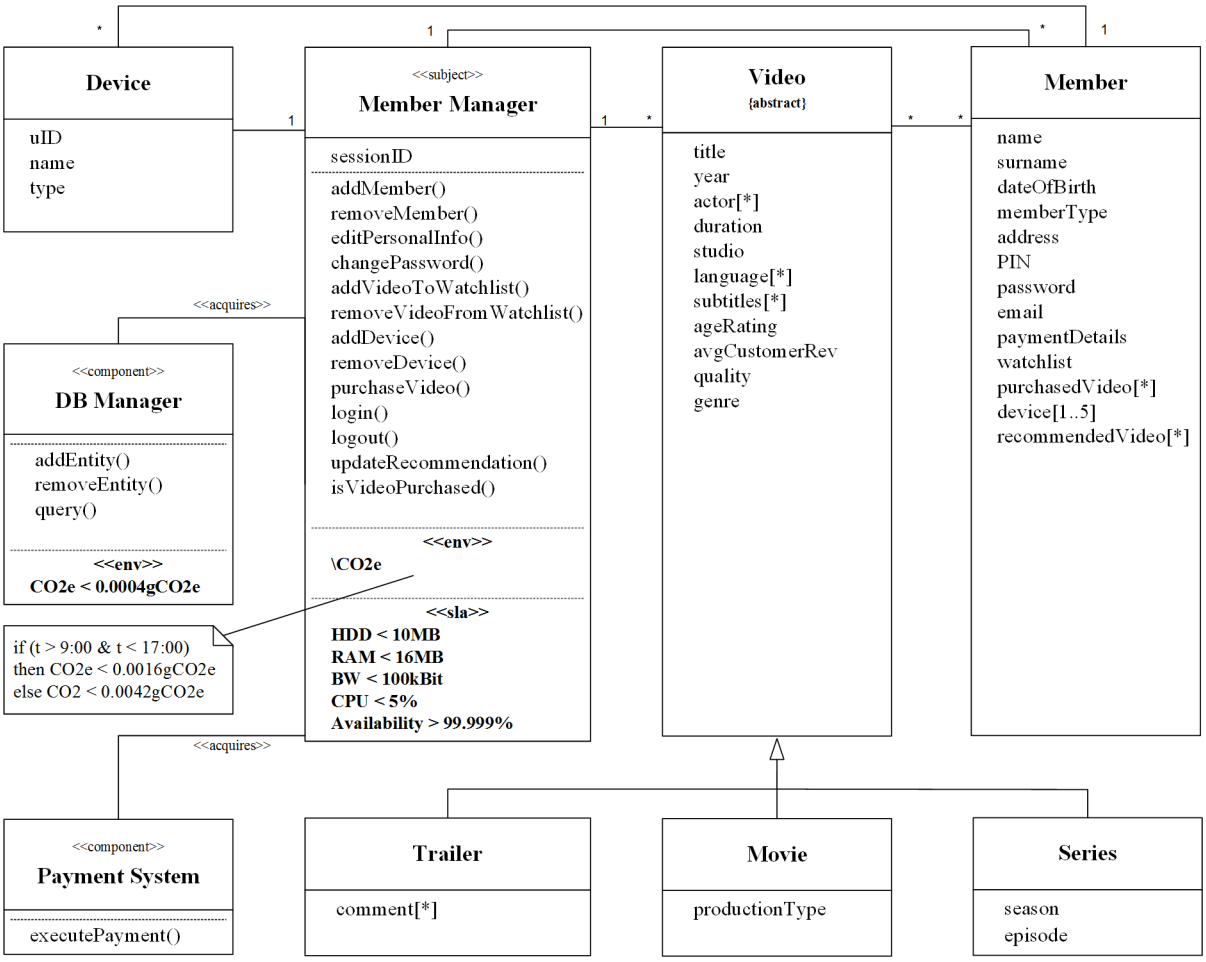
Figure 7. Structural view of a green specification for the video manager



Similar to the video manager, the member manager is specified using KobrA. Figure 8 shows an already enhance version of a structural KobrA specification, i.e. a green specification of the member manager. Like the video manager, the classes have been annotated with ecological and SLA constraints. The member manager consists of six classes describing the data structure, where four of them ((Trailer, Movie, Series, and Video) are already known from the video manager specification. Note, however, that the attribute data is missing in the Video description. This is a consequence of the, by now well know, principle of parsimony. As the actual data of the video (i.e. the actual content) is not of importance in the context of the member manager, it is not specified here. In addition, a Member and a Device is defined. A member consist of personal information (e.g. name, age, address, email), the PIN, the password, the member type (e.g. prime member), payment details, his/her watchlist containing all videos he/she marked as interesting to watch in the near future, a list of purchased videos, a list of devices he/she owns and a list of recommended videos which have been automatically generated by the VoD service based on previously watched videos and videos on the watchlist. A device is identified by the uID, has a name and is of a certain type (e.g. PC, Smartphone, TV). The devices are used as a kind of copyright

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 8. Structural view of a green specification for the member manager



protection. Each member is allowed to register only up to five devices, which makes it more difficult to illegally share videos with a large group of people. Furthermore, the member manager acquires the DB Manager and an external Payment System.

For the data types Video, Member, Trailer, Movie, Series and Device no environmental and SLA constraints are provided. However, they are indirectly limited by the constraints limiting the overall component. Therefore, the availability constraint used for the overall component (Availability > 99.999%) constrains the availability of these two classes as well. The same holds true for the DB Manager. However, in addition it is annotated with an environmental constraint and indirectly restricted by the overall SLA constraints of the Member Manager. The environmental constraint is bound to the context of the Member Manager. This means that whenever the Member Manager uses the DB Manager, the emission must be lower than 0.4 mg CO2e. However, this limitation does not restrict the CO2e unit of emission caused by any action not involving the Member Manager. Furthermore, Figure 8 shows a so called derived attribute within the Member Manager which can be used for describing more complex constraints. The environmental constraint is dependent on the time of day. During daytime, when people are normally working, the CO2e constraint is set to 0.0016 gCo2e, whereas during the evening this value is allowed

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

to be higher, i.e. 0.0042 gCO2e. The reason for this is twofold. On the one hand the assumption is being made that during daytime more solar energy is available which leads to fewer emissions. On the other hand the assumption is being made that during daytime less people are watching videos because they are at work. Therefore, QoS constraints like response time can be lowered. Once again, how the constraints in the specification are met is the responsibility of developers and data center personnel and is not part of the specification. Finally, it can be noted that the Payment System has not been annotated with any constraints. This is the usual case for any external component. However, it might also be possible in special situations to define constraints for external components as well. In these cases an external service must be selected which adheres to these constraints.

The Green Operational View

Green operation specifications are built on operation specifications of the kind described previously (cf. Table 1). Table 2 shows the operational view of the green specification for the play operation. Similar to the structural view enhancements, both environment and SLA constraints are added. The constraints limit the CO2e units the operation may emit to 0.1mg per minute of video, restricts the use of resources such as the hard disk (<7.76MB multiplied by the duration of the video), memory (<16MB), bandwidth (<195kBit) and CPU (<5%), and furthermore sets a guaranteed availability of the operation to 99.999%. Like the green structural views, these are constraints that the developer and responsible data center personnel have to take into consideration during the implementation and execution of the service.

In general KobrA does not define the level of formality the descriptions need to adhere to. In principle it is a tradeoff between universal, understandability and precision. Mission critical services will probably we described in a more mathematical, formal way. A compromise commonly used in KobrA

Table 2. A green operation specification for the play operation of the video manager

Name	**play**
Description	The operation retrieves the video from the database, enacts DRM methods, encodes the video and streams it to the client
Receives	**name**: the name of the video which is supposed to be played **sessionID**: the session ID of the member who wants to watch the video
Returns	A protected and encoded video stream
Assumes	The VoD service has been started and a member has logged in
Result	• It was checked that the video was purchased by the member and was located in the database, • if the video was purchased and was located in the database, it has been retrieved from the database, • the watermark has been included into every frame of the video, • the video has been encrypted, • encoded, and • has been streamed
Constraint: Environment	CO2e < 0.1mg * video.duration
SLA: Resources	HDD < 7.76MB * video.duration RAM < 16MB BW < 195kBit CPU < 5%
SLA: Availability	Availability > 99.999%

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 3. Green operation specification of the enactWatermark operation

Name	**enactWatermark**
Description	Adds a watermark to every frame of the video
Receives	**video**: the video to which a watermark is supposed to be added **watermark**: the content of the watermark, consisting of the member ID and the current date and time.
Returns	The video with embedded watermark
Assumes	pre: VoD.OclIsInState(Running) and MemberManager.OclIsInState(LoggedIn)
Result	post: VideoFrames->notEmpty() implies (WatermarkedFrames->size() = VideoFrames->size())
Constraint: Environment	CO2e < 0.038mg * video.duration
SLA: Resources	RAM < 16MB CPU < 5%

is the Object Constraint Language (OCL). Table 3 shows the green operation specification for the enactWatermark operation using OCL in the pre and post condition. The operation is located in the DRM Manager, which is a subcomponent of the Video Manager (see Figure 3).

Digital watermarking is the process of adding hidden information to a digital source. In the case of videos this information is added to the frames of the video, preferably without any visible disturbance for the viewer. The benefit of digital watermarking in contrast to traditional DRM methods lies in the fact that even when copying the video by filming it with another camera, the watermark is still intact. In Germany this technique is already in use in most cinemas and has already lead to successful arrests.

The green operation specification in Table 3 specifies that the watermark should be embedded into every frame of the video. For this purpose it needs the video and the watermark as input. In order to uniquely identify the video in the case of a copyright violation it uses the member ID and the time and date in the watermark. The pre-condition is equivalent to that of the play method, but is described using OCL. The VoD system must both be running and the member must be logged in. The post condition, which is also specified in OCL, requires the operation to have inserted the watermark into every frame, i.e. the number of watermarked frames is equivalent to the number of video frames.

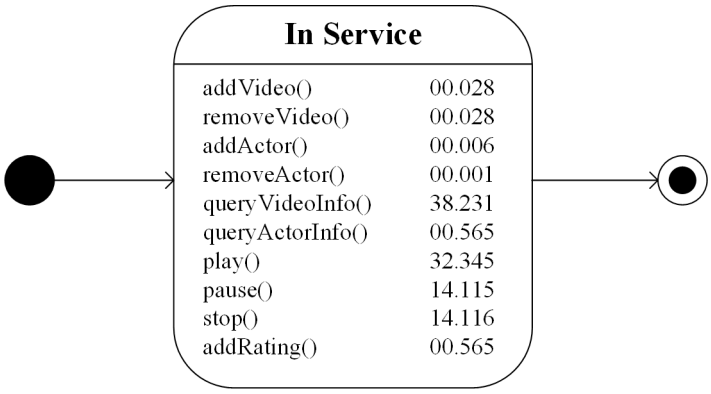
In addition, the specification contains environmental as well as resource constraints. Note, that only the RAM and CPU is restricted by the green specification, as these are the only resources used by the operation. Furthermore no constraint on the availability is provided. In this case, however, the overall availability constraint provided in the green structural specification of the component is used.

The Green Behavioral View

In the context of a green specification a behavioral view of the kind described in Figure 9 is used to on the one hand describe usage profiles and on the other hand to place constraints on certain behavior. This means that in contrast to the green structural and green operation views not only additional constraints, but also additional information related to the constraints located in the structural specification are provided.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 9. Green behavioral specification of the video manager



In Figure 9 the behavioral view of the green specification of the Video Manager is shown. Each operation is annotated with a probability of execution while in this state. The probability of playing a video when being in the state In Service is therefore 32.345 per cent, of adding a video is 0.028 per cent and so on. This reflects the typical usage profile of the Video Manager. Adding such probabilities to the state chart diagram transforms it into a Markov Chain. This technique is commonly used, for example, in the area of reliability predictions in software engineering (Reussner, Schmidt, & Poernomo, 2003). A Markov Chain within a green specification enables the overall probability of executing the different operations to be calculated. In combination with the constraints contained in the green operation specifications it is then possible to calculate the minimum restrictions the overall constraints need to specify and, vice versa, check if the constraints specified for the individual operations are consistent to the overall restrictions.

Retrieving the probability of executing an operation is a two-step process. First, the probability of being in a state needs to be identified. If the Markov Chain is time-homogeneous, a simple steady state analysis can be used for this purpose. Also in certain other cases it is possible to use this approach. At this point, however, we refer the interested reader to other literature concerning the topic of Markov Chains. Once the probability of being in a state is known, it can be multiplied by the probability of executing the operation. Next, it is possible to calculate the lower boundaries for the overall constraints by multiplying the overall probability of an operation with the corresponding constraints specified in the operation specifications and calculating the sum over all operations.

Taking the green behavioral specification from Figure 9 as an example, the minimal overall constraint restraining the CO2e emissions can be calculated as follows: The steady state probability of the state In Service is 1 since it is the only state available. Thus the overall probability of executing an operation is 1 times the probability specified for each operation in the state In Service. For the play operation it is therefore 1 x 32.345 = 32.345 per cent.

Table 4. CO2e emission constraints of all operations in the video manager

$CO2e_{addV...}$	$CO2e_{removeV...}$	$CO2e_{addA...}$	$CO2e_{removeA...}$	$CO2e_{queryV...}$	$CO2e_{queryA...}$	$CO2e_{play}$	$CO2e_{pause}$	$CO2e_{stop}$	$CO2e_{addR...}$
0.00714	0.00714	0.00011	0.00011	0.00143	0.00071	9.10000	0.02499	0.02499	0.00004

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Now, assuming the CO2e emission constraints provided in Table 4, the minimal overall CO2e constraint for the Video Manager is 2.951 mgCO2e. However, as the specification of a CO2e constraint is not mandatory in the operation specification, there is a good chance that the calculated minimal value of the overall constraint is too low. Picture for instance the scenario that the CO2e constraints for the operations pause and stop are not provided in the operation specification. This would result in a minimal overall CO2e constraint of about 1.030. If this value would be set as the overall constraint it would result in the fact that neither of the operations can be executed or the CO2e constraints of one or multiple operations must be undercut. However, as the predicted use of both operations is more than 28% it is unlikely that they will ever be executed and by knowing this the specification of the other constraints becomes obsolete. Therefore, in any cases were the specification of the constraints in the operation specification is incomplete the overall constraint should be specified with caution and never be set to the minimum calculated value.

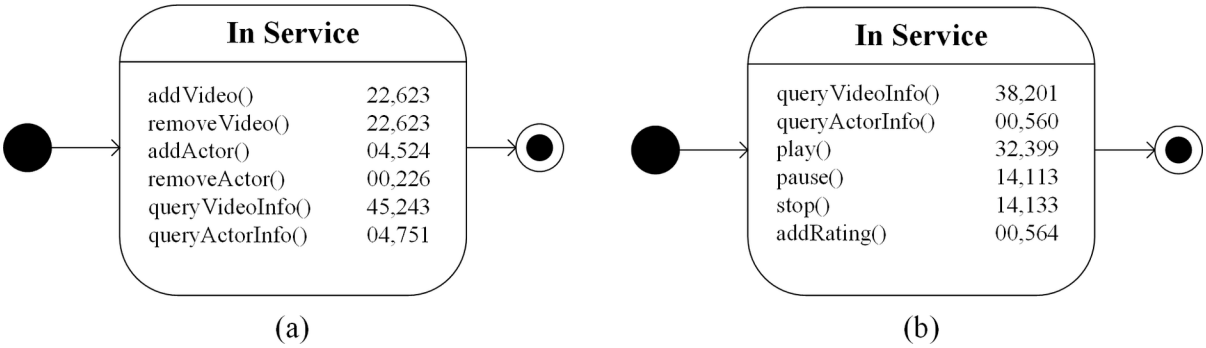
It is also possible to create multiple green behavioral specifications of the same component. This is useful for specifying typical usage profiles for different user types or usage scenarios. Figure 10 shows the behavioral view of the green specifications for the two user types administrator (a) and VoD-user (b).

Note that both specifications differ fundamentally from each other. While the admin mainly queries, adds and removes videos a user mainly queries, plays, pauses and stops videos. Following the principle of parsimony only operations utilized by the corresponding user are included in each specification.

The calculation of the minimal overall constraints is similar to the one with only one user. The first step is to calculate the minimal overall constraints for each user separately. Then these individual constraints are multiplied by a weighting factor and finally summed up. These weighting factors express the estimated distribution of usage of the different users. For the example in Figure 10 it is assumed that the number of accesses of admins in comparison to users is about 1:100000 (i.e. that while only one administrator is accessing the system one hundred thousand users will access the system within a certain timespan). Thus, the weighting factor for the user is 0.999991 and for the administrator is 0.000009.

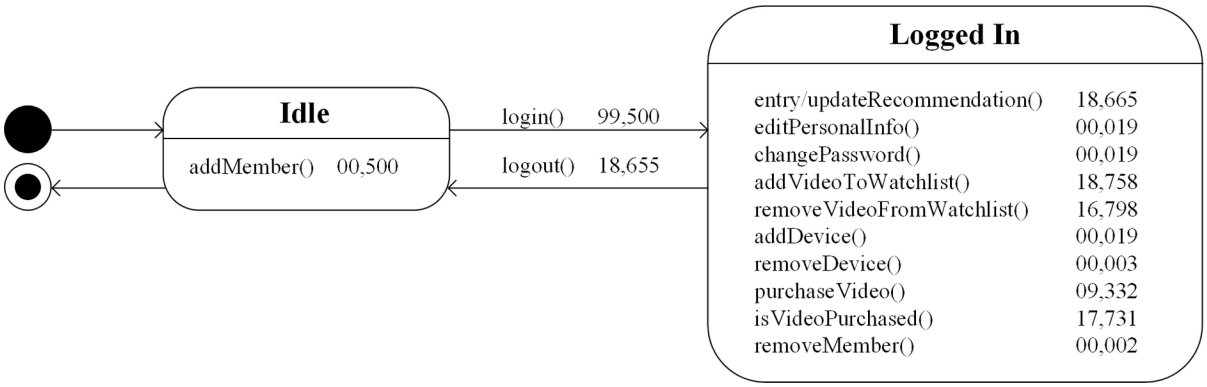
In Figure 11 the behavioral view of the green specification of the Member Manager is shown. As in the previous specification all internal and external state transitions are annotated by probabilities. The Member Manager can be in two states: Idle and Logged In. The steady state probability of being in the Idle state is 1.2 and the steady state probability of being in state Logged In is 98.8. At a first glance it

Figure 10. User type specific green behavioral specification of the video manager



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 11. Green behavioral specification of the member manager



appears that the login operation is the most important operation of the Member Manager with a probability of 99.5 per cent. However, due to the relatively low steady state probability of the Idle state from which the login operation is executed the overall probability of the login operation is only 1.194. This means that at any given time the probability of executing the login operation as the next step is 1.194 per cent. Therefore, it is important to differentiate between the probabilities provided in the diagram and the overall probabilities.

REDUCING THE ENVIRONMENTAL IMPACT

Previously we have provided some examples on how green specifications can help to reduce the environmental impact by inserting constraints. For instance, by inserting a lower availability constraint for a trailer in the structural view it is possible to reduce the number of redundant servers, or by specifying resource constraints in the operational view of the enactWatermark operation it is possible to restrict the resource utilization and with that in the best case the number of necessary servers. In the following we will provide a few more examples showing how green specifications can further help to reduce the environmental impact of the SoftFlix VoD service and allude to some not so obvious implications originating from the previously described green specifications.

In principle, when trying to further reduce the environmental impact of a software service one should start by identifying the aspects of the service which are expected to have the highest environmental impact. First the component with the highest impact can be identified by looking at the constraints limiting the whole component within the structural view. In the example of the SoftFlix VoD service this is the Video Manager which has an overall CO2e constraint of 1.0328g. Next, the operation with the highest impact within this component can be located by identifying the highest CO2e constraint related to the probability of execution. This information can be extracted from the green operational and green behavioral view. For the Video Manager this is the play operation with an overall impact of 3.479 (assuming an average duration of 90 minutes). When looking at the corresponding operation specification one can identify multiple tasks, namely checking if the video was purchased, retrieving the video, including the Watermark, encrypting, encoding and streaming the video. Now, depending on the flexibilities of the

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

stakeholder different actions can be taken to modify the requirements and with that foster a more eco-friendly play operation. In the current form of the specification a check is being performed to ensure the video was purchased every time the operation is called. By changing the structure to ensure that only videos can be played that are on a list this check becomes obsolete. Next, the specification states that the watermarking process includes the watermark into every frame of the video. On second thoughts this might not be necessary. A normal video contains 24 to 48 frames per second. If the watermark would only be embedded in for instance ten per cent of the frames the whole process would use less resources and become more energy efficient. Of course, it is not possible to simply put the watermark into every 10th frame, as these could easily be eliminated and exchanged by interpolated frames. Instead the watermark should be included in larger groups at random distances, which results in an unacceptable user experience when removed (cf. Table 5).

Besides enhancing the energy efficiency of the subtask "include watermark" it is also possible to enhance the eco-efficiency directly by providing more flexibility on the time of execution. As renewable energy sources like solar and wind energy are not always available this flexibility can significantly reduce the environmental impact. In the current specification the watermarking task is done on the fly every time the video is played. However, many people use the watchlist feature giving the service provider the chance of knowing what the member is likely to watch in the near future. This information can be used to include the watermark into the videos on the watchlist at times where renewable energy is available. In order to support this approach customers can be encouraged to add and remove videos to the watchlist by granting them a discount for every video which has been added at least 24 hours before watching and has not been on the watchlist longer than one week for instance.

Table 5. An optimized green operation specification of the play operation

Name	**play**
Description	The operation retrieves the video from the database, enacts DRM methods, encodes the video and streams it to the client
Receives	**name**: the name of the video which is supposed to be played **memberID**: the ID of the member who wants to watch the video
Returns	A protected and encoded video stream
Assumes	The VoD service has been started and a member has logged in
Result	• If the video was located in the database, it has been retrieved, • If the video did not contain a watermark before, it has been included into ten percent of the frames. These frames are larger groups, distributed randomly, • The video has been encoded, and • has been streamed
Constraint: Environment	CO2e < 0.0473mg * video.duration
Constraint: Resources	HDD < 7.76MB * video.duration RAM < 16MB BW < 195kBit CPU < 5%
SLA: Availability	Availability > 99.99%
SLA: Cost	If the video was added to the playlist between 24 and 168 hours ago cost = 0.09€ * video.duration / 100 else cost = 0.21€ * video.duration / 100

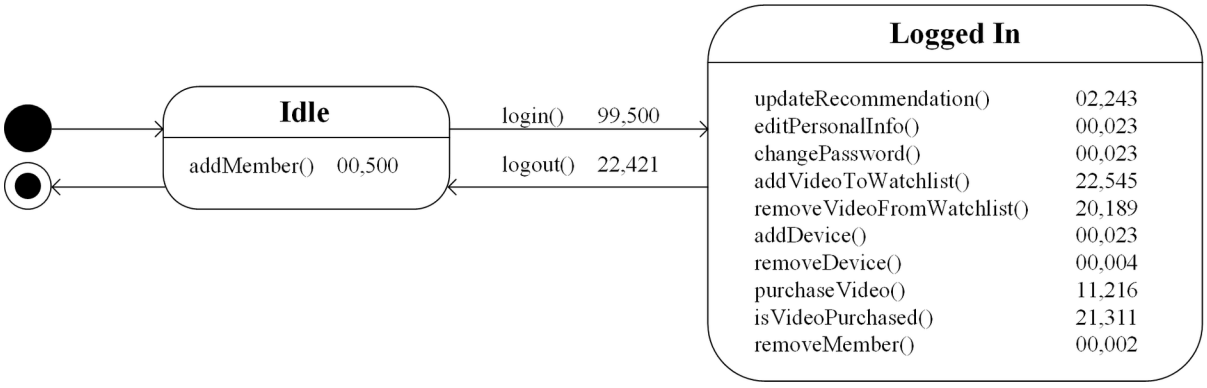
EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The next subtask in the operation specification is to encrypt the video. This is another commonly used security feature to assure copyright protection. However, in theory this step becomes obsolete when using a good watermarking technique. Therefore, dependent on the position of the stakeholder it is possible to eliminate this subtask completely and by that reduce the environmental impact even further. Table 5 shows the operational view of an optimized green specification for the play operation. Due to the change enabling the watermarking task to be executed independently of the play operation, the member ID is used within the watermark instead of the season ID (cf. receives compartment). In addition, the cost specification is refined to promote the desired user behavior. Note that the cost is not the cost of developing the operation but the cost to execute the operation which is to be paid by the user and therefore specified as part of the SLA. Within the result compartment, both the check of whether the video was purchased and the task of encryption has been removed. In addition, the description of the result of the watermarking task has been modified according to the enhancements presented above. In addition both the environmental and resource constraints except the one from the hard disk could be lowered. Obviously, the measures taken to reduce the environmental impact have a large effect on the overall environmental friendliness of the SoftFlix VoD service given that they can reduce it by up to 47.25%. Note, however, that although green specifications allow inefficiencies to be removed, most of the proposed optimizations depend on the cooperation of the customers.

The change to the operation specification of the play method also impacts other parts of the green specification, like the corresponding constraints in the structural view and even the probabilities in the behavioral view, due to the new cost model entailed. In addition, a new independent operation is needed in order to control the execution of the watermarking process to ensure that it is synchronized with the generation of renewable energy.

The aspect with the second largest impact on the environment is the updateRecommendation operation which is executed whenever a member logs in. Similar to what have been proposed for the task of including the watermark, this operation can be optimized by introducing more time flexibility. More specifically, by eliminating the entry keyword and instead executing the operation mainly at times where renewable energy is available, significant CO2 emissions can be saved (cf. Figure 12). A secondary effect is that the operation is on average executed less frequently (i.e. the probability of execution and by that the overall environmental impact of the operation is lower). Note, that this change in probabilities means also the importance of the other operations that are executable in the log in state increase in the

Figure 12. An optimized green behavioral specification of the member manager



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

context of the Member Manager. This change towards a more environmental friendly service again is expected to have a low to no impact on the quality of the user experience.

Even though it should always be used with care, it is also possible to optimize the service further by modifying aspects that have an impact on the quality of experience. Often such restrictions are bound to a specific group of members and combined with monetary gains. SoftFlix has two types of paying members: Premium Members and Standard Members. In contrast to the latter, the premium membership is more expensive and contains special features like for example earlier access to new movies. From an environmental point of view it is possible to further differentiate between these two member types by lowering the quality of experience of standard members.

Table 6 shows the green operation specification of the streaming operation. Here, an SLA parameter has been inserted indicating the maximum time a member has to wait for the video to start. This time span is longer for standard members compared to premium members. The technical implication behind this is that more servers can be kept in cold standby. Servers kept in this mode need more time to startup but consume less energy than servers in hot standby mode. However, such measures to reduce the environmental impact always need to be carefully evaluated to be compliant with the needs of the members.

While there are many more ways to optimize the SoftFlix service and make it more environmentally friendly we would now like to draw your attention to an implication of an already described optimization step that is not visible at first sight. The principle of parsimony that is used in all green specifications leads to models including the minimal set of elements needed in the different contexts. As seen earlier a video specified in the structural view of the Video Manager contains among other attributes an attribute with the name data, which is the raw data, i.e. the video itself. In contrast, a video in the Member Manager does not contain this attribute, as the video itself is not of importance in that context but only its metadata.

In practice the developer would normally have developed one method to retrieve a video from the data base. However, the two specifications differ and indicate that two different implementations of the operations involved should be developed. Therefore, the query operation should be implemented twice, one retrieving only the metadata for the Member Manager and one also including the video itself. Thus,

Table 6. An optimized green operation specification of the stream operation

Name	**stream**
Description	The operation streams the video to the client
Receives	**video**: the video which is supposed to be streamed
Returns	A video stream
Assumes	The VoD service has been started and a member has logged in
Result	The video has been streamed
Constraint: Environment	CO2e < 0.031mg
Constraint: Resources	BW < 195kBits/s
Constraint: Availability	Availability > 99.99%

SLA: MaxTimeToStart	If (memberType = Premium) then
	maxTime = 3 seconds
	else
	maxTime = 15 seconds

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

at least two green operation specifications of the query operation should be specified. The result is a more environmentally friendly SoftFlix VoD service.

As we have indicated, although they reduce the environmental impact of services, optimizations also tend to limit the freedom of certain stakeholders. Green specifications provide the possibility to let all stakeholders make well informed choices and decide to what degree certain optimizations are acceptable.

FUTURE RESEARCH DIRECTIONS

As we have shown in this chapter green specifications provide an important foundation for developing more environmental friendly software services. In our example of specifying a VoD service we have used the metric CO2e to express the eco-friendliness. However, as mentioned earlier, green specifications do not limit the stakeholders to the use of this specific metric. Therefore, one research direction focuses on analyzing the practicability and usefulness of existing metrics and if applicable defining new ones.

Furthermore, green specifications do not specify where the values for the constraints originate from. In our example we have used the knowledge of domain experts. However, such an approach might not always be applicable due to the absence of such experts. Furthermore, these estimations might not always be very accurate which might lead to complications during development and later execution. For example, if a constraint is set to a value which is simply impossible for a developer or service provider to adhere to, a conflict could arise. Therefore, the second research direction focuses on finding ways to more easily and more accurately estimate these values.

CONCLUSION

Green specifications enable more environmental friendly software services to be developed by describing the relationship between different consumption choices (at different QoS levels) and environmental impact in a way that is understandable to the widest possible range of stakeholders. Evidently, green specifications can have a significant impact on the eco-efficiency and can even in already optimized environments lead to significant savings.

REFERENCES

Atkinson, C., Bayer, J., & Muthig, D. (2000). Component-based Product Line Development: The KobrA Approach. *Proceedings of the First Conference on Software Product Lines: Experience and Research Directions: Experience and Research Directions* (pp. 289-309). Norwell, MA, USA: Kluwer Academic Publishers. 10.1007/978-1-4615-4339-8_16

Atkinson, C., & Schulze, T. (2013). Towards application-specific impact specifications and GreenSLAs. *Green and Sustainable Software (GREENS), 2013 2nd International Workshop on* (pp. 54-61).

Atkinson, C., Schulze, T., & Klingert, S. (2014). Facilitating Greener IT through Green Specifications. *Software, IEEE*, *31*(3), 56–63. doi:10.1109/MS.2014.19

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Basmadjian, R., Bunse, C., Georgiadou, V., & ... . (2010). FIT4Green - Energy aware ICT Optimization Policies. *Proc. of the COST Action IC0804 on Energy Efficiency in Large Scale Distributed Systems - 1st Year*, COST Office.

Basmadjian, R., Lovasz, G., Beck, M., & ... . (2013). A Generic Architecture For Demand Response: The ALL4Green Approach. *Proc. of the Int'l Workshop on European Actions Towards Eco-Friendly Data Centers (EuroEcoDC 2013)*, IEEE. 10.1109/CGC.2013.79

DC4Cities. (2014). *Environmentally sustainable data centre for Smart Cities - Data Centres in an energy-efficient and environmentally friendly Internet.* Retrieved May 20, 2014 from http://www.dc4cities.eu

Reussner, R., Schmidt, H., & Poernomo, I. (2003). Reliability prediction for component-based software architectures. *Journal of Systems and Software*, *66*(3), 241–252. doi:10.1016/S0164-1212(02)00080-8

KEY TERMS AND DEFINITIONS

Behavioral View: The behavioral view describes the externally visible states and state transitions visible to external users of the component/system and takes the form of a UML state diagram.

CO2e: CO2 equivalents (CO2e) express the amount of CO2 emissions that would have the equivalent global warming effect to a mixture of gases emitted in an industrial process such as methane or nitrous oxide.

Functional View: The functional (a.k.a. operational) view describes the functionality of a component. It is actually composed of a set of tabular operation specifications, each describing the effects of one operation of the component in terms of pre and post conditions.

Green Specifications: Green specifications describe the properties of a service from distinct viewpoints which describes the data structure, its externally visible states and transitions exhibited by the service, and the effects of the service's operations. These are augmented with non-functional information describing the environmental properties of, or constraints on, the service.

KobrA: The KobrA method is a view-based approach to component specifications that strictly prescribes how different UML diagrams and tabular operation specifications should be used to model the properties of components from distinct perspectives - the behavioural, structural and functional viewpoint.

Structural View: The structural view describes the externally visible types and external components (e.g. services) which the system uses to deliver its own functionality, and takes the form of a UML class diagram.

Video on Demand: A Video on demand (VOD) service provides users with the ability to watch video content on demand over the internet. Popular examples today are Netflix, or Amazon Instant Video.

Watermarking: Digital watermarking is the process of adding hidden information to a digital source for security purposes. In the case of videos this information is added to the frames of the video, preferably without any visible disturbance for the viewer.

This research was previously published in Green Services Engineering, Optimization, and Modeling in the Technological Age edited by Xiaodong Liu and Yang Li, pages 1-24, copyright year 2015 by Information Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 35
Introducing Eco Friendly Urban Traffic Control Room: A Green Approach

Somasree Bhadra
University of Calcutta, India

Anirban Kundu
Netaji Subhash Engineering College, India

Sunirmal Khatua
University of Calcutta, India

ABSTRACT

In this article, new services in Green Computing environment is introduced. Energy and power is saved in an efficient manner using proposed services. These services are still undefined to the researchers in most of the cases. A typical framework of hierarchical structure for typical software managed central urban traffic control room is considered as case study. Each type of services is shown with an example which is interrelated with central traffic control room scenario. The authors' aim is to produce an energy efficient and power savings method in computing environment. Urban Traffic Control Room is considered as a case study. This is because in today's world urban traffic management is one of the most burning issues of any smart city management. Use of complex yet efficient software in the urban traffic control room may aid in proper management of road traffic. Keeping in mind growing environmental concerns, efficient green system architecture needs to be in place to ensure high performance, reliability and security of such an important public service sector.

INTRODUCTION

Modern IT systems rely upon a complicated mixture of people, networks and hardware. Green computing shows an initiative with systemic nature, and addresses increasingly sophisticated problems. Elements of such a solution may comprise items such as end user satisfaction, management restructuring, regulatory compliance, disposal of electronic waste, telecommuting, and virtualization of server resources, energy

DOI: 10.4018/978-1-5225-7915-1.ch035

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

use, thin client solutions, and return on investment (ROI). As 21st century belongs to computers, gizmos and electronic items, and as the public debate on carbon emissions, global warming and climate change gets warmer, energy issues will get a serious ring in the coming days. Taking into consideration its popularity, the industry of Information Technology has to lead a revolution of sorts by turning GREEN in a manner no industry has ever done before.

Green computing is the study and practice of using computing resources efficiently. The primary objective of such a program is to account for the triple bottom line, an expanded spectrum of values and criteria for measuring organizational (and societal) success. The goals are similar to green chemistry; reduce the use of hazardous materials, maximize energy efficiency during the product's lifetime, and promote recyclability or biodegradability of defunct products and factory waste.

Effective power utilization, maximizing efficiency, proficient utilization, correct disposal of electronic gadgets, reliable and cost effectiveness, etc. are addressed in green computing research. Power consumption is minimized by implementing green concept in different functional components of personal computer (Mala et al., 2013).

Energy consumption rates based on services have been analyzed for different systems for facilitating green cloud computing (Anwar et al., 2013). Power consumption of resources and amount of electronic waste are reduced by implementing different eco-friendly hardware. Power consumption and heat have been reduced by proposed technique in (Schmidtet al., 2008). Different techniques such as unplugging a computer, use of LCD, use of flash drives have been discussed for minimizing power and energy wastage (Anwar et al., 2013).

In present day scenario, green computing concept is implemented everywhere due to increasing energy cost and growing environmental concerns. Efficient system architecture is required for analyzing performance, reliability, maintainability and security of the system. Energy and power consumption of a system depend on the particular system architecture. Energy usage of the system architecture is monitored and analyzed in (Zhong et al., 2010.).

Green computing concept is implemented in cloud computing. Large amount of energy is consumed by the data centers hosting cloud computing applications contributing high operational costs and carbon footprints to the environment. Hence, green solution is implemented to save energy and reduce operational costs (Ponnusamy & Sasikumar, 2012).

Rest of the paper is organized as follows: related work is mentioned in next section; proposed services in green computing are implemented in an urban traffic control room within proposed work section; layer based protocols in Green environment and Green index are discussed further; experimental results are depicted for better clarifications; conclusion is drawn in last section.

RELATED WORK

Green computing, the study of efficient and eco-friendly computing resource is under the attention of environmental organizations, and businesses from other industries. In recent years, companies in the computer industry have come to realize that going green is in their best interest, both in terms of public relations and reduced costs (Lakshmi et al., 2012). In (Mittal& Kaur, 2013), harmful impacts of computers over environment are discussed. In today's era computer is the basic need of everyone. Computer is required for different purposes by different sectors. Most of the CO_2 emission is produced through the heat generated by computer and its devices. The energy consumption by various computing devices also

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

plays a main role towards harming our environment. This research paper analyzes the factors related to awareness of green computing among common man. It also includes a survey questionnaire which takes all the factors into account and before starting actual survey a pilot study for this questionnaire was done which confirm its acceptance (Mittal et al., 2013). In (Aggarwal et al., 2012) power saving concept in cloud environment is discussed. As cloud-based services become more dynamic, resource provisioning becomes more challenging. The Quality of Service (QoS) constrained resource allocation problem is considered in this paper, in which customers are willing to host their applications on the provider's cloud with a given Service Level Agreement (SLA) requirements for performance such as throughput and response time. Since, the data centres hosting the applications consume huge amounts of energy and cause huge operational costs, solutions that reduce energy consumption as well as operational costs are gaining importance. In this work, we propose an energy efficient mechanism that allocates the cloud resources to the applications without violating the given SLA using Ant colony framework (Aggarwal et al., 2012). Energy efficient approach is adopted in cloud computing to achieve eco-friendly application. Cloud computing data centres are emerging as new candidates for replacing traditional data centres. Cloud data centres are growing rapidly in both number and capacity to meet the increasing demands for highly-responsive computing and massive storage. Making the data centre more energy efficient is a necessary task. In this paper, the focus is on organisation's internal Infrastructure as a Service (IaaS) data centre type. An internal IaaS cloud data centre has many distinguished features with heterogeneous hardware, single application, stable load distribution, lived load migration and highly automated administration (Quan et al., 2011). An energy aware resource allocation method for clouds is proposed in (Mazzucco et al., 2010). However, it is developed mainly for scheduling theservers for completing the customers jobs and not applicable for scheduling different applications that need critical performance requirements. Some other techniques also have been proposed for predicting the workloads of the servers by applying statistical methods (Gong& Wilkes, 2001). General energy saving approaches has been studied in (Berl et al., 2010). Saving energy in ICT divides into two main fields, saving energy for network (Sheikh, 2010; Gelenbe & Mahmoodi, 2011) and saving energy for computing nodes (Heath et al.,2005; Xian & Lu, 2006). Energy saving approach for Platform as a Service (PaaS) cloud data center is discussed in (Shinde et al., 2013). Integration of NAND flash memory into DB-based architecture and support by adjusted DBMS algorithms governing IO process is discussed in(Schmidt et al., 2008). Different green initiatives in different sectors are discussed in (Chakraborty et al., 2009). Authors have discussed efficient and minimum power utilization using green concept in (Jadhwani et al., 2012).

A scheduling algorithm called DSSTS is proposed to minimize the overall energy consumption for sporadic tasks with shared resources. This algorithm schedules the job in dynamic low speed and switches to high speed if another low priority task blocks it (Zhang et al., 2017). Relationship between energy consumption and microprocessor frequency for application purpose is establishes by theoretical and experimental evidences by (Vogeleer et al., 2017).

PROPOSED SERVICES IN GREEN COMPUTING

It is discussed by different researchers that ecological equilibrium is affected heavily by the large amount of power and energy emissions due to ever increasing usage of technology. Different services are proposed in this work for minimizing power and energy consumptions from electronic devices.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

A typical urban traffic control room scenario is considered in our paper as a platform for implementing services. The proposed system framework is shown in Figure 1.

In our proposed approach different required services in a central traffic control room hierarchy are redesigned to produce a power saving system. In typical central traffic control room environment different types of traffic conditions are handled based on city traffic congestion along with management of general and emergency road traffic situation. It is considered that city traffic control room should function in such a manner that minimum power and energy would be used. Transaction, Resource management and security are the mandatory tasks to be performed by any city traffic control room. Different types of resource and repository are also playing a major role to run the office successfully. Different proposed services are explained in following sub sections:

Green Traffic Control Room

Maximum utilization of energy and manpower is ensured at the Central Traffic Control Room by introducing Green Traffic Room measures without compromising on efficiency. In this paper power savings and maximum resource utilization are achieved by introducing following approaches.

Reduce Power Consumption

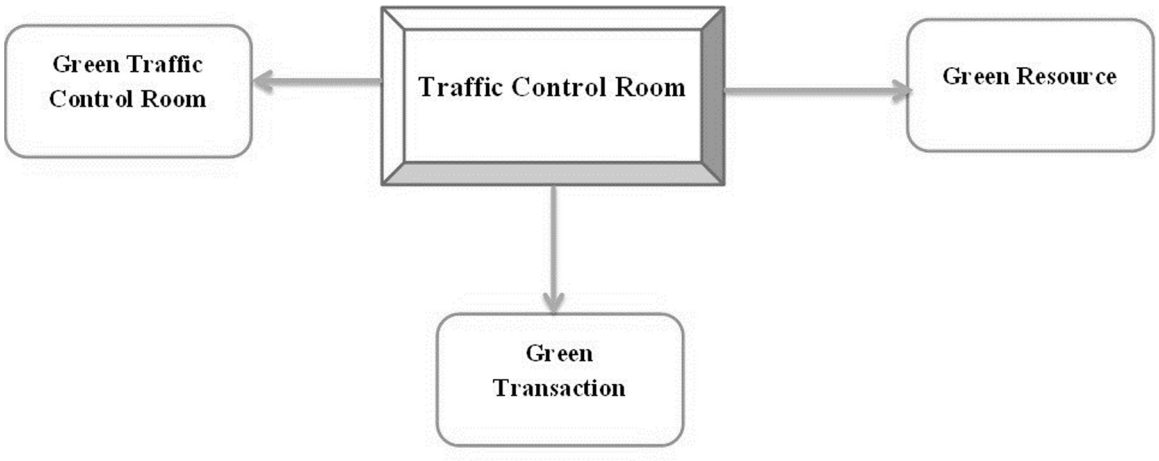
Allocate optimal number of terminals in the control room based on needs without compromising on safety. Also, allocate maximum project members in a single room without affecting the efficiency. Minimum amount of power and energy is used.

Let, energy consumption by terminals and electronics devices per room is E_T and E_R respectively and total number of terminals and rooms used are N_T and N_R respectively.

Then,

$$E_T \propto N_T \tag{1}$$

Figure 1. Typical System Framework



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

$$E_R \propto N_R \tag{2}$$

It is clear from Equation (1) and (2) that N_T and N_R must be minimized to obtain minimize energy consumption.

Total number of terminals could be minimized by implementing 'Minimal Terminal Display (MTD)' approach. In this approach we proposed that only concerned traffic point would be displayed in a terminal and whenever the particular terminal is attained or solved it will be replaced by next concerned terminal. In other words, there will not be displays for each and every traffic terminals. There will be minimal number of displays and selected problematic terminals would be displayed there and they will be replaced whenever required as depicted in Figure 2 and Figure 3.

Figure 2 presents situations of traffic points 1, 2, 3 and 4 are displayed in display 1, 2, 3 and 4 respectively. After these situations are handled they are replaced by next problematic terminals as displayed in Figure 3.

Traffic terminals are leveled based on some parameters. We consider Average Waiting Time (AWT) and Car Density (CD) at a certain time interval as the decisive parameters. We implement fuzzy set theory to identify the status of a particular terminal. Crisp input ranges for the parameters are shown in Table 1.

Figure 2. Minimal Terminal Display (MTD) instance 1

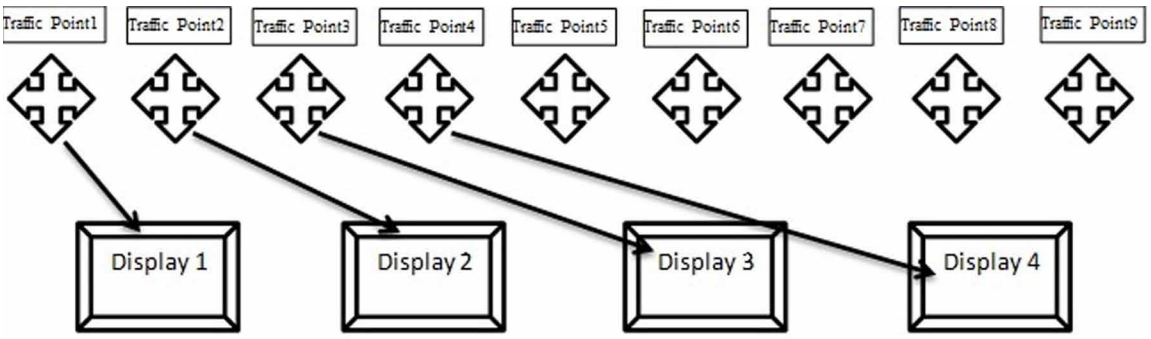
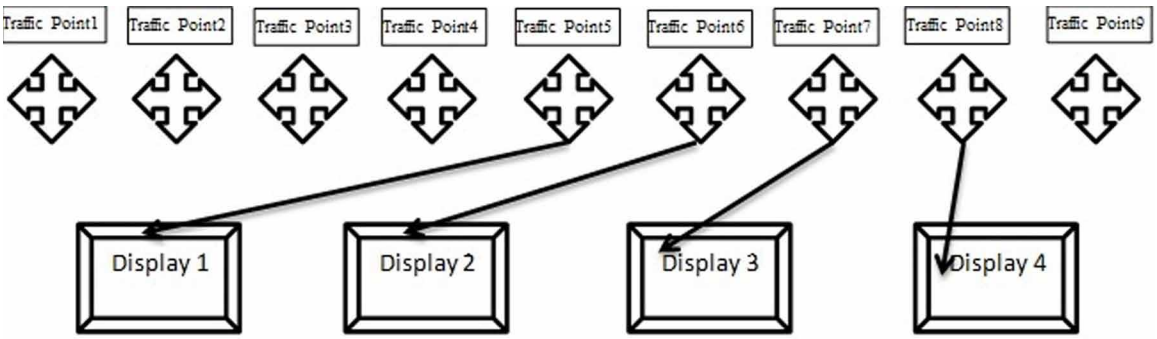


Figure 3. Minimal Terminal Display (MTD) Instance 2



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 1. Crisp Input range for Parameters

Parameters	Crisp Input Range	State
Average Waiting Time (AWT)	0-0.4	Minimum
	0.3-0.7	Medium
	0.6-1.0	Maximum
Car Density (CD)	0-0.4	Low
	0.3-0.7	Moderate
	0.6-1.0	High

Lane status will be determined as a combination of parameters value. Combination of different parameters and corresponding lane status is shown in Table 2.

Level 4 lane status is considered as the most congested lane.

Total number of rooms could be minimized by placing maximum human resource in a single room without affecting comfort level and efficiency.

Parallel Processing

City traffic is always managed from traffic control room which is equipped with numerous video terminals. These terminals may receive live video footage from any traffic terminals (TP) spread all over the city. However during real time traffic management feeds from pre decided traffic points are considered.

We propose a green handling of traffic terminals at the control room. Nowadays, the roads are overloaded due to ever increasing traffic. It is observed that typical traffic signal management (release and Hold) is always predefined or manual. Accordingly the decisive terminals are predefined as well. However, it may happen that traffic situation may vary within a short while. Thus the decisive terminals may change thereafter. In this paper, we would devise a green mechanism to select proper decisive terminals.

Let, total number of traffic terminals (TP) is 'T', the number of Decisive Terminals is 'D' and the total traffic volume is 'v'.

$$T \propto v \tag{3}$$

$$D \propto T \tag{4}$$

and, T>>D

Table 2. Different Lane Status based on input parameters

	Minimum AVT	Medium AVT	Maximum AVT
Low CD	Level 1	Level 1	Level 2
Moderate CD	Level 1	Level 2	Level 3
High CD	Level 2	Level 3	Level 4

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

By combining Equations (3) and (4)

$$D \propto v \tag{5}$$

Thus,

$$D = cv\,.$$

where, c is a constant and is named as the Traffic Decisive Index

$$c = D \,/\, v$$

Let Single Terminal Energy Usage be ‘e’.

Energy required for Context Switch from current executing Terminal to new Terminal be ‘E’.

Here we assume that only decisive traffic terminal would be displayed in the display board in traffic control room instead of displaying all terminals. Energy usage would be ‘De’ instead of ‘Te’.

Energy saving would be (T-D)e.

Energy usage due to context switching would be (T-D)E.

It is obvious that e>>E, hence our proposed approach will save certain amount of energy without effecting system performance.

Green Transaction

Two types of transaction are typically involved in traffic management system, namely financial transaction and project-related transaction.

Financial Transaction

Usage of paper money is avoided by implementing electronic financial transaction. It is evident from different research work that online financial transaction is more eco-friendly than conventional transaction procedure (Lakshmi, Sarwani and Tuveera, 2012). Carbon emissions are reduced as the transaction is executed without being travelled. Usage of paper is minimized by this approach as the entire transaction is performed electronically.

Project-Related Transaction

It is considered that different types of transactions including acceptance of new hardware or software components from vendors to successfully upgrade the system. It is proposed in this paper to execute these project-related transactions electronically to minimize the energy consumption and cost.

In present day scenario electronic transaction is most feasible and convenient way in every aspect. Hence more eco-friendly system is achieved by implementing electronic transaction system as shown in Table 3.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 3. Comparison between Typical approach and proposed Green approach

Typical Paper Based Approach			Electronic Green Approach		
Transaction Medium	**Transaction Mode**	**Advantage/Disadvantage**	**Transaction Medium**	**Transaction Mode**	**Advantage/Disadvantage**
Paper	Physical	1. Wastage of Paper 2. Wastage of Trees 3. Wastage of Time 4. Wastage of Energy 5. High Carbon Emissions	Electronic	Electronic	1. Time Saving 2. No Paper wastage 3. Eco friendly

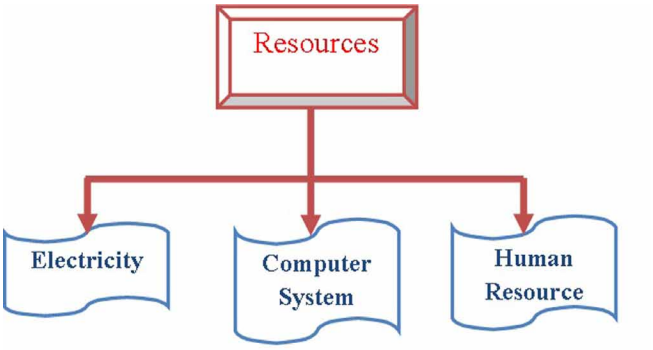
Green Resource

Different resources are required for a traffic control room to run the system smoothly. The resources used in typical traffic control environment are categorized as shown in the Figure 4.

Electricity usage is controlled by implementing an automated controller, namely Electricity Controller (EC). Operational activity of EC is explained in Algorithm 1 and in Algorithm 2.

Maximum utilization of natural resources is ensured by this algorithm. Lighting devices are controlled automatically by EC based on the actual requirement of artificial light. Lighting devices are powered on by the EC in case of insufficient natural light and sufficient light is required for that particular place.

Figure 4. Resource Categories



Algorithm 1. Light_Devices_Control

Input: Environmental Conditions
Output: Controlling light devices
Step 1: Start
Step 2: If there is no day light, go to Step 5.
Step 3: If there is sufficient day light, go to Step 6.
Step 4: If there is insufficient day light, go to Step 5.
Step 5: If there is a person sitting next to the light, then SWITCH ON LIGHT and go to Step 7.
Step 6: Then SWITCH OFF LIGHT, and go to Step7.
Step 7: Goto the NEXT LIGHT, if no LIGHT is left, then go to Step 8.
Step 8: End

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Algorithm 2. Cooling_Devices_Control

Input: Environmental Conditions
Output: Controlling cooling devices
Step 1: Start
Step 2: If the temperature is Hot, then DECREASE THE TEMPERATURE and go to Step 6.
Step 3: If the temperature is Cold, then INCREASE THE TEMPERATURE and go to Step 6.
Step 4: If the temperature is Optimum, then go to Step 6.
Step 5: If there is no person in the zone, then go to Step 6.
Step 6: Goto the NEXT DEVICE, if no DEVICE is left, then go to Step 7.
Step 7: End

It is evident that maximum power and energy is consumed by the cooling devices. Hence maximum energy and power is conserved by minimizing the usage of these devices. This usage would be minimized by maximum utilization of natural resources. Operational activities of cooling devices are controlled by EC. Unnecessary power and energy wastage are minimized by implementing this automated approach. Power and energy wastage due to human error or negligence is avoided by this automated approach.

Large amount of time and energy wastage is caused by human resource wastage. It is avoided by implementing following approaches:

- Each Team is consisted optimum number of resources.
- A common transport is provided to avoid late arrival or early departure; hence the working hours will be maximized.

Most widely used resource by a modern corporate sector is computer. Hence energy usage of computer is considered as major resource of wastage. Hence operational activity of these computers are controlled and handled automatically as shown in Figure 5. Operational activity of the proposed automatic system is shown in Algorithm 3.

User Response Delay (URD) is the response delay from computer user side and Computer Response Delay (CRD) is the response delay from computer side. In this paper these two delays are considered as the decisive factor. Status of a computer is either ‘SLOW’ or ‘IDLE’ or ‘INACTIVE’ according to the degree of non-responsiveness. The status of the computer is measured by computer controller and the operational activity of computer controller is shown in Figure 6.

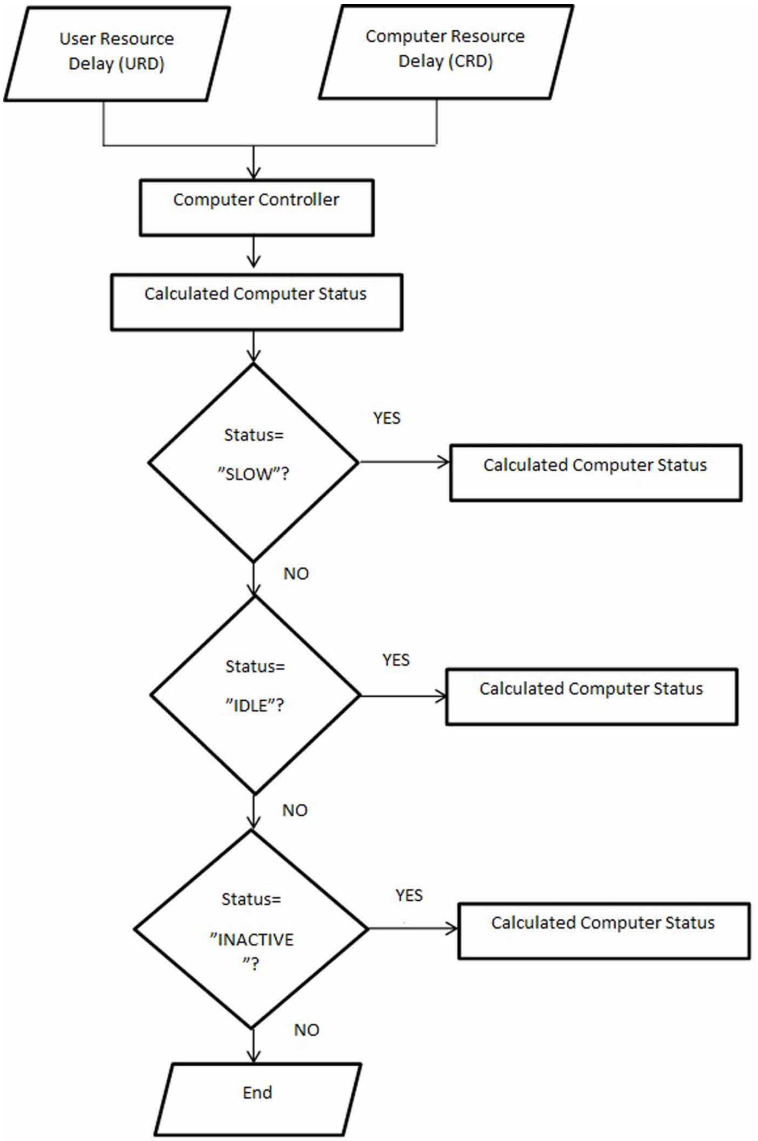
URD and CRD at any time instance is categorized as Minimum, Moderate and Maximum. Computer status is measured as the combination of two inputs as described in Table 4.

Algorithm 3. Computer_Control

Input: User Response Delay (URD) and Computer Response Delay (CRD)
Output: Status of Computer
Step 1: Start
Step 2: Collect URD and CRD.
Step 3: Compute the input through Computer Controller.
Step 4: If the computer status is ‘SLOW’, then LOG OUT and go to Step 7.
Step 5: Otherwise, if the computer status is ‘IDLE’, then SLEEP and go to Step 7.
Step 6: Otherwise, If the computer status is ‘INACTIVE’, then SWITCH OFF and go to Step 7.
Step 7: End

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 5. Operational flowchart of automatic computer controlling system



Computers are powered on or off automatically based on URD and CRD. Hence, wastage of power is minimized.

Human resource wastage is controlled by implementing following:

- Fixing the strength of each Team to an appropriate number so that Resources are not wasted due to paucity of work.
- By providing a common commutation to every employee, we can eliminate the wastage of time due to a late arrival.
- Set Short-term goals along with Long-term ones, while working on a project to minimise, project delays.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 6. Operational activity of Computer Controller (CC)

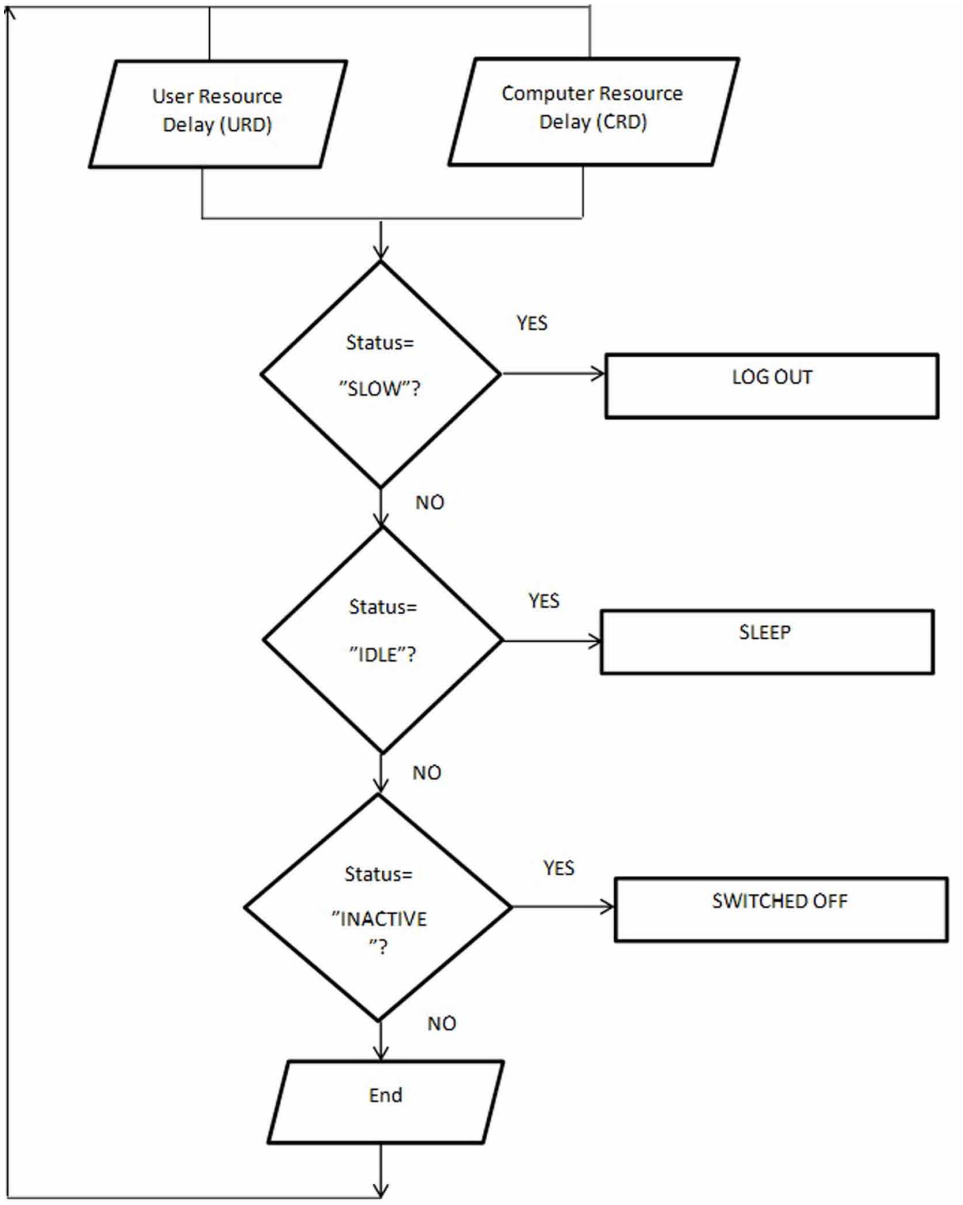


Table 4. Combination of URD and CRD

	Maximum URD	Moderate URD	Minimum URD
Maximum CRD	INACTIVE	INACTIVE	IDLE
Moderate CRD	INACTIVE	IDLE	IDLE
Minimum CRD	IDLE	SLOW	SLOW

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

PROPOSED LAYER BASED PROTOCOLS IN GREEN ENVIRONMENT

In our paper we propose Layer based protocols to implement the Green concept. It is obvious that power and energy usage must be minimized to achieve an echo friendly system. Maximum utilization of resources and proper authorization and authentication of resources would reduce the power consumption.

A four level service layer abstraction in Green environment is introduced in this section. This is a logical and modularized separation that helps in describing of each service layer during the design process. It is the integrated and co-related modules as shown in Figure 7. This framework is basically an abstract representation of the proposed services.

Proposed Green Computing multi-layered service suites are discussed in following sub-sections:

Power Savings Layer (PSL)

In this layer power usage of the system is controlled. Operational activity of PSL is shown in Figure 8.

In PSL unused devices are terminated to reduce the power consumption.

It is observed that power consumption in a system is directly proportional to the number of running device components in the system. Mathematical representation is as follows:

$$D_R \propto P \tag{6}$$

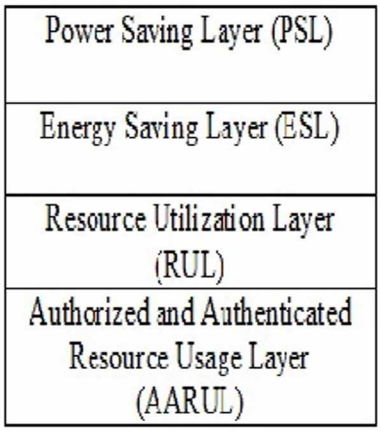
where, D_R = Number of running devices in the system;

P= Total power consumption in the system;

Similarly,

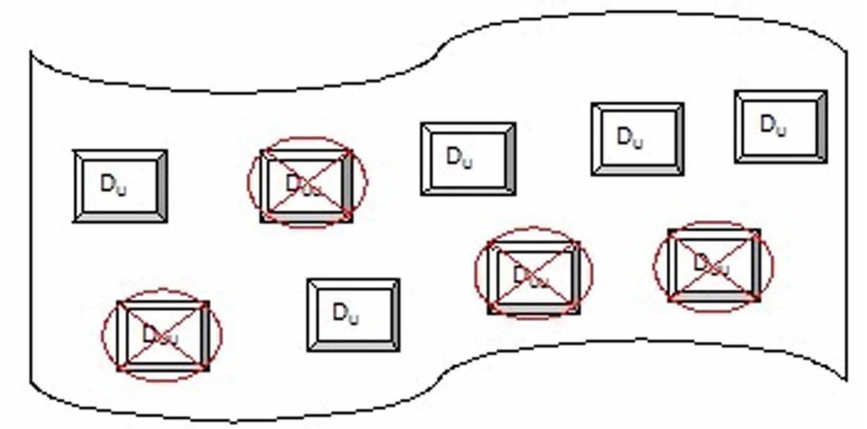
$$D_U \propto P_S \tag{7}$$

Figure 7. Proposed Service Layers in Green Computing Environment



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 8. Operational activity of PSL



where, D_U = Number of used devices in the system;

P_S= System Performance;

$$\therefore D_U \propto D_R$$

$$\therefore D_{UU} = D_R - D_U$$

where, D_{UU}= Number of Unused devices in the system;

Let, power consumed by D_{UU} devices is ΔP.

As per Equation (1),

$$D_R \propto P$$

$$\therefore \left(D_R - D_{UU}\right) \propto \left(P - \Delta P\right)$$

Therefore, power consumption is reduced by terminating the unused devices without affecting system performance as P_S is related with D_U. Green Project is contained in this layer.

Energy Savings Layer (ESL)

In this layer energy usage of the system is controlled. Operational activity of ESL is shown in Figure 9.

In ESL energy wastage is minimized by terminating energy resources that are not occupied as shown in Figure 9.

Let there are ‘n’ number of devices in a system and corresponding energy usage is ‘m’ unit. Hence, total energy usage is “m x n”’ unit. It is obvious that,

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

$$m \propto \left(m \times n\right) \tag{8}$$

and,

$$n \propto \left(m \times n\right) \tag{9}$$

If, 'p' number of devices are unoccupied then 'p x m' unit energy is wasted. Hence, 'p x m' unit energy is saved by terminating 'p' number of devices without affecting the productivity.

Green Projects and Green Transactions are the member of this layer.

Resource Utilization Layer (RUL)

In this layer available resources are fully utilized. This layer contains Green Resources. Maximum outcome is attained against minimum energy and power wastage. Maximum utilization of available resources is implemented in this layer as shown in Figure 10.

It is presumed that power and energy are wasted in case of inefficient resource usage. It is observed that resource idle time in sequential operation flow is larger than that of parallel operation flow. Hence energy and power are saved by minimizing resource idle time. This layer contains Green Resources.

Authorized and Authenticated Resource Usage Layer (AARUL)

It is observed that power and energy usage are reduced by using authorized and authenticated product. Usage of pirated product cause high power consumption and less efficient operation. Hence, more power and energy are required to accomplish the task.

Comparative analysis of energy, power and cost based on real time data is depicted in Figure 11. This layer contains Green Maintenance services.

Figure 9. Operational activity of ESL



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Introducing Green Index

As per Green Project concept,

$$M_W \propto E_f \text{ or, } E_f \propto M_W \tag{10}$$

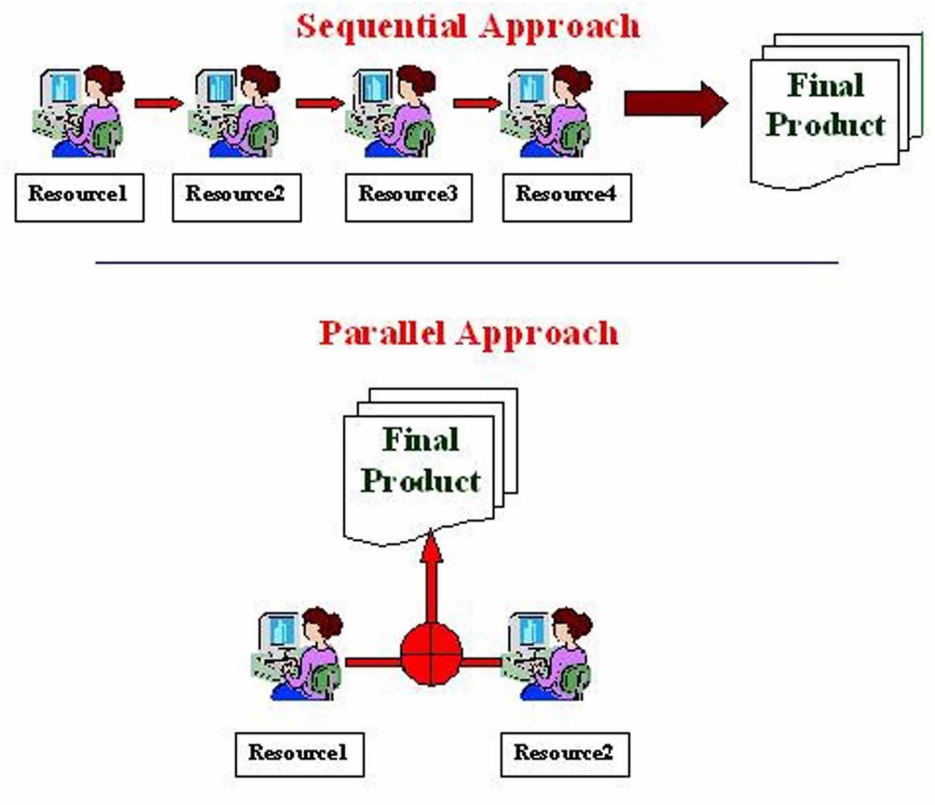
and

$$M_W \propto \frac{1}{P_M} \text{ or, } P_M \propto \frac{1}{M_W} \tag{11}$$

where, M_W = Working Men;

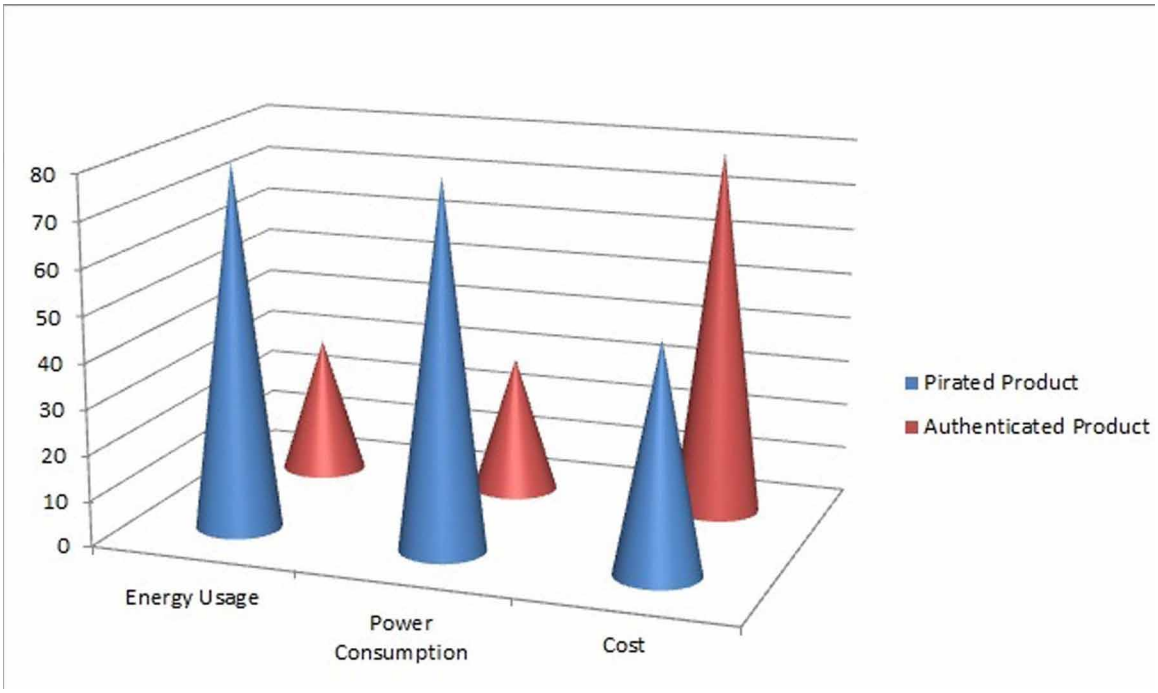
E_f = Efficiency;
P_M = Man Power Wastage;
As per PSL concept,

Figure 10. Operational activity of RUL



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 11. Comparative study of Energy Consumption, Power Consumption and Product Cost



$$E_f \propto \frac{1}{P} \tag{12}$$

and

$$D_R \propto P$$

where, P = Power Wastage;

D_R = Number of Running Devices;
∵Unused Devices = D_R- D_U
It is obvious that,

$$\therefore D_U \propto P \tag{13}$$

As, D_R value is presumed to be constant as efficiency of the system is not compromised.

$$\therefore Unused\ Devices \propto \frac{1}{P} \tag{14}$$

As per Green Project, Green Maintenance, and PSLconcept,

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

$$P \propto R_N \tag{16}$$

$$P \propto \frac{1}{D_A} \tag{17}$$

$$D_U \propto E_f \tag{18}$$

where, R_N = Number of Room used;

D_A = Number of Authenticated Devices;
D_U = Number of Used Devices;

As per Equation (10) and Equation (18),

$$E_f \propto \left(M_W \times D_U\right) \tag{19}$$

As per Equation (11), Equation (13), Equation (16), Equation (17),

$$Power \propto \frac{\left(R_N \times D_U\right)}{\left(M_W \times D_A\right)} \tag{20}$$

where, Power = P_M X P;

It is presumed from Equation (19) and Equation (20) that minimum power wastage without affecting the efficiency is achieved, if and only if, right hand side value of Equation (20) is minimal. This value is designated as "Green Index" and the mathematical representation is as follows:

$$Green\ Index = \frac{\left(R_N \times D_U\right)}{\left(M_W \times D_A\right)} \tag{21}$$

Theorem 1. Performance and efficiency of an automated system is increased if amount of unused human resource and device is minimized

Proof:

As per Equation (10) and Equation (11),

$$E_f \propto \frac{1}{P_M} \quad (15)$$

As per Equation (14) and Equation (15),

Performance and efficiency of an automated system is inversely proportional with man power wastage and number of unused devices.

(Proved)

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

A real time case study having a varying Green Index value and corresponding power wastage is shown in Figure 12.

It is depicted from Figure 12 that minimum power wastage is achieved from minimum Green Index value.

EXPERIMENTAL RESULTS

Our proposed approach is implemented on an urban traffic control room having 30 computers, 8 ceiling fans, 8 tube lights and two air conditioners. Experimental details and result is shown in Table 5.

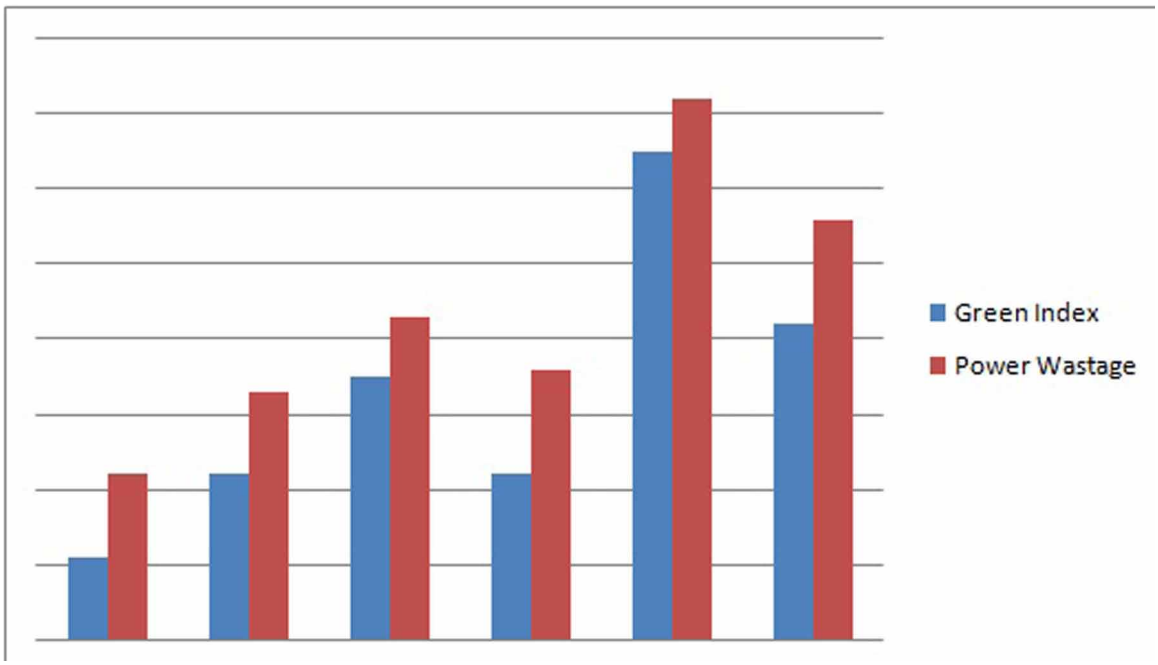
It is evident from Table 3 that power saving concept is successfully achieved by implementing our proposed approach without compromising with the service quality. Faster and efficient task completion is accomplished. Comparative performance analysis is shown in Figure 13.

It is evident from Figure 13 that maximum power consumption is achieved by our proposed green approach when test sample size is large. Hence, the proposed approach is more useful and efficient for large scale production.

Implementation of new devices or new architecture is suggested in various research works to reduce power consumption. Initial investment is required to employ new devices. Implementation of new architecture causes initial discomfort to workers. Hence production efficiency is reduced initially. Implementation of these proposals causes energy savings as well as initial efficiency loss as depicted in Figure 14.

It is evident from a real time case that, implementing typical existing approaches cause initial efficiency loss as shown in the Figure 13. It is evident that high efficiency and low power saving is achieved later by those approaches. Hence initial compromise in terms of efficiency may not be feasible in many sectors.

Figure 12. Green Index vs. Power Wastage

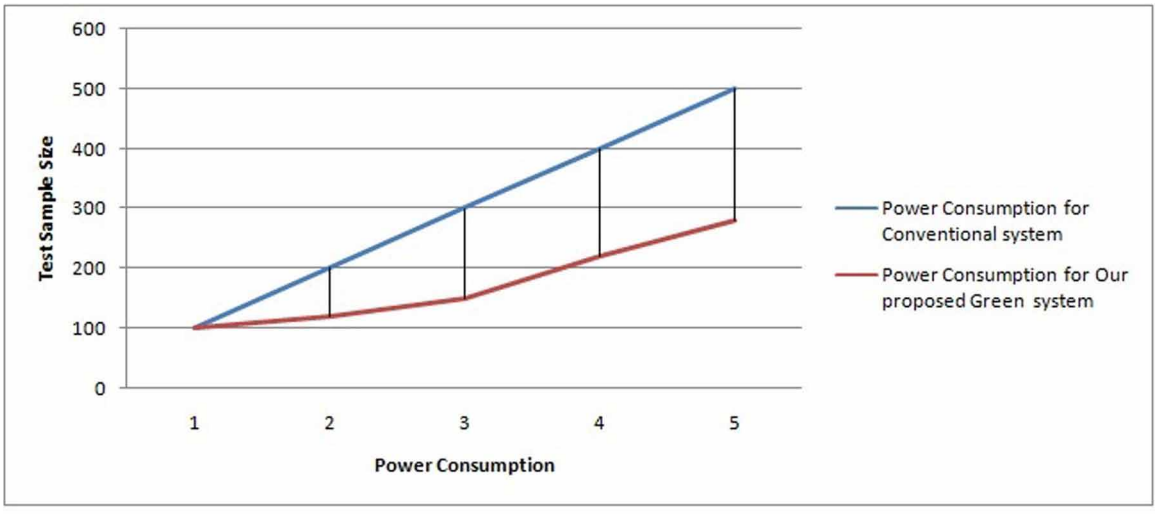


EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 5. Experimental Observations

Green Approaches	Task	Execution by Conventional Approach		Execution by Our Proposed Green Approach		Advantages
Green Project	Same projects are given to Two teams having 20 students each.	Test	Result	Task	Result	1. Time savings 2. Power savings
		Project is executed in sequential approach by another team and team is allowed to work in different places	Project is completed in 10 days and more power consumption	For one team project is executed in parallel approach and entire team works in a single room	Project is completed in 3 days and as single room is used minimum power consumption	
Green Transaction	Two same projects are given to Two teams.	Test	Result	Test	Result	1. Trees are saved as paper is not used. 2. Communication cost is minimum. 3. Fast communication 4. Fast processing
		Project requirement is given in a paper and only physical communication is allowed for another team	Physical communication makes the entire process time consuming	Project requirement is given through e-mail and e-communication is maintained for one team	Project is completed quickly due to fast communications.	
		One team is operating on a computer having old version software and no authorization/ authentication is checked	Project completion is delayed due to unexplainable behaviour of computer, such as sudden shut down, slow processing, malfunctioning due to unauthorized access.	Another team is operating on a computer having updated software.	Project is completed smoothly	
Green Resource	Two teams are given same resources to complete same project	Test	Result	Test	Result	1. Projects are completed in same time but minimum power is used.
		One team do not follow any automated system to operate the resources	Unlimited power usage	Another teams use the resources by implementing our proposed approach	Minimum power is used	

Figure 13. Comparative Power Consumption between Conventional System and Our proposed Green approach



**For a more accurate representation see the electronic version.*

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

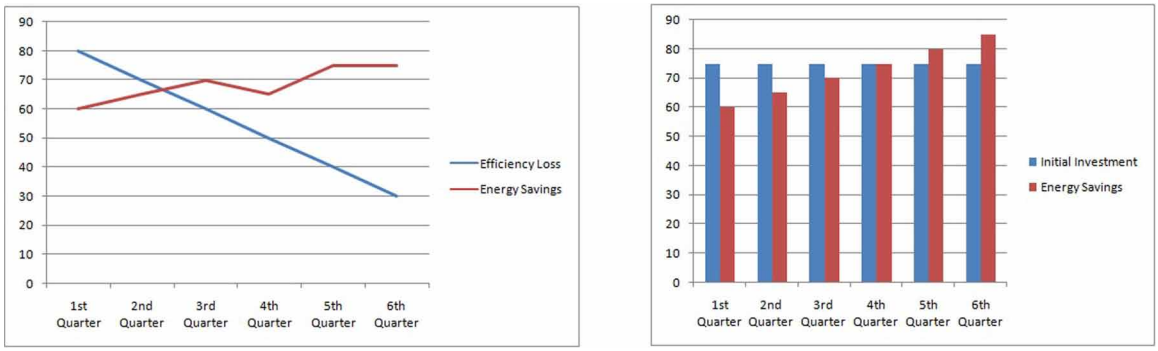
Initial investment is required for implementation of new architecture. Hence, expected outcome in terms of business as well as environmental point is achieved later as shown in Figure 14.

In our paper existing infrastructures of the system is tuned to achieve maximum energy savings. Highest degree of energy savings may not be achieved but maximum energy savings without compromising efficiency or initial investment. Energy savings with respect to the efficiency loss and initial investment is shown in Figure 15.

CONCLUSION

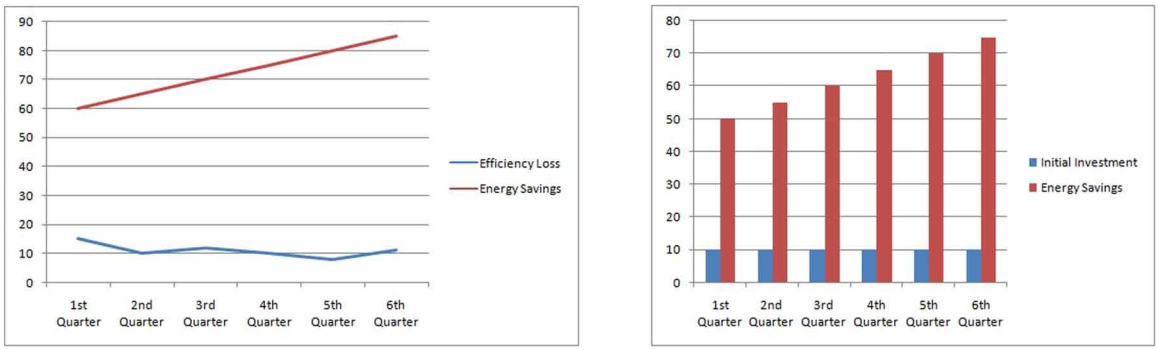
In this paper we propose different green services. We implement our proposed services in an urban traffic control room. It is evident from our framework and experimental results that proposed green approach is eco-friendly and efficient. Maximum power and energy are saved without affecting the accuracy of the system. We primarily focus on minimum energy usage without affecting the efficiency of the system. Different layer-based protocols are proposed to implement the Green concept in an automated system.

Figure 14. Efficiency Loss and Initial Investment for typical Green approaches



**For a more accurate representation see the electronic version.*

Figure 15. Efficiency Loss and Initial Investment with respect to Energy Consumption



**For a more accurate representation see the electronic version.*

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

In layer-based protocol we concentrate on power savings, energy savings, and maximum utilization of resources, proper authorization and authentication of resources to minimize the energy wastage and maximize efficiency. Faster and efficient system is formed reducing the consumption of power and energy. System productivity is also increased as time and energy is preserved. Implementation of automated system in different sectors would be increased as the chance of environmental pollution is reduced by implementing this approach.

REFERENCES

Aggarwal, S., Garg, M., Kumar, P. (2012). Green Computing is smart computing- A Survey. *International Journal of Emerging Technology and Advanced Engineering, 2*(4), 297-303.

Anwar, M., Qadri, S. F., Sattar, A. E. (2013). Green Computing and Energy Consumption Issues in the Modern Age. *IOSR Journal of Computer Engineering, 15*(6), 697-702.

Berl, A., Gelenbe, E., Girolamo, M. D., Giuliani, G., Meer, H. D., Dang, M. Q., Pentikousis, K. (2010). Energy-Efficient Cloud Computing. *The Computer Journal, 53*(7) 1045-1051.

Chakraborty, P., Bhattacharyya, D., Nargiza, S. Y., Bedajna, S. (2009). Green computing: Practice of Efficient and Eco-Friendly Computing Resources. *International Journal of Grid and Distributed Computing, 2*(3), 33-38.

Gelenbe, E., & Mahmoodi, T. (2011). Energy-Aware Routing in the Cognitive Packet Network. *International Conference on Smart Grids*. *Energy*, *68*(4), 338–346.

Gong, X. G. Z., & Wilkes, J. (2001). PRESS: Predictive Elastic Re-Source Scaling for cloud systems. In *6th IEEE/IFIP International Conference on Network and Service Management (CNSM 2010).* IEEE.

Heath, T., Diniz, B., Carrera, E. V., Meira, W. Jr, & Bianchini, R. (2005). Energy conservation in heterogeneous server clusters. In *10th ACM SIGPLAN symposium on Principles and practice of parallel programming (PPoPP'05).*186-195.

Jadhwani, D., Agrawal, M., Mande, H. (2012). Study of Efficient Utilization of Power using green Computing. *International Journal of Advanced Computer Research,2*(4).16-27.

Lakshmi, S. V. S. S., Sarwani, I. S. L., Tuveera, M. N. (2012). A Study on Green Computing: The Future Computing And Eco-Friendly Technology. *International Journal of Engineering Research and Applications, 2*(4), 1282-1285.

Mala, A., RaniUma, C., Ganesan, L. (2013). Green Computing: Issues on the Monitor of Personal Computers. *International Journal of Engineering and Science, 3*(2), 31-36.

Mazzucco, M., Dyachuk, D., & Deters, R. (2010). Maximizing Cloud Providers' Revenues via Energy Aware Allocation Policies. *IEEE 3rd International Conference on Cloud Computing* (pp. 131-138(.

Mittal, P., & Kaur, N. (2013). Study and Analyze the Factors Related to Green Computing. *International Journal of Advanced Research in Computer Science and Software Engineering, 3*(4), 366-369.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Ponnusamy, Y., & Sasikumar, S. (2012). Application of Green Cloud Computing for Efficient Resource Energy Management in Data Centres. *International Journal of Computer Science and Information Technologies*, *3*(5), 5101–5107.

Quan, D. M., Basmadjian, R., Meer, H. D., Lent, R., Mahmoodi, T., Sannelli, D., . . . Dupont, C. (2011). Energy efficient resource allocation strategy for cloud data centres. In *26th International Symposium on Computer and Information Sciences (ISCIS 2011)* (pp. 133-142). Springer-Verlag. Retrieved from http://eco-officegals.com/online-banking-an-eco-friendly-way-to-manage-your-money/

Schmidt, K., Härder, T., Klein, J., & Reithermann, S. (2008). Green Computing a Case for Data Caching and Flash Disks. In *Tenth International Conference on Enterprise Information Systems (ICEIS 2008)*. Barcelona, Spain.

Sheikh, R. A., Lanjewar, U. A. (2010). Green Computing- Embrace a Secure Future. *International Journal of Computer Applications, 10*(4), 22-26.

Shinde, S., Nalawade, S., & Nalawade, A. (2013). Green Computing: Go Green and Save Energy. *International journal of Advanced Research in Computer Science and Software Engineering, 3*(7), 1033-1037.

Vogeleer, K. D., Memmi, G., Jouvelot, P. (2017). Parameter sensitivity analysis of the Energy/Frequency Convexity Rule for application processors. *Sustainable Computing: Informatics and Systems, 15*.

Xian, C., & Lu, Y. H. (2006). Dynamic voltage scaling for multitasking real-time systems with uncertain execution time. In *16th ACM Great Lakes symposium on VLSI* (pp. 392-397). New York: ACM Press. 10.1145/1127908.1127998

Zhang, Y., Wang, C., & Lin, C. (2017). Energy-aware sporadic tasks scheduling with shared resources in hard real-time systems. *Sustainable Computing: Informatics and Systems*, *15*, 52–62.

Zhong, B., Feng, M., & Lung, C. H. (2010). A Green Computing Based Architecture Comparison and Analysis. In *IEEE/ACM International Conference on Green Computing and Communications (GreenCom)*, Hangzhou, China.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

This research was previously published in the International Journal of Green Computing (IJGC), 8(2); edited by Vicente Gonzalez-Prida, pages 77-97, copyright year 2017 by IGI Publishing (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Section 4
Utilization and Applications

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 36
Green Practices Implementation as Prerequisite to Sustain Firm Competitive Advantages:
The Empirical Study from Indonesia Large Scale Enterprises (LSEs)

Kardison Lumbanbatu
University of Diponegoro, Indonesia

Vincent Didiek Wiet Aryanto
Dian Nuswantoro University, Indonesia

ABSTRACT

Encompassing firms to apply green policy in a holistic management practices are strongly required in order to maintain competitive advantages and experience long-term marketing performance. This current empirical research is aimed to fill the lack of empirical findings and empirical studies on firm's innovative concept. Green-based product innovation, green management practices and green corporate image are presented as the antecedents and postulated as the sources of sustaining firm competitive advantages. A questionnaire-based survey was deployed to collect data from Large Scale Enterprises in Indonesia with Top Management, Operational and Marketing Managers served as respondents. 500 questionnaires were mailed and 388 were valid for further analysis. Data was analyzed by using Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM) via AMOS statistical software. Statistical findings demonstrated that green-based product innovation, green management practices and green corporate image significantly has a positive affect to sustain firm competitive advantages which is led to enhance long term marketing performance. However, green-based product innovation plays insignificant direct relationship on long term marketing performance. This study discusses some managerial implications for enterprises and recommendations on a basis of green implementation.

DOI: 10.4018/978-1-5225-7915-1.ch036

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

1. INTRODUCTION

Many reseach had been conducted regarding on green concept to find out the green operation of firms world-wide. The topic and the strategy applied were varies such as studies which assessed the greenness of environmental advertising conducted by Leonidou, Leonidou, Hadjimarcou, and Lytovchenko (2014); the finding claimed that the green advertisements played a significant role such as situation points, the profile of advertiser, targeting features, message factors and the nature. Other research showed the effects of consumers on environmental impact in product labelling (Borin, Cerf, and Krishnan, 2011), meanwhile the Consumer responses to Eco-labelling showed by Thøgersen, Haugaard, and Olesen (2010). Moreover, customer social responsibility attached to product, also trigger the green firm performance as shown by the strong impact of CSR-labelled products in retailers' assortment (Carrero and Valor, 2012); sustainability labels in the consumer perception (Binnekamp and Ingenbleek, 2008); Effect of green labelling on residential property price (Jayantha and Man, 2013); Exploring green consumers' product demands and consumption processes (Luzio and Lemke, 2013); Green care governance (Vik and Farstad, 2009); Label design (Henley, Fowler, Yuan, Stout, and Goh, 2011); competitive advantage has a strong relationship with CSR to increase higher and profitable corporate image (Bansal and Kumar, 2011), competitive advantage has a strong relationship with CSR to increase higher and profitable corporate image (Pop, Vaduva, Dabija, and Fotea, 2010), sustainable development as a set of transformation that align human relationship with nature (McLane, 2015), customers attitude on online grocery shopping It stated that the green image of firm will sustain customers trust

(Al Nawayseh and Balachandran, 2012), holistic sustainability of tourism attractions (Ottenbacher, Schwebler, Metzler, and Harrington, 2015), green new deal to seek for knowledge, Sustainability, and green development (Barth, 2011).

The green side of materialism in emerging BRIC and developed markets (Strizhakova and Coulter, 2013); The effect of green messages on brand purchase and brand rejection (Wheeler, Sharp, and Nenycz-Thiel, 2013); The influence of private labels on retailer cooperation (Zippel, Wilkinson, and Vogler, 2013); The nature and incidence of private label rejection (Nenycz-Thiel and Romaniuk, 2012); Understanding efficiencies behind logistics service providers' green offerings (Isaksson and Huge-Brodin, 2013).

Besides focusing on green product labelling, the most recently trending topic in green is green environmental. green management and environmental (Teixeira, Jabbour, and Jabbour, 2012); From shadow to green (Markandya, González-Eguino, and Escapa, 2013); environmental technology sector green (Guziana, 2011); Green teams: understanding their roles in the environmental management (Jabbour, Santos, Fonseca, and Nagano, 2013); environmental management capability (Wong, Lai, Shang, Lu, and Leung, 2012); Environmental innovations and profitability (Ghisetti and Rennings, 2014); environmental innovation embedded within high-performance (Antonioli, Mancinelli, and Mazzanti, 2013); effects of environmental policies (Saltari and Travaglini, 2011); How green is Environmental gardening identity (Kiesling and Manning, 2010); green and profitable sustainable (Figge and Hahn, 2012); Embedding "substrate" in environmental assessment of green (Peri, Traverso, Finkbeiner, and Rizzo, 2012); Going green or going away (Zhu, He, and Liu, 2014).

Studies which propose standards to apply green business strategies such as (Nulkar, 2014); how firm should have environmental consciousness and green (Huang, Lin, Lai, and Lin, 2014); available information on environmental issues (Mitomo and Otsuka, 2012); green product innovation on firm performance (Ar, 2012); Does international experience help firms to be green (Aguilera-Caracuel, Hurtado-Torres, and Arago´ n-Correa, 2012); Urban green space, public health, and environmental justice (Wolch, By-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

rne, and Newell, 2014); Influence of green spaces on environmental (Qin, Zhou, Sun, Leng, and Lian, 2013); Environmental performance (Rincón et al., 2014); pro-environmental self-identity (Whitmarsh and O'Neill, 2010); How green are environmental technologies (Papa, Pedrazzani, and Bertanza, 2013); business environment on environmental purchasing (Björklund, 2011); Pro-environmental behaviours (Kalamas, Cleveland, and Laroche, 2014).

The natural resources, renewable as well as un-renewable affected the firm policy implementation. Some previous studies related, such as the Energy, economic and environmental discourses and their policy impact by Winfield and Dolter (2014); impact of environmental proactively on multiple performance outcomes (Sambasivan, Bah, and Jo-Ann, 2013); green energy brands (Hartmann and Apaolaza-Ibáñez (2012); Does it really pay to be green (Clarkson, Li, Richardson, and Vasvari, 2011); renewable energy, environmental degradation and economic growth (Zeb, Salar, Awan, Zaman, and Shahbaz, 2014); Environmental orientation and corporate performance (Chan, He, Chan, and Wang, 2012); green information systems adoption and environmental performance (Gholami, Sulaiman, Ramayah, and Molla, 2013); strategy selection for environmental risk (Zhao, Neighbour, Han, McGuire, and Deutz, 2012); environmental competitiveness and innovation (Fankhauser et al., 2013); Effective environmental marketing of green cars (Siriwardena, Hunt, Teisl, and Noblet, 2012); How much green for the buck (Chabé-Ferret and Subervie, 2013); environmental management system for green (Hsiao, Chuang, Kuo, and Yu, 2014); Geo-Environmental Challenges (Ismail, Don, Diman, and Wijeyesekera, 2013); green innovation on environmental performance (Tzu-Yun Chiou, Hing Kai Chan, Fiona Lettice, and Sai Ho Chung, 2011); Going Green of Mission (Yozgat and Karataş, 2011); Prioritizing Drivers for Green Manufacturing: Environmental (Mittal and Sangwan, 2014); To be or not to be green (Cho, Thyroff, Rapert, Park, and Lee, 2013); Moving towards an ecologically sound society .

Concurrent encountered problems are vary, as Juan (2011) claimed that the most challenging problem concerns on the environmental is unwise energy consumption. Meanwhile Huber (2004) highlighted that the most difficult factors in achieving the living standard is the ecological sustainability. This finding aligned with Frenken and Faber (2009) demonstrated that recognized environmental innovation offer benefit to sustainability. These finding to conclude that there is a significant relationship between environmental issue and business. Furthermore, Yang and Chen (2011) reported some studies have been implemented to reduce the negative impact of industry on environmental. The effort of top management support on environmental management plays crucial role to increase firm performance (Y-S. Chen, 2008).

Some benefits impact of the improved innovation such as energy saving, reduction of CO2 emissions, savings water consumption, increased recycling, increased biodiversity, environmental pollution decreased. Carrion-Flores and Innes (2010) added some positive impact of innovation such as growth and competitive capability, higher productivity and economic wealth, waste reduction and environmental damage (Carrion-Flores and Innes, 2010). T-Y. Chiou, H.K. Chan, F. Lettice, and S.H. Chung (2011) stated that stresses on green innovation with lower environmental impact during life cycle will effect on higher green sales as the percentage of total sales. Furthermore, green innovation is considered as key factor to achieve sustainable development (M.-J. J. Lin and Chang, 2009), as well as the contribution on sustainable society (Carrillo-Hermosilla and del Rio, 2009).

There are two huge parts known in green innovation or environmental innovation. Firstly, green product design process (GPDP) or eco-innovative design (EiD) (Chang and Chen, 2004; K. Rennings, Ziegler, Ankele, and Hoffmann, 2006; Ziegler and Nogareda, 2009). Secondly, the relationship between environmental innovation and science or environmental innovation and science or government policy (K. Rennings, 2000; Kemp and Arundel, 2008; Janicke M., 2008; Carrion-Flores and Innes, 2010; Demirel

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

and Kesidou, 2011). Yang and Chen (2011) contended that there was the significant impact of innovation on new products. The lack of findings and scientific studies are considered as the most problems encountered to identify the green innovation concept. The improvement in innovation and economic development somehow lead to environmental damage.

Current study will investigate the impact of green based product innovation, assessing the relationship between green innovation, green management practices, green corporate image on sustained competitive advantage, and the impact of sustained competitive advantage on long term marketing performance. The study has the sequences as follows. The next step is presenting the theoretical framework and develops the research hypotheses. Section 3 discusses the methodology, data collection and analysis. Section 4 reveals the findings, section 5 demonstrates results, sump up, managerial implications and further research.

2. THEORETICAL FRAMEWORK AND HYPOTHESIS DEVELOPMENT

2.1. Green Innovation

Carrillo-Hermosilla and del Rio (2009) stated that it hardly to define green innovation even though many attempts have been made. Krammerer (2009) defined environmental innovation as a part of innovation which leads to the improvement on equality of ecological. Y-S. Chen, Lai, and Wen (2006) described the definition of green innovation relates with the engagement in energy saving, pollution prevention, waste recycling, green product design, furthermore, Halila and Rundquist (2011) said that the term of Eco-Innovation (environmental innovation, green innovation or continuously innovation) are mostly deployed to identify the innovation which contributes on environmental through ecology. Eco-Innovation also defined as the application which contains new product, technical, practical, system and product to avoid and reduce the negative impact on environmental. Current study focuses on green product innovation and analyzes the relationships between green-based product innovation, green management practices, green corporate image, sustainable competitive advantage and long term marketing performance as can be seen in Figure 1.

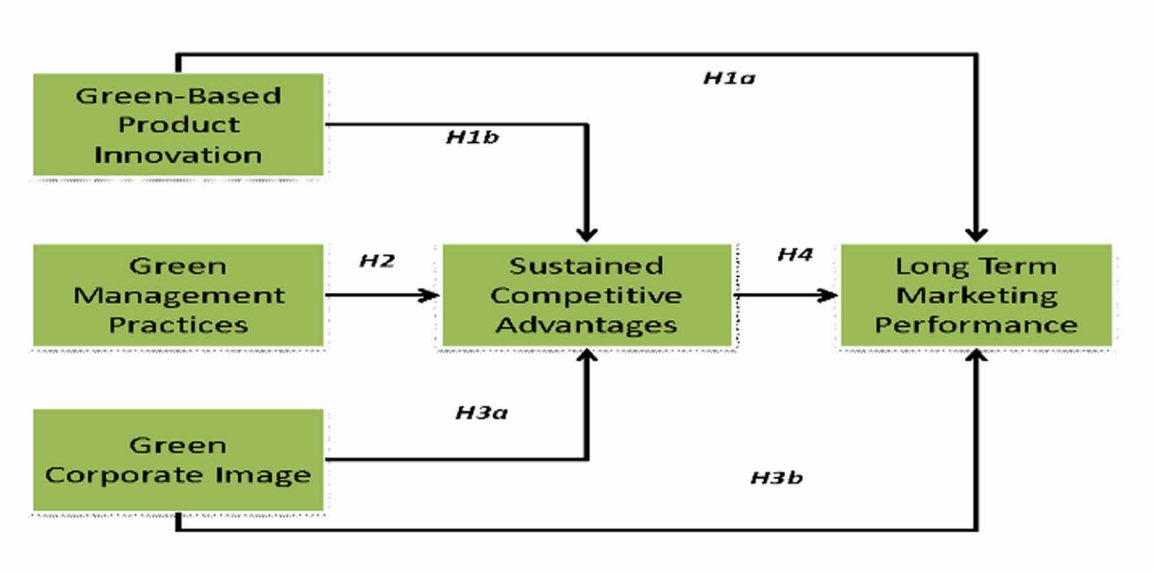
In this study, the green innovation defined as the whole actions taken by the stakeholder which is relevant to development and application, process, products, technical and management that offers contribution to reduce negative impact on ecology (Kemp and Arundel, 2008). According to Yu-Shan Chen (2011) green innovation could be classified in to three categories as green product innovation, green process innovation and green managerial innovation. This conventional category enhance to increase in creating the focus on eco-innovation concept. This study focuses on green based product innovation, green management practices, green corporate image, sustainable competitive advantage and marketing performance as seen at Figure 1.

2.1. Green-Based Product Innovation on Sustainable Competitive Advantage and Long Term Marketing Performance

There are some consideration to propose green product innovation and marketing performance as the antecedents and consequences for current study. Some factors in green product innovation which is believed as the key drivers for the efficiency of material usage, low cost will lead the way for firm to find out new method to change the waste to additional value. Besides, growth the cash flow, increased

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 1. The proposed theoretical model



performance and corporate reputation (Eiadat, Kelly, Roche, and Eyadat, 2008). Krammerer (2009) noted that green product as public benefit instead of private benefit for customers to obtainand increase strong consumer demands.

One of research and development purposes is to design and to discover green technology for manufacturing green products. Hence, research and development required good cash flow performances. Kahloul and Zouari. (2013) stated that firm's immediate growth was triggered by research and development to sustain corporate growth.

Y-S. Chen et al. (2006) claimed that firms could leverage the resources' productivity through green innovation whilst Carrion-Flores and Innes (2010) demonstrated that there is a strong relationship environmental innovation and environmental performance based study on 127 manufacturers. Furthermore, the innovation could minimize the cost, determinant factor to a higher environmental performance. Gluch and Thuvander (2009) described that organization could push it capability to absorb the green innovation and business performance, a study conducted in Sweden.

Moreover, Edgeman., Bøllingtoft., Eskildsen., Kallehave., and Kjærgaard. (2013) Rick Edgeman also declared that to sustain excellence firm performance and firm going concern, Innovation is definitely needed to be accentuated.

Pujari (2006) conducted a survey concerned on projects of new product development in North America reported that Eco-Innovation has a positive impact on competitive advantage. The current research proposed hypotheses as follows:

Hypothesis 1a (H1a): The higher the degree of green-based product innovation, the higher the rate of sustainable competitive advantage.

Hypothesis 1b (H1b): The higher the degree of green-based product innovation, the higher the rate of long term marketing performance.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

2.2. Green Management Practices on Sustained Competitive Advantage and Long Term Marketing Performance

It is a crucial factor that top management support could achieve the innovative application. This innovative application is generally considered as a green management practices. Besides, (Ho, Lin, & Chiang, 2009) highlighted that the higher green management practices, the higher rate of firm's willingness to implement green innovation. Buyukkeklik, Toksari, and Bulbul (2010) emphasized that the environmental managerial cases is considered as a determinant factor to effect green managerial practices. This, at the finally could trigger the green innovation implementation, as in return, it could lead the firms to sustain competitive and high performance.

C.-Y. Lin and Ho (2008) declared that by support and motivation of firm will affect the willingness to adopt green practices. Furthermore, Jansson, Marell, and Nordlund (2010) claimed that values, trust, and norms that determine the willingness to adopt the Eco-innovation. Buyukkeklik et al. (2010), also claimed that even managers had just begun to care the environmental, so far it was not reflected green practices on his or her business.

M.-J. J. Lin and Chang (2009) conducted a study in Taiwan by exploring the effect of firm's etiquette on green learning and innovation performance. Furthermore, managerial focus is considered as the most crucial driver to adopt and apply the green practices as the empirical finding gained from industry in China. The green practices will finally lead to higher sustainable competitive advantage. Therefore, the current study proposed the hypotheses as follows.

Hypothesis 2 (H2): The higher the degree of green management practices and, the higher the rate of sustainable competitive advantage.

2.3. Green Corporate Image on Sustained Competitive Advantage and Long Term Marketing Performance

Many previous research which concerned on green corporate image demonstrated the similar findings that claims positive relationship between green corporate image and purchase behavior or loyalty (David, Kline, and Dai, 2005; Keh and Xie, 2009; Lee, Hsu, Han, & Kim, 2010). Furthermore, as consumer find more satisfaction, the more intense investigating conducted related with the new product, this defines the important of green corporate image in buying behavior.

Corporate Social Responsibility sometimes considered as firm green image. Kakabadse., Kakabadse., and Lee-Davies (2014) described that in order to sustain corporate image, CSR should be embedded within firm environment. Green corporate image which obtained from CSR will lead to green customer behavior and long term marketing performance.

Hsieh, Pan, and Setiono (2004) declared the important of consumers' attitude on green corporate image had a significant impact on brand purchase behavior. Corporate image and corporate reputation are believed to be the factors that affect consumer behavior, such as customer loyalty and word of mouth behavior. Furthermore, corporate reputation was also considered as the most influenced on word of mouth behavior. Besides, Ha (1999) product-related factor of green corporate image is the key predictor factor which is crucial in purchase intention, where those factors are believed could reduce the hardest in purchase decisions. Obviously, green corporate image could increase the competitive advantage. Therefore, the current study proposed the hypotheses as follows:

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Hypothesis 3 (H3a): There is a positive relationship between Green Corporate Image and sustained competitive advantage.

Hypothesis 3 (H3b): There is a positive relationship between Green Corporate Image and Long Term Marketing Performance.

2.4. Sustained Competitive Advantage and Marketing Performance

Higher marketing performance could be gained and leveraged through customer orientation with adequate understanding on aimed consumers. Firstly, Competitor orientation is also believed as other factor to increase marketing performance. The producers not only have to recognize and understand the strength, weakness, capability, long-term strategy but also potential competitors. Thirdly, inter-functional coordination utilization of coordinated resources in firms to create superior value for targeted customers (Narver, Slater, and MacLachlan, 2004).

Hadjimanolis (2000) claimed that the most important marketing performance measurement is sales growth, workforce growth, profits growth and market share growth. The argumentation on growth is the precisely indicators and convenience compared with accounting measurement. Financial performance and growth are the different aspects from marketing performance, which is having important information and uniqueness. Simultaneously, the growth and financial performance provide broaden description on actual performance from an industry compared with using self-measurement. Others findings found three criterion of marketing performance measurement, effectivity, efficiency and adaptability.

Mavondo (2008) summarized that human resources practicals has strong relationship with marketing effectiveness, operational effectiveness and marketing performance. Further in study conducted showed that human resources mediated the relationship of market orientation and performance, this could emphasize that human resources should take a part in market orientation (Hult, Ketchen, and Nichols, 2002).

Madu, Kuei, and Lin (1995) measure the market performance with some dimensions such as productivity, cost performance, profitability, competitiveness, sales growth, earning growth and market share. Moreover, market performance is organization ability to self-transformation encounter the challenges from the environment with long-term perspective. To sum up, the following hypothesis is related works of previous study:

Hypothesis 4 (H4): There is a positive relationship between sustain competitive advantage and Marketing Performance.

3. RESEARCH METHOD

3.1. Measurement

A self-administered questionnaire was constructed in accordance with robust literatures traced. The questionnaires focus on green firm's concept. Investigating the conceptual model, present study adopts a 19-item-questionnaire which contains of green-based product innovation (five items), long term marketing performance (three items), Green Corporate Image (four items), sustained competitive advantages (five items items) and Green management Practices (four items). A ten-point rating scale was used to measure the items which anchored by strongly disagree," (1) and "strongly agree,"(10).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

3.2. Sampling and Data Collection

The large scale enterprises in Indonesia are chosen for current research. There are some criteria considered to be fulfilled before selected as the sample. Firstly the length of firms operation is five years minimum, secondly, the number of workforces is also taken into consideration.

The data were collected from Indonesia during the late of 2013 and early 2014. Data collection was conducted via mailing and E-mail, face to face. A total of 500 questionnaires were sent, 400 were received and 388 were valid for further used. To increase the questionnaires rate of return, author resent questionnaires and called back. The sample size meets the requirement for the casual model with 19 indicator refers to Bentler and Chou (1987)'s claimed that about 5 to 10 observations per indicator variable.

3.3. Analysis

Testing six main hypotheses, present study deployed Structural Equation Modeling (SEM) via AMOS 4.0 and SPSS 16 software packages. Byrne (2001) suggested that the assessment of hypotheses' relationship among constructs to find out latent variables and identify the direction and the relationship, SEM software was used. Firstly, the measurement scale assessment, the EFA was conducted, then for test validation, CFA was done.

4. ANALYSIS AND RESULTS

4.1. Descriptive Statistics

In terms of the number of workforces, all selected firms have been run the firms more than five years and have more than one hundred employees. The employees are distributed working in the field of Mining, Furniture & Industry Processing, Rubber industry, Lodging, Vehicles, Paper and Pulp, Chemistry, Leather, Electrical, Food and Beverages, Machine and Supplies, Machine and Office Utensil, Garment, Publishing and Printing, Gas, Radio, TV and Electronic, Textilee, Steel and Tobacco.

The very beginning and the latest responses were investigated to avoid response test bias as advised by J.S. and T. (1977) regarding on the nature, operational time and the total of employees. T-tests result demonstrated that the mean differences for each measure was not significant at a significance leve, 0.05, therefore, there is no "non-response bias"

4.2. Measurement and Structural Models

4.2.1. Measurement Model Results

The usage of CFA to measure the reliability and validity, noticing that all observed indicators were considered free by standardizing the exogenous as well as endogenous latent variables. The statistical results described that the measurement model includes all of the indicator items of the constructs shown in Table 1. The global fit Indices of this model (2/df=2.00, GFI =0.955, AGFI= 0,943, NFI=0.947, CFI=0.999, TLI = 998 and the RMSEA=0.08, and Hoelter = 437) this output indicated that the hypothesized model fits the data. However, further validity should be examined the critical psychometric properties such as

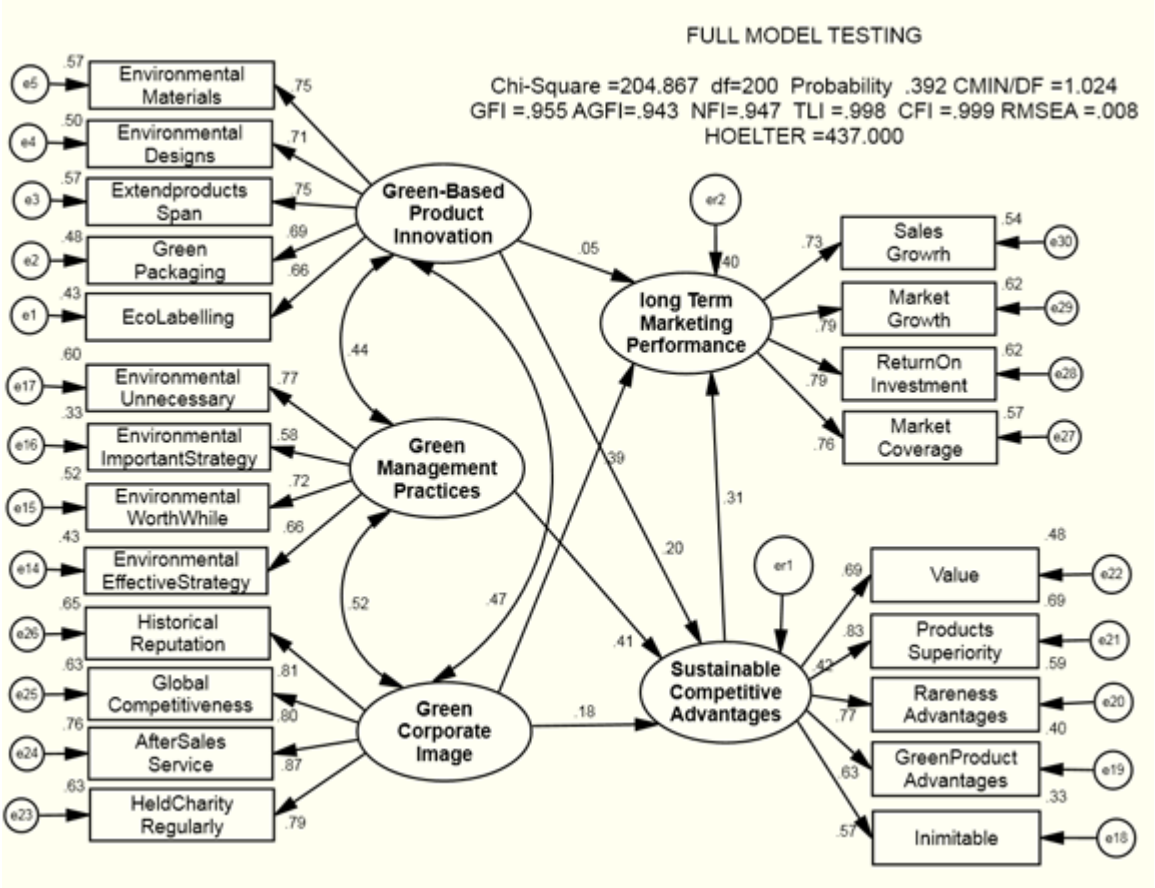
EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

unidimensionality, reliability, and validity. Composite reliability Pop et al. (2010) were tested by computing the composite reliability estimation, whilst discriminant and convergent validity were measured by means of Average Variance Extracted (Peri et al., 2012).

The whole of items should be referred to confirmatory factor analysis (CFA) to verify unidimensionality, discriminant and convergent validity. Based on to the output of CFA, described at Table 1, the range of factor loading of CFA started from 0.70 to 0.90, and all loadings are significant ($p<0.001$), by means supports the unidimensionality and all composite reliability more than then considered that all construct meet the requirements.

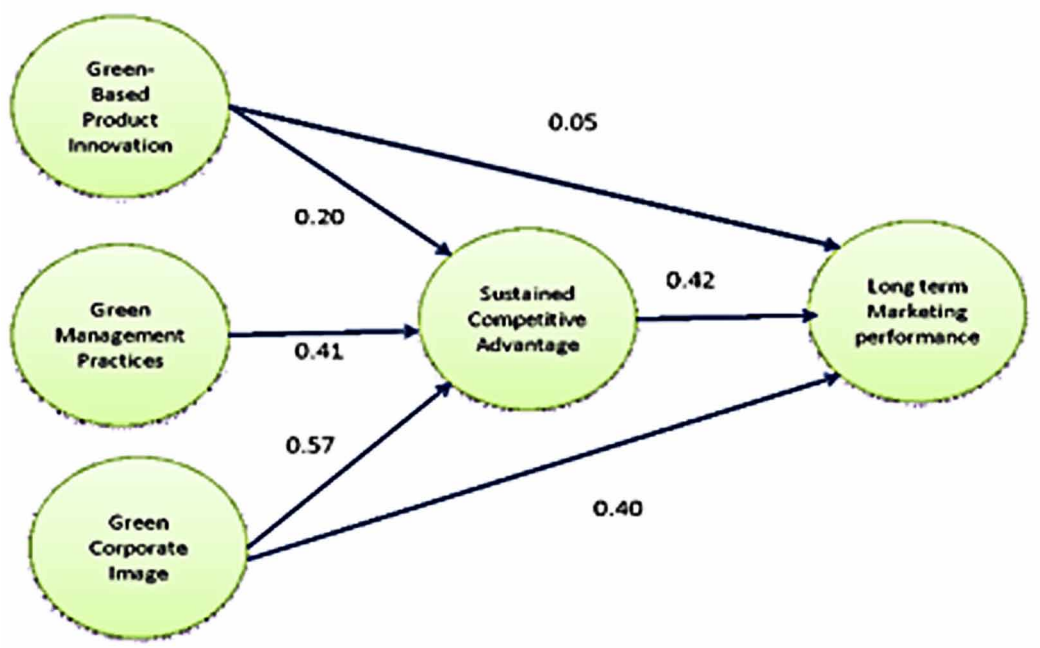
Testing reliabilities of the constructs was conducted to compute cronbach's Alpha. Nunnally and Berstein (1999) claimed that a Conbach's Alpha of >,07 met the requirements on reliability. Having the all constructs are satisfactory and acceptance of convergent validity, the research can be proceeded. As suggested that AVE values for each construct should be more than the threshold (0,60). Finally, the statistical output demonstrated that the square root of the AVE value for each construct is bigger than the correlation coefficients which is becoming the evident for convergent validity as seen in Table 2.

Figure 2. Full model testing



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 3. Full structural model



The coefficient of determination of all proposed variables green-based product innovation (mediated by sustained competitive advantage), green management practices, Green corporate image < sustained competitive advantages) are high, this indicates that, the used variables (antecedents) are truly necessary and key determinant factor to increase marketing performance.

4.3. Structural Equation Modeling

Having met the requirement obtained from measurement issues, the structural model in Figure 1 was subsequently tested. According to the results are presented in Table 3, the measurement model includes all of the indicator items of the constructs shown in Table 1. The global fit Indices of this model (2/df=2.00, GFI =0.955, AGFI= 0,943, NFI=0.947, CFI=0.999, TLI = 998 and the RMSEA=0.08) respectively. These results indicate a good fit of the model.

4.4. Hypotheses Testing

The structural model illustrated in Figure 2 highlighted the insignificant and significant standardized path coefficients. Green-based product innovation is significantly related to sustained competitive advantage but it is insignificant on long term marketing performance directly. Green management practices as well as green corporate image are strongly as the key antecedents of sustained competitive advantages. Green corporate image is also significant on long term marketing performance directly. As predicted before, sustained competitive advantages are a determinant factor for long term marketing performance.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 1. Results of the measurement model (confirmatory factor analysis

Constructs and Measurement Items	Standardized Loadings	*α*	*CR*	*EVA*
Green –Based Product Innovation (GBPI)		.90	.87	.76
• *Using less or non-polluting/toxic materials (Using environmentally friendly material*	.75			
• *Improving and designing environmentally friendly*	.71			
• *Recovery of company's end life product and recycling*	.75			
• *packaging (e.g.: less paper and plastic material used) for existing and new products*	.69			
• *Using eco-labeling*	.66			
Long Term Marketing Performance (MP)		.78	.75	.72
• *Sales growth*	.73			
• *Market share*	.79			
• *Return on investment*	.79			
• *Market Coverage*	.76			
Green Corporate Image (GPI)		.82	.84	.64
• *Historical and traditional reputation is strongly seen*	.83			
• *Achieving global competitiveness*	.81			
• *Providing after sales services*	.83			
• *Held regularly charity*	.79			
Sustained Competitive Advantage		.78	.92	.67
• *Value*	.57			
• *Product Superiority*	.63			
• *Inimitability*	.77			
• *Rareness Advantages*	.83			
• *Green Product Advantages*	.69			
Green Management Practices (GMP)		.73	.88	.74
• *Environmental innovation is not necessary to achieve high levels*	.77			
• *Environmental innovation is an important components of strategy*	.68			
• *Most environmental innovations are worthwhile*	.63			
• *Environmental innovation is an effective strategy*	.79			

Note: All items is measured with Ten-point scale, anchored by "Strongly Disagree" and "Strongly Agree. All factor loadings are standardized and significant at 5%, CR: Composite Reliability, AVE: Average Variance Extracted.

Table 2. Correlations and the square root of the AVE

Research Construct	Green–Based Product Innovation	Green Management Practices	Green Corporate Image	Sustained Competitive Advantage	Long Term Marketing Performance
Green –Based Product Innovation	0.90	0.56	0.68	0.47	0.43
Green Management Practices		0.94	0.78	0.56	0.27
Green Corporate Image			0.88	0.48	0.34
Sustained Competitive Advantage				0.85	0.24
Long Term Marketing Performance					0.92

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

4.4.1. Direct and Indirect Effects

H1a proposes that green-based product innovation affect sustained competitive advantages play significant role on sustaining the competitive advantages, whilst H1b green-based product innovation on long term marketing performance is insignificant, As Figure 3 showed that green-based product innovation has a positive effect on sustaining competitive advantages (0.20), meanwhile the insignificant green-based product innovation on long term marketing performance (0.05). Thus, H1a is rejected and H1b is supported. This suggested that long term marketing performance is more likely achieved through sustained competitive advantage rather than a direct relationship with green-based product innovation.

H2 proposes the effect of green management practice on sustained competitive advantages is supported (0.41).

H3a which proposes the effect of green corporate image on sustained competitive advantage and H3b the effect of green corporate image on long term marketing performance are supported (0,39) and (0.18) respectively. This could be meant that when corporate image is considered green, firm will sustain its competitive advantages and also will experience its long term marketing performance.

Once firms sustained its competitive advantages, firm will perform long term marketing performance as H4 proposes the effect of sustained competitive advantage on long term marketing performance is supported (0.31).

5. DISCUSSION AND CONCLUSION

Winning tough competition, green concept and green implementation is viewed crucial factors and part of firm's policy. Providing some insights for policy makers and top management into mapping the green concept as well as green image as aligned with previous study (Ellen, Webb, and Mohr, 2006; Melewar, Karasmanoglu, and Paterson, 2005).

Based on the acceptance of proposed hypotheses to sustain long-term marketing performance, firms should strongly emphasize on green-based product innovation by friendly material, design environmental

Table 3. The results of path analysis (base model)

Hypothesized Variables			Estimate	SE	CR	Hypotheses	Support
Long Term Marketing Performance	**<--**	**Green-Based Product Innovation**	.058	.078	.742	H1a	No
Sustained Competitive Advantages	**<--**	**Green-Based Product Innovation**	.219	.071	3.099	H1b	Yes
Sustained Competitive Advantages	**<--**	**Green Management Practices**	.528	.098	5.403	H2	Yes
Sustained Competitive Advantages	**<--**	**Green Corporate Image**	.163	.060	2.695	H3a	Yes
long Term Marketing Performance	**<--**	**Green Corporate Image**	.406	.069	5.896	H3b	Yes
long Term Marketing Performance	**<--**	**Sustained Competitive Advantages**	.352	.075	4.673	H4	Yes

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

friendly, green packaging as well as eco-labelling. Meanwhile, green management practices should be attained through green innovation to achieve high levels and green innovation as components of strategy. To increase the green firm image, there are some options to consider such as firm should depict their historical and traditional reputation are strongly shown, reaching global competitiveness, the availability of after sales service and social charity.

The existence of green based- product innovation is positively related with sustained competitive advantages, as well as green management practices, and green corporate imagee, further sustained competitive advantages has a significant impact on marketing performance. The purposes of this study is to offer added views and perception within the relationship between green-based product innovation, green management practices and green corporate image.

The evidences presented in this present study elaborated the relationship between between green-based product innovation, green management practices and green product image, market position and marketing performance. This showed that green-based product innovation in general have positive impact on market position and marketing performance. This could be shown that the strong significant and impact of all green innovation practices at the end will lead to higher rate of marketing performance, (Pujari, 2006; Y-S. Chen et al., 2006; T-Y. Chiou et al., 2011).

Some implications that can be taken such as the promotion made by firms to introduce, develop green-based practices, green innovation should be coordinated with any related fields and implemented as well to integrate the environmental and green innovation to increase marketing performance. For all stakeholders should more focus on environmental issue for green performance.

Like other studies, current study has some limitations that are recommended for future study to conduct such as manufacturing sectors, future research might use a sample from market in a different countries. Firstly, the data were collected from large scale enterprises in Indonesia with general manager, operational and marketing managers served as respondents. Having them as respondents for somehow have different perceptions on completing the questionnaires.

Secondly, based on the statistical output highlighted that the coefficient of determination is relatively low for the target variables such as green corporate image (0.163), and green based product innovation (0.058) that indicates the other green practices are compulsory considered.

Third, one of current study a hypothesis is rejected, that is the impact of green-based product innovation on long term marketing performance. Generally, green product innovation in a long term could not be sustained as a new innovation will be emerging.

Further research also could consider some options. Firstly, single respondent is enough to representative one firm, suggest avoiding multi-sources respondent that represent a firm since this could lead to bias respond. Secondly, a moderator variable such as environmental regulation is worth trying. Furthermore, to be more specific, and to make more specific, to mention a product line innovation is better than just generalizing products in common.

ACKNOWLEDGMENT

Herewith, we would like to thank the reviewers for constructive suggestions and valuable comments, also for the respondents participated in this study.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

REFERENCES

Aguilera-Caracuel, J., Hurtado-Torres, N., & Aragón-Correa, J. A. (2012). Does international experience help firms to be green? A knowledge-based view of how international experience and organisational learning influence proactive environmental strategies. *International Business Review*, *21*(5), 847–861. doi:10.1016/j.ibusrev.2011.09.009

Al Nawayseh, M., & Balachandran, W. (2012). Online Grocery Shopping in Developing Countries. *International Journal of Social Ecology and Sustainable Development*, *3*(3), 1–14. doi:10.4018/jsesd.2012070101

Antonioli, D., Mancinelli, S., & Mazzanti, M. (2013). Is environmental innovation embedded within high-performance organisational changes? The role of human resource management and complementarity in green business strategies. *Research Policy*, *42*(4), 975–988. doi:10.1016/j.respol.2012.12.005

Ar, I. M. (2012). The Impact of Green Product Innovation on Firm Performance and Competitive Capability: The Moderating Role of Managerial Environmental Concern. *Procedia: Social and Behavioral Sciences*, *62*, 854–864. doi:10.1016/j.sbspro.2012.09.144

Bansal, S. P., & Kumar, J. (2011). Ecotourism for Community Development. *International Journal of Social Ecology and Sustainable Development*, *2*(2), 31–40. doi:10.4018/jsesd.2011040103

Barth, T. D. (2011). The Idea of a Green New Deal in a Quintuple Helix Model of Knowledge, Know-How and Innovation. *International Journal of Social Ecology and Sustainable Development*, *2*(1), 1–14. doi:10.4018/jsesd.2011010101

Binnekamp, M., & Ingenbleek, P. (2008). Do "good" food products make others look "bad"?: Spin-off effects of labels for sustainable food production in the consumer perception. *British Food Journal*, *110*(9), 843–864. doi:10.1108/00070700810900576

Björklund, M. (2011). Influence from the business environment on environmental purchasing — Drivers and hinders of purchasing green transportation services. *Journal of Purchasing and Supply Management*, *17*(1), 11–22. doi:10.1016/j.pursup.2010.04.002

Borin, N., Cerf, D. C., & Krishnan, R. (2011). Consumer effects of environmental impact in product labeling. *Journal of Consumer Marketing*, *28*(1), 76–86. doi:10.1108/07363761111101976

Buyukkeklik, A., Toksari, M., & Bulbul, H. (2010). An investigation of environmental sensitivity and innovativeness (in Turkish). Suleyman Demirel University. *The Journal of Faculty of Economics and Business Administrations*, *5*(3), 373–393.

Byrne. (2001). *Structural Equation Modeling with AMOS*. Lawrence Earlbaum Associates. London, UK.

Carrero, I., & Valor, C. (2012). CSR-labelled products in retailers' assortment: A comparative study of British and Spanish retailers. *International Journal of Retail & Distribution Management*, *40*(8), 629–652. doi:10.1108/09590551211245425

Carrillo-Hermosilla, J., & del Rio, P. (2009). Diversity of eco-innovations: Reflections from selected case studies. *Journal of Cleaner Production*.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Carrion-Flores, C. E., & Innes, R. (2010). Environmental innovation and environmental performance. *Journal of Environmental Economics and Management*, *59*(1), 27–42. doi:10.1016/j.jeem.2009.05.003

Chabé-Ferret, S., & Subervie, J. (2013). How much green for the buck? Estimating additional and windfall effects of French agro-environmental schemes by DID-matching. *Journal of Environmental Economics and Management*, *65*(1), 12–27. doi:10.1016/j.jeem.2012.09.003

Chan, R. Y. K., He, H., Chan, H. K., & Wang, W. Y. C. (2012). Environmental orientation and corporate performance: The mediation mechanism of green supply chain management and moderating effect of competitive intensity. *Industrial Marketing Management*, *41*(4), 621–630. doi:10.1016/j.indmarman.2012.04.009

Chang, H.-T., & Chen, J. L. (2004). The conflict-problem-solving CAD software integrating TRIZ into eco-innovation. *Advances in Engineering Software*, *35*(8-9), 553–566. doi:10.1016/j.advengsoft.2004.06.003

Chen, Y.-S. (2007). The positive effect of green intellectual capital on competitive advantages of firms. *Journal of Business Ethics*, *77*(3), 271–286. doi:10.100710551-006-9349-1

Chen, Y.-S. (2011). Green organizational identity: Sources and consequence. *Management Decision*, *49*(3), 384–404. doi:10.1108/00251741111120761

Chen, Y.-S., Lai, S.-B., & Wen, C. T. (2006). The influence of green innovation performance on corporate advantage in Taiwan. *Journal of Business Ethics*, *67*(4), 331–339. doi:10.100710551-006-9025-5

Chiou, T.-Y., Chan, H. K., Lettice, F., & Chung, S. H. (2011). The influence of greening the suppliers and green innovation on environmental performance and competitive advantage in Taiwan. *Transportation Research Part E, Logistics and Transportation Review*, *47*(6), 822–836. doi:10.1016/j.tre.2011.05.016

Chiou, T.-Y., Chan, H. K., Lettice, F., & Chung, S. H. (2011). The influence of greening the suppliers and green innovation on environmental performance and competitive advantage in Taiwan. *Transportation Research Part E, Logistics and Transportation Review*, *47*(6), 822–836. doi:10.1016/j.tre.2011.05.016

Cho, Y.-N., Thyroff, A., Rapert, M. I., Park, S.-Y., & Lee, H. J. (2013). To be or not to be green: Exploring individualism and collectivism as antecedents of environmental behavior. *Journal of Business Research*, *66*(8), 1052–1059. doi:10.1016/j.jbusres.2012.08.020

Clarkson, P. M., Li, Y., Richardson, G. D., & Vasvari, F. P. (2011). Does it really pay to be green? Determinants and consequences of proactive environmental strategies. *Journal of Accounting and Public Policy*, *30*(2), 122–144. doi:10.1016/j.jaccpubpol.2010.09.013

David, P., Kline, S., & Dai, Y. (2005). Corporate social responsibility practices, corporate identity, and purchase intention: A dual-process model. *Journal of Public Relations Research*, *17*(3), 291–313. doi:10.12071532754xjprr1703_4

Demirel, P., & Kesidou, E. (2011). Stimulating different types of eco-innovation in the UK government policies and firm motivations. *Ecological Economics*, *70*(8), 1546–1557. doi:10.1016/j.ecolecon.2011.03.019

Edgeman, R., Bøllingtoft, A., Eskildsen, J., Kallehave, P., & Kjærgaard, T. (2013). Sustainable-Enterprise-Excellence-and-the-Continuously-Relevant-and-Responsible-Organization. *International Journal of Social Ecology and Sustainable Development*, *4*(4), 65–76. doi:10.4018/ijsesd.2013100105

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Eiadat, Y., Kelly, A., Roche, F., & Eyadat, H. (2008). Green and competitive? An empirical test of the mediating role of environmental innovation strategy. *Journal of World Business*, *43*(2), 131–145. doi:10.1016/j.jwb.2007.11.012

Ellen, P. S., Webb, D. J., & Mohr, L. A. (2006). Building corporate associations: Consumer attributions for corporate socially responsible programs. *Journal of the Academy of Marketing Science*, *34*(2), 147–157. doi:10.1177/0092070305284976

Fankhauser, S., Bowen, A., Calel, R., Dechezleprêtre, A., Grover, D., Rydge, J., & Sato, M. (2013). Who will win the green race? In search of environmental competitiveness and innovation. *Global Environmental Change*, *23*(5), 902–913. doi:10.1016/j.gloenvcha.2013.05.007

Figge, F., & Hahn, T. (2012). Is green and profitable sustainable? Assessing the trade-off between economic and environmental aspects. *International Journal of Production Economics*, *140*(1), 92–102. doi:10.1016/j.ijpe.2012.02.001

Frenken, K., & Faber, A. (2009). Introduction Evolutionary methodologies for analyzing environmental innovations and the implications for environmental policy. *Technological Forecasting and Social Change*, *76*(4), 449–452. doi:10.1016/j.techfore.2008.04.008

Ghisetti, C., & Rennings, K. (2014). Environmental innovations and profitability: How does it pay to be green? An empirical analysis on the German innovation survey. *Journal of Cleaner Production*, *75*, 106–117. doi:10.1016/j.jclepro.2014.03.097

Gholami, R., Sulaiman, A. B., Ramayah, T., & Molla, A. (2013). Senior managers' perception on green information systems (IS) adoption and environmental performance: Results from a field survey. *Information & Management*, *50*(7), 431–438. doi:10.1016/j.im.2013.01.004

Gluch, P., Gustafsson, M., & Thuvander, L. (2009). An absorptive capacity model for green innovation and performance in the construction industry. *Construction Management and Economics*, *27*(5), 451–464. doi:10.1080/01446190902896645

Guziana, B. (2011). Is the Swedish environmental technology sector 'green'? *Journal of Cleaner Production*, *19*(8), 827–835. doi:10.1016/j.jclepro.2010.09.007

Ha, B. J. (1999). *A study of corporate image factors affecting purchasing intention* [Unpublished doctoral dissertation]. Kyunghee University, Seoul, Korea.

Hadjimanolis, A. (2000). A resource based view of innovativeness in small firms. *Technology Analysis and Strategic Management*, *12*(2), 263–281. doi:10.1080/713698465

Halila, F., & Rundquist, J. (2011). The development and market success of eco-innovations a comparative study of eco-innovations in Sweden. *European Journal of Innovation Management*, *14*(3), 278–302. doi:10.1108/14601061111148807

Hartmann, P., & Apaolaza-Ibáñez, V. (2012). Consumer attitude and purchase intention toward green energy brands: The roles of psychological benefits and environmental concern. *Journal of Business Research*, *65*(9), 1254–1263. doi:10.1016/j.jbusres.2011.11.001

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Henley, C. D., Fowler, D. C., Yuan, J., Stout, B. L., & Goh, B. K. (2011). Label design: Impact on millennials' perceptions of wine. *International Journal of Wine Business Research*, *23*(1), 7–20. doi:10.1108/17511061111121371

Ho, Y.-H., Lin, C.-Y., & Chiang, S.-H. (2009). Organizational determinants of green innovation implementation in the logistics industry. *International Journal of Organizational Innovation*, *2*(1), 3–12.

Hsiao, T.-Y., Chuang, C.-M., Kuo, N.-W., & Yu, S. M.-F. (2014). Establishing attributes of an environmental management system for green hotel evaluation. *International Journal of Hospitality Management*, *36*, 197–208. doi:10.1016/j.ijhm.2013.09.005

Hsieh, M. H., Pan, S. L., & Setiono, R. (2004). Product-, corporate-, and country-image dimensions and purchase behavior: A multicountry analysis. *Journal of the Academy of Marketing Science*, *32*(3), 251–270. doi:10.1177/0092070304264262

Huang, H.-C., Lin, T.-H., Lai, M.-C., & Lin, T.-L. (2014). Environmental consciousness and green customer behavior: An examination of motivation crowding effect. *International Journal of Hospitality Management*, *40*, 139–149. doi:10.1016/j.ijhm.2014.04.006

Huber, J. (2004). *New technologies and environmental innovation. Cheltenham*. UK: Edward Elgar.

Hult, G. T. M., Ketchen, D. J. Jr, & Nichols, E. L. Jr. (2002). An examination of cultural competitiveness and order fulfilment cycle time within supply chains. *Academy of Management Journal*, *45*(3), 577–586. doi:10.2307/3069382

Isaksson, K., & Huge-Brodin, M. (2013). Understanding efficiencies behind logistics service providers & green offerings. *Management Research Review*, *36*(3), 216–238. doi:10.1108/01409171311306382

Ismail, T. N. H. T., Don, R. A. M., Diman, S. F., & Wijeyesekera, D. C. (2013). Innovative Green Technology and Products Meeting Geo-Environmental Challenges. *Procedia Engineering*, *53*, 104–115. doi:10.1016/j.proeng.2013.02.016

Jabbour, C. J. C., Santos, F. C. A., Fonseca, S. A., & Nagano, M. S. (2013). Green teams: Understanding their roles in the environmental management of companies located in Brazil. *Journal of Cleaner Production*, *46*, 58–66. doi:10.1016/j.jclepro.2012.09.018

Janicke, M. (2008). Ecological Modernization: New perspectives. *Journal of Cleaner Production*, *16*(5), 557–565. doi:10.1016/j.jclepro.2007.02.011

Jansson, J., Marell, A., & Nordlund, A. (2010). Green consumer behavior: Determinants of curtailment and eco-innovation adoption. *Journal of Consumer Marketing*, *27*(4), 358–370. doi:10.1108/07363761011052396

Jayantha, W. M., & Man, W. S. (2013). Effect of green labelling on residential property price: A case study in Hong Kong. *Journal of Facilities Management*, *11*(1), 31–51. doi:10.1108/14725961311301457

J.S., A., & T., O. (1977). Estimating nonresponsive bias in mail surveys. *JMR, Journal of Marketing Research*, *24*, 396–402.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Juan, Z. (2011). R&D for environmental innovation and supportive policy: The implications for new energy automobile industry in China. *Energy Procedia*, *5*, 1003–1007. doi:10.1016/j.egypro.2011.03.177

Kahloul, A., & Zouari, E. (2013). Corporate Sustainable Growth and the Financing of Innovation: Evidence from Cash-Flow Disaggregation. *International Journal of Social Ecology and Sustainable Development*, *4*(4), 43–64. doi:10.4018/ijsesd.2013100104

Kakabadse, A. P., Kakabadse, N. K., & Lee-Davies, L. (2014). Learning-CSR-for-Sustainable-Corporate-Advantage. *International Journal of Social Ecology and Sustainable Development*, *5*(2), 13–23. doi:10.4018/ijsesd.2014040102

Kalamas, M., Cleveland, M., & Laroche, M. (2014). Pro-environmental behaviors for thee but not for me: Green giants, green Gods, and external environmental locus of control. *Journal of Business Research*, *67*(2), 12–22. doi:10.1016/j.jbusres.2013.03.007

Keh, H. T., & Xie, Y. (2009). Corporate reputation and customer behavioral intentions: The roles of trust, identification and commitment. *Industrial Marketing Management*, *38*(7), 732–742. doi:10.1016/j.indmarman.2008.02.005

Kemp, R., & Arundel, A. (2008). Survey indicators for environmental innovation. IDEA Report, Oslo.

Kiesling, F. M., & Manning, C. M. (2010). How green is your thumb? Environmental gardening identity and ecological gardening practices. *Journal of Environmental Psychology*, *30*(3), 315–327. doi:10.1016/j.jenvp.2010.02.004

Krammerer, D. (2009). The effects of customer benefit and regulation on environmental product innovation. empirical evidence from appliance manufacturers in Germany. *Ecological Economics*, *68*(8-9), 2285–2295. doi:10.1016/j.ecolecon.2009.02.016

Lee, J. S., Hsu, L. T., Han, H., & Kim, Y. (2010). Understanding how consumers view green hotels How a hotel's green image can influence behavioral intentions. *Journal of Sustainable Tourism*, *18*(7), 901–914. doi:10.1080/09669581003777747

Leonidou, L., Leonidou, C., Hadjimarcou, J., & Lytovchenko, I. (2014). Assessing the greenness of environmental advertising claims made by multinational industrial firms. *Industrial Marketing Management*, *43*(4), 671–684. doi:10.1016/j.indmarman.2014.02.003

Lin, C.-Y., & Ho, Y.-H. (2008). A Journal of Technology Management & Innovation *1*, 17.26.

Lin, M.-J. J., & Chang, C.-H. (2009). The positive effect of green relationship learning on green innovation performance: the mediation effect of corporate environmental ethics. *PICMET 2009 Proceedings*, 2341-2348.

Luzio, J. P. P., & Lemke, F. (2013). Exploring green consumers; product demands and consumption processes: The case of Portuguese green consumers. *European Business Review*, *25*(3), 281–300. doi:10.1108/09555341311314825

Madu, C. N., Kuei, C., & Lin, C. (1995). A comparative analysis of quality practice in manufacturing firms in the U.S. And Taiwan. *Decision Sciences*, *26*(5), 621–635. doi:10.1111/j.1540-5915.1995.tb01443.x

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Markandya, A., González-Eguino, M., & Escapa, M. (2013). From shadow to green: Linking environmental fiscal reforms and the informal economy. *Energy Economics*, *40*, S108–S118. doi:10.1016/j.eneco.2013.09.014

McLane, D. N. (2015). Can Ecotourism in the Global South Develop the North? *International Journal of Social Ecology and Sustainable Development*, *6*(2), 102–116. doi:10.4018/ijsesd.2015040107

Melewar, T. C., & Karasmanoglu, E., & Paterson. (2005). Corporate identity: Concept, components and contribution. *Journal of General Management*, *31*(1), 59–81.

Mitomo, H., & Otsuka, T. (2012). Rich information on environmental issues and the poor reflections on consumers' green actions: A behavioral economic approach. *Telematics and Informatics*, *29*(4), 400–408. doi:10.1016/j.tele.2012.01.001

Mittal, V. K., & Sangwan, K. S. (2014). Prioritizing Drivers for Green Manufacturing: Environmental, Social and Economic Perspectives. *Procedia CIRP*, *15*, 135–140. doi:10.1016/j.procir.2014.06.038

Narver, J. C., Slater, S. F., & MacLachlan, D. L. (2004). Responsive and proactive market orientation and new product success Journal of Product Innovation Management. *Journal of Product Innovation Management*, *21*(5), 334–347. doi:10.1111/j.0737-6782.2004.00086.x

Nasution, H.N., & Mavondo, F.T. (2008). Organizational capabilities: antecedents and implications for customer value. *European Journal of Marketing, 42*(3/4), 477 - 501.

Nenycz-Thiel, M., & Romaniuk, J. (2012). Value-for-money perceptions of supermarket and private labels. *Australasian Marketing Journal*, *20*(2), 171–177. doi:10.1016/j.ausmj.2011.12.002

Nulkar, G. (2014). SMEs and Environmental Performance – A Framework for Green Business Strategies. *Procedia: Social and Behavioral Sciences*, *133*, 130–140. doi:10.1016/j.sbspro.2014.04.177

Nunnally, J.C. (1999). *Psychometric Theory*. New York; McGraw-Hill.

Ottenbacher, M. C., Schwebler, S., Metzler, D., & Harrington, R. J. (2015). Sustainability Criteria for Tourism Attractions. *International Journal of Social Ecology and Sustainable Development*, *6*(2), 20–39. doi:10.4018/ijsesd.2015040102

Papa, M., Pedrazzani, R., & Bertanza, G. (2013). How green are environmental technologies? A new approach for a global evaluation: The case of WWTP effluents ozonation. *Water Research*, *47*(11), 3679–3687. doi:10.1016/j.watres.2013.04.015 PMID:23726704

Peri, G., Traverso, M., Finkbeiner, M., & Rizzo, G. (2012). Embedding "substrate" in environmental assessment of green roofs life cycle: Evidences from an application to the whole chain in a Mediterranean site. *Journal of Cleaner Production*, *35*, 274–287. doi:10.1016/j.jclepro.2012.05.038

Pop, N. A., Vaduva, S. A., Dabija, D. C., & Fotea, I. S. (2010). Consumers Perception of Corporate Social Responsibility Empirical Study in Romanian Retail. *International Journal of Social Ecology and Sustainable Development*, *1*(4), 1–9. doi:10.4018/jsesd.2010100101

Pujari, D. (2006). Eco-innovation and new product development understanding the influences on market performance. *Technovation*, *26*(1), 76–85. doi:10.1016/j.technovation.2004.07.006

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Qin, J., Zhou, X., Sun, C., Leng, H., & Lian, Z. (2013). Influence of green spaces on environmental satisfaction and physiological status of urban residents. *Urban Forestry & Urban Greening*, *12*(4), 490–497. doi:10.1016/j.ufug.2013.05.005

Rennings, K. (2000). Redefining innovation eco innovation research and the contribution from ecological economics. *Ecological Economics*, *32*(2), 319–332. doi:10.1016/S0921-8009(99)00112-3

Rennings, K., Ziegler, A., Ankele, K., & Hoffmann, E. (2006). The influence of different characteristics of the EU environmental management and auditing scheme on technical environmental innovations and economic performance. *Ecological Economics*, *57*(1), 45–59. doi:10.1016/j.ecolecon.2005.03.013

Rincón, L., Coma, J., Pérez, G., Castell, A., Boer, D., & Cabeza, L. F. (2014). Environmental performance of recycled rubber as drainage layer in extensive green roofs. A comparative Life Cycle Assessment. *Building and Environment*, *74*, 22–30. doi:10.1016/j.buildenv.2014.01.001

Saltari, E., & Travaglini, G. (2011). The effects of environmental policies on the abatement investment decisions of a green firm. *Resource and Energy Economics*, *33*(3), 666–685. doi:10.1016/j.reseneeco.2011.02.001

Sambasivan, M., Bah, S. M., & Jo-Ann, H. (2013). Making the case for operating "Green": Impact of environmental proactivity on multiple performance outcomes of Malaysian firms. *Journal of Cleaner Production*, *42*, 69–82. doi:10.1016/j.jclepro.2012.11.016

Siriwardena, S., Hunt, G., Teisl, M. F., & Noblet, C. L. (2012). Effective environmental marketing of green cars: A nested-logit approach. *Transportation Research Part D, Transport and Environment*, *17*(3), 237–242. doi:10.1016/j.trd.2011.11.004

Strizhakova, Y., & Coulter, R. A. (2013). The "green" side of materialism in emerging BRIC and developed markets: The moderating role of global cultural identity. *International Journal of Research in Marketing*, *30*(1), 69–82. doi:10.1016/j.ijresmar.2012.08.003

Teixeira, A. A., Jabbour, C. J. C., & Jabbour, A. B. L. S. (2012). Relationship between green management and environmental training in companies located in Brazil: A theoretical framework and case studies. *International Journal of Production Economics*, *140*(1), 318–329. doi:10.1016/j.ijpe.2012.01.009

Thøgersen, J., Haugaard, P., & Olesen, A. (2010). Consumer responses to ecolabels. *European Journal of Marketing*, *44*(11/12), 1787–1810. doi:10.1108/03090561011079882

Vik, J., & Farstad, M. (2009). Green care governance: Between market, policy and intersecting social worlds. *Journal of Health Organization and Management*, *23*(5), 539–553. doi:10.1108/14777260910984023 PMID:19862881

Wheeler, M., Sharp, A., & Nenycz-Thiel, M. (2013). The effect of 'green' messages on brand purchase and brand rejection. [AMJ]. *Australasian Marketing Journal*, *21*(2), 105–110. doi:10.1016/j.ausmj.2013.02.007

Whitmarsh, L., & O'Neill, S. (2010). Green identity, green living? The role of pro-environmental self-identity in determining consistency across diverse pro-environmental behaviours. *Journal of Environmental Psychology*, *30*(3), 305–314. doi:10.1016/j.jenvp.2010.01.003

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Winfield, M., & Dolter, B. (2014). Energy, economic and environmental discourses and their policy impact: The case of Ontario′s Green Energy and Green Economy Act. *Energy Policy*, *68*, 423–435. doi:10.1016/j.enpol.2014.01.039

Wolch, J. R., Byrne, J., & Newell, J. P. (2014). Urban green space, public health, and environmental justice: The challenge of making cities 'just green enough'. *Landscape and Urban Planning*, *125*, 234–244. doi:10.1016/j.landurbplan.2014.01.017

Wong, C. W. Y., Lai, K.-, Shang, K.-C., Lu, C.-S., & Leung, T. K. P. (2012). Green operations and the moderating role of environmental management capability of suppliers on manufacturing firm performance. *International Journal of Production Economics*, *140*(1), 283–294. doi:10.1016/j.ijpe.2011.08.031

Yang, C. J., & Chen, J. L. (2011). Accelerating preliminary eco-innovation design for products that integrates case based reasoning and TRIZ method. *Journal of Cleaner Production*, *19*(9-10), 998–1006. doi:10.1016/j.jclepro.2011.01.014

Yozgat, U., & Karataş, N. (2011). Going Green of Mission and Vision Statements: Ethical, Social, and Environmental Concerns across Organizations. *Procedia: Social and Behavioral Sciences*, *24*, 1359–1366. doi:10.1016/j.sbspro.2011.09.110

Zeb, R., Salar, L., Awan, U., Zaman, K., & Shahbaz, M. (2014). Causal links between renewable energy, environmental degradation and economic growth in selected SAARC countries: Progress towards green economy. *Renewable Energy*, *71*, 123–132. doi:10.1016/j.renene.2014.05.012

Zhao, R., Neighbour, G., Han, J., McGuire, M., & Deutz, P. (2012). Using game theory to describe strategy selection for environmental risk and carbon emissions reduction in the green supply chain. *Journal of Loss Prevention in the Process Industries*, *25*(6), 927–936. doi:10.1016/j.jlp.2012.05.004

Zhu, S., He, C., & Liu, Y. (2014). Going green or going away: Environmental regulation, economic geography and firms' strategies in China's pollution-intensive industries. *Geoforum*, *55*, 53–65. doi:10.1016/j.geoforum.2014.05.004

Ziegler, A., & Seijas Nogareda, J. (2009). Environmental management systems and technological environmental innovations exploring the causal relationship. *Research Policy*, *38*(5), 885–893. doi:10.1016/j.respol.2009.01.020

Zippel, C., Wilkinson, J., & Vogler, T. (2013). The influence of private labels on retailer cooperation. *Australasian Marketing Journal*, *21*(4), 271–277. doi:10.1016/j.ausmj.2013.08.008

This research was previously published in the International Journal of Social Ecology and Sustainable Development (IJSESD), 6(4); edited by Elias G. Carayannis, pages 34-53, copyright year 2015 by IGI Publishing (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 37
The Drivers, Practices and Outcomes of Green Supply Chain Management:
Insights From ISO14001 Manufacturing Firms in Malaysia

K.S. Savita
Universiti Teknologi PETRONAS, Malaysia

P.D.D. Dominic
Universiti Teknologi PETRONAS, Malaysia

T. Ramayah
Universiti Sains Malaysia, Malaysia & Universiti Teknologi Malaysia, Malaysia

ABSTRACT

The global shift in ecological movement has significant impacts on business operation of manufacturing firms that are located in developing countries. The intense pressure of being environmentally sustainable has caused Green Supply Chain Management (Green SCM) concept to emerge as an important corporate environmental strategy for manufacturing companies. Information technologies and systems have permeated in most business activities, in which, they extend important opportunities to resolve environmental issues. However, many researchers, including manufacturers and government bodies often disregard the green concept of information technologies and systems in minimizing environmental issues. A comprehensive review on Green SCM, Green IT and Green IS for sustainable environmental performance in manufacturing companies is presented using Input-Process-Output (IPO) Theory and Technological-Organizational-Environmental (TOE) theory. In bridging the research gap, a model is constructed to link the aforementioned constructs. Next, the paper reports on the development of survey questionnaire using cognitive interviewing strategies, followed up with semi-structured interview to investigate and obtain preliminary findings on the influential factors, green activities and performance

DOI: 10.4018/978-1-5225-7915-1.ch037

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

outcomes from implementing Green SCM. Lastly, the finalized survey questionnaire was distributed to 60 ISO14001 certified manufacturing companies located in the region of Perak and Kulim. Out of 60 manufacturing companies, only 32 responses received as the dataset in analyzing for improvements in reliability, measurement error, and validity of measured items. The findings from this pilot study explain that internal and external factors have stronger influence over the implementation of green initiatives in supply chain with substantial outcome on environmental performance. The information technologies and systems being the physical resource, capability and backbone to run a business seamlessly are significantly recognized. But, the green component of IT and IS were poorly attended and disregarded to an extent in the process of greening the processes, operations or entire business. Therefore, further investigations are required in the main study to validate the findings obtained here and other possible association between the factors, practices and outcomes in realizing ecological improvements in the supply chain and firm itself.

INTRODUCTION

Manufacturing sector plays a key role in the modernization of a country, and is capable to extensively differentiate the developed countries from the developing ones (El-Khasawneh, 2012). The developing countries are the main contributors of increasing environmental issues, in which have negatively affecting the ecological sustainability as compared to the developed countries (Markandya & Halsnaes, 2004; Mithas, Jiban, & Roy, 2010). The increased levels of production of CO^2 and Greenhouse Gas (GHG) emissions are significantly causes adverse change to the global climate. This phenomena is in responds to the intensified growth of economic and urban populations of a nation (Gholami, Sulaiman, Ramayah, & Molla, 2013).

Being a nation that has emerged in a multi-sector economy, Malaysia offers a cost-competitive location for investors to capitalize in manufacturing advanced technological products for both national and international markets. Hence, manufacturing sector still remains as a significant contributor to the growth of Malaysia's economy (MIDA, 2012). Furthermore, Malaysia is making marginal, yet positive progression towards environmental management for the past few years (MGCC, 2012). Despite that, Malaysia is facing ecological challenges in terms of increased usage of energy (electricity), inadequate management of household and industrial wastes as well as poor treated gases emitted to the air (Abidin & Jelani, 2011; MGCC, 2012).

Industrialization, urbanization and boundless transactions are stimulating the production and widespread use of computers, printers, office equipment, servers, air conditioning devices and related IT infrastructures. These machines, hardware and infrastructures are consuming substantial amounts of energy to produce and operate (San Murugesan, 2008). Furthermore, ill-treated and irresponsible acts of manufacturing, managing and disposing of those tools are detrimental to the quality of air, water and soil that severely influence the environmental degradation (San Murugesan, 2008). In addition, the increase in information technologies and systems usage along with continuous high edge innovation has caused the shortening of IT product's life span, while mounting on the amount of e-waste being disposed. This scenario is obvious in developing countries like Malaysia, whereby the large scale adoption of PC, facilities equipment and proliferation of data centers are growing steadily in contributing to carbon emission, energy consumption and e-waste production.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The term green, eco-sustainable and environmental friendly are often used interchangeably. This concept describe an entity as a company, its products or production processes that consume less energy, minimize use of harmful materials, use of recycled materials, reduce of waste produce, minimize emission and pollution, as well as preserving natural resources (Molla, Cooper, & Pittayachawan, 2011). Both the Environmental Management (EM) and Supply Chain Management (SCM) have their own root that complement each other and must not be disregarded (Zhu, Sarkis, & Lai, 2008b). The implementation of Information Technology (IT) and Information System (IS) in SCM is becoming apparently important in a progressively globalized and competitive economy. The development of IT and IS in supply chain has rapidly changed the ways business are carry out seamlessly around the world. The uses of IT and IS are considered as prerequisite for an effective control of today's complex supply chain (Fasanghari, Roudsari, & Chaharsooghi, 2008). This highlighted that IT is a spring of essential resources for competitive necessity in achieving an edge in business (Li, Yang, Sun, & Sohal, 2009).

Although broader literature suggests that other internal and external factors have much stronger influence on the organization's behavior towards sustainability, yet the roles of Information Technologies and Systems (IT&S) are often ignored by organizations in the assessment of their environmental footprints (Jenkin, Webster, & McShane, 2011). The design, development and implementation of IT&S represent the backbone of ecological friendly efforts that support a firm's environmental management systems (Cai, Chen, & Bose, 2013).

The positive and negative impacts that IT&S might have on the organizations' environmental and sustainable movement still remain unexplored. Therefore, an in-depth research is required to determine the extent to which IT&S may improve sustainability in the realm of supply chains and logistics as suggested in (Melville, 2010). The same concern is displayed in the work of Zhu, Sarkis, & Lai (2008a) that emphasized the study on Green SCM is timely and necessary to better aid the organization and have yet to be fully investigated.

The business research on Green SCM, Green IT and Green IS have produced extensive review for last few years while the academia has now started to fill the research gaps and linkage of these three fields. Nevertheless, this topic is current and still lacking in research especially in the context of Malaysia. In responds to the research gaps identified, this study aims to identify and investigate the associating factors of Green IT&S, internal and external elements in influencing the implementation of Green SCM. Next, is to examine green practices within SCM that highly adopted and implemented within the manufacturing firms. Lastly, to investigate the outcomes from implementing the Green SCM on environmental and technological performance.

In this paper, proposed hypotheses are presented, along with method of study carried out for questionnaire development, pre-test with expert and pilot test of survey questionnaire. In the designing the questionnaire, cognitive interview method is adopted with selected ISO 14001 companies. The semi-structured interview during the pre-test allow the researchers to grasp initial understanding on the factors, practices and outcomes that related to Green SCM implementation. Whilst, the pilot test of the survey questionnaire is to determine the validity and reliability of the items measured.

The International Organization for Standardization (ISO) for 14001:2004 maps out a framework that an organization can follow to set up an effective environmental management system, as well as it provide an assurance that environmental impact is being measured and improved (http://www.iso.org/iso/iso14000). In this research, the respondents that are participating in the pre/pilot study and main study are Environmental Management System (EMS) ISO14001 certified manufacturing firms that are

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

located in Malaysia. The ISO 14001 manufacturing firms are choose as the population sample since those firms are expected to have embarked in environmental friendly activities in greening their business processes and operations.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Input-Process-Output (IPO) Theory

The current study attempts to conceptualize a successful implementation of Green Supply Chain Management from IPO conceptual model. The term of IPO is defined as "inputs that lead to processes that in turn lead to outcomes" (Ilgen, Hollenbeck, Johnson, & Jundt, 2005). The IPO Model explains Green SCM in terms of having "input", "process" and "output" which represent the building blocks of the integrated research framework of this study. IPO Model is used as the basis of the research framework which postulate input that represent the antecedents from TOE theory, follows by process that explains green practices carry out throughout the supply chain, and lastly output that portrays the performance outcomes resulted from employing the soundly antecedents and green practices.

Technological-Organizational-Environmental (TOE) Theory: Input Perspective

The TOE theory was developed in 1990 by Tornatzky & Fleischer. It identifies three aspects of an enterprise's context that influence the process by which it adopts and implements a technological innovation: that are, the technological context, organizational context, and environmental context (Tornatzky & Fleischer, 1990). The TOE framework as originally presented, and later adapted in IT adoption studies, provides a useful analytical framework that can be used for studying the adoption and assimilation of different types of IT innovation. The TOE framework has a solid theoretical basis, consistent empirical support and the potential for application to IT and IS innovation domains, however, specific factors identified within the three contexts may vary across different studies (Oliveira & Martins, 2011).

In this perspective, inputs, which refer to the antecedents that influence the Green SCM implementation. The factors are categorized into the three contexts of TOE framework, whereby Green IT and Green IS are represent technological context, follows with Internal Commitment in organizational context and Regulatory Pressure in environmental context. The four constructs identified represent the three contexts which explain technological and non-technological factors that drive the implementation of Green SCM.

Technological Context: Input Perspective

The implementation of Information System (IS) and Information Technology (IT) in Supply Chain Management (SCM) is becoming apparently important in an increasingly globalized and competitive economy. The advancement in the technology with high degree of automation in business processes is offering more opportunities than previously. IT as an infrastructure and a solution plays a critical factor in the improvement of SCM in within, downstream and upstream of the organization (Li, Yang, Sun, & Sohal, 2009). IT has leads to better performance in the supply chain with its power to provide timely, accurate, and reliable information, in which enabled real-time integration of SCM activities (Li et al., 2009). IT facilitates SCM by improving integration and coordination of physical flow as wells as

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

the various information flow in the supply chain (Omar, Ramayah, May-Chuin, Sang, & Siron, 2010). Furthermore, data capture technologies such as barcode, global positioning, and radio frequency identification, ICT can significantly reduce labor, errors, and response time across the entire supply chain whilst decrease total supply chain costs and increase responsiveness in customer service (Lau & Huang, 2012). The use of IT is considered as a prerequisite for an effective control of today's complex supply chain (Fasanghari, Roudsari, & Chaharsooghi, 2008).

The green elements of IT and IS are often ignored by organizations in the assessment of their green movement and environmental footprints (Jenkin et al., 2011). Although technology components are critical, much are still lacking in the urgency to measure the impacts of IT and IS have on processes and business operations (Faucheux & Nicolaï, 2011). IT sector has begun to deploy on Green IT and Green IS, however, inadequate study exist on the actual practices in other sectors such as manufacturing, logistic and services (Faucheux & Nicolaï, 2011; Jenkin et al., 2011; Melville, 2010). Furthermore, most of the studies have concentrated on direct, first-order impacts of Green IT. Lately, researchers have initiated the investigation on the second-order effects of IT, or known as Green IS or IT for Green (Dedrick, 2010; Melville, 2010). The concept of "Green" is actively emerging in Malaysia with introduction of the strategic policies, programs and plans as part of government initiatives (PIKOM, 2012). Nevertheless, the importance of role of IT and IS for environmental sustainability in manufacturing sector is still under research.

Information Technologies and Systems (IT&S) have been contributing to environmental problems for the past few decades, which many have not realized till recently. The environmental issues are mainly caused by inefficient technologies, poorly designed systems and short life spans of IT products that take up the organizations' electricity costs (F Loeser, Grimm, Erek, & Zarnekow, 2012). But, IT&S are capable of reversing their impacts on the environment by going green. Green IT and Green IS are conceptualized in various ways depending on its context and scope. Green IT is referred as environmentally sound IT that focuses on practice of designing, manufacturing, usage and disposal of computers, servers and its associated subsystems with minimal or no impact on the environment, energy efficiency and total cost of ownership (Elliot & Binney, 2008; San Murugesan, 2008). In contrast, Green IS refers to the design and implementation of information systems that contribute to sustainable business processes (Dedrick, 2010; Faucheux & Nicolaï, 2011; Jenkin et al., 2011). Although, Green IT and IS are interrelated, but each has a different focus and purpose (Molla, 2013).

The adoption of eco-friendly technologies, systems and practices increase the ability to address IT&S environmental related concerns. These technologies, systems and practices are vital to be diffused and institutionalized rightly (A. J. W. Chen, Boudreau, & Watson, 2008). Hence, corporate greening can be construed as a first step towards the superior goal of environmental sustainability (Molla, 2009). Organizations are facing increasing pressure to look at every aspect of their operations and business with intention of greening, in preventing environmental degradation and negative financial credentials (Brooks, Wang, & Sarker, 2012). The increase in electricity costs has driven the rising demand for solutions that are able to reduce the need of high consumed technologies, and simultaneously use existing IS resources efficiently to operate the processes in an integrated and sustainable manner (Dedrick, 2010).

Therefore, with assimilation of IT&S solutions into supply chain daily activities, organization are capable of making sound and effective environmental decisions at each stage of SCM. Hence, Green IT is considered as one of the significant components that transforms supply chain management function towards environmentally conscious strategic movement (Cai et al., 2013; Gholami et al., 2013; Rao & Holt, 2005). The replacement of traditional technologies with Green IT has the capability to minimize

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

the consumption of energy, carbon emission, equipment utilization and waste produced in manufacturing sector (Faucheux & Nicolaï, 2011; Molla, 2013). We therefore propose to contribute to the body of knowledge, in determining the extent to which technological factor coined as Green IT influence the implementation of Green SCM. The following hypotheses are therefore proposed:

Hypotheses 1 (H1): Green IT positively influences the implementation of Green SCM within ISO 14001 manufacturing firms in Malaysia.

In the recent years, IS literature began to realize the importance of sustainability, and its potential relationships in minimizing ecological footprints. The concept of Green IS is proposed with the focus to reduce the impact of IT but also used to help firms reduce their carbon footprint through automating the systems and application in order to transforms products, processes, and practices to an eco-friendly state (Melville, 2010; R. Watson, Boudreau, Chen, & Huber, 2008). Since, environmental sustainability is a supply chain commitment, therefore, Green IS is essential for creation, maintenance, and survival of environmental conscious practices in supply chain (Kenneth, Zelbst, Meacham, & Bhadauria, 2012). The Green IS have the ability to enable interconnectedness, realign and reinvent business processes in support of productivity and efficiency towards ecological improvements (Dwyer & Hasan, 2012).

The design and development of information systems represent the backbone of environmental management efforts that supports the firm's environmental management systems (Cai et al., 2013). Green IS encourages the application of information systems thinking and skills to initiatives across all functions of the organization (Adela J Chen, Watson, Boudreau, & Karahanna, 2010). Green IS is viewed as an enabler in inducing changes within and among business processes that decreases the environmental impacts through proper integration and coordination throughout the SCM (Boudreau, Watson, & Chen, 2008; Kenneth et al., 2012). Organizations are increasingly integrating their business processes without realizing that Green IS initiatives are not limited within companies, but extended to the externalities that need collaboration from the suppliers, customers and shareholders (Brooks et al., 2012). As emphasized in (Melville, 2010), a much in-depth research is required to determine the extent to which IS might improve sustainability in the realm of supply chains and logistics. Hence, the proposed hypothesis is:

Hypothesis 2 (H2): Green IS (IT for Green) positively influences the implementation of Green SCM within ISO 14001 manufacturing firms in Malaysia.

Organizational and Environmental Context: Input

Many researchers have placed a greater importance on firm's internal capabilities in order to overcome internal obstacles towards achieving sustainable competitive edge (Hart, 1995; Vachon & Klassen, 2006; Zhu & Sarkis, 2006). The internal factors encompass internal drivers (top/ middle management support, pressure from employees, leadership from influential individuals and environmentally committed organizational culture), environmental attitude, and internal obstacles (Holt & Ghobadian, 2009). The implementation eco-friendly within an organization rely on the associated internal and external factors. Some of external factors identified are legislation, competition and society (Holt & Ghobadian, 2009).

Companies that focus on development and deployment of firm's internal resources more than external factors are likely to implement successful Green SCM practices (Guang, Lenny, Baldwin, & Cucchiella, 2012). The top management environmental commitment, cross-departmental cooperation and employee

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

dedication, internal EMS with regular auditing as well as reliable financial resources are essential as the company organizational capabilities to efficacious implement environmentally friendly practices in the supply chain (Guang et al., 2012; G.-C. Wu, Ding, & Chen, 2012).

Many of these previous studies have concluded that regulation is a foremost external factor to drive an organization towards environmental management (Weng & Lin, 2011). Therefore, being compliance to the laws, regulations, directives and standard increase the organizations' capability to go green and be environmental friendly in the processes and business operations (A.J. Chen, Watson, & Boudreau, M.-C., Karahanna, 2009). Hence, regulation pressure plays an important role in shaping a firm's sustainability effort (Haanaes et al., 2011).

As highlighted in (Holt & Ghobadian, 2009), internal drivers and legislation are the most influential factors of Green SCM. Similarly, in (Zhu, Geng, Fujita, & Hashimoto, 2010), internal environmental management and regulations were the influential drivers in large Japanese organizations as well as among UK manufacturers (Kenneth et al., 2012). In (Diabat & Govindan, 2011), Interpretative Structural Modeling method was used to summarize the 11 drivers that affect Green SCM implementation, in which, the most influential driver is the government regulation and legislation. In addition to it, green movement is driven largely by stricter regulations as well as intense pressure from stakeholders and community (Srivastava, 2007; Zhu et al., 2008a). The previous research findings are supplement further with the recent articles that emphasize Government Regulation, Internal Readiness, and Corporate Social Responsibility as the motivators for an organization to make decisions pertaining to green initiatives within supply chain practices (Kohli & Hawkins, 2015).

Of the 30 research papers reviewed, the factors that scored the highest are regulations, expected business benefits, customer pressures and social responsibility, in which, comparable outcomes were discovered among EMS ISO 140001 manufacturing firms in Malaysia (Eltayeb, Zailani, & Filho, 2010). Many of the previous studies in Malaysia concluded that support from top management, legislation requirements, customer/supplier pressure and existence of Environmental Management System (EMS) are the most important factors that influence Green SCM within the manufacturing sector (Eltayeb et al., 2010; Eltayeb & Zailani, 2009; Ishak & Ahmad, 2010; Rusli, Rahman, & Ho, 2012). These findings are very much consistent with the results from other studies conducted outside Malaysia as well. The broader literature suggests that internal and external forces have strong influence on the organization's behavior towards sustainability (Jenkin et al., 2011).

Therefore, addressing own internal environmental management with continuous commitment is the first step towards Green SCM implementation, before extending the efforts to suppliers and customers (Zhu et al., 2010). Thus, the proposed hypothesis is:

Hypothesis 3 (H3): Internal commitment positively influences the implementation of Green SCM within ISO 14001 manufacturing firms in Malaysia.

In Malaysia, however, obtaining environmental protection certification of ISO 14001 is not compulsory. Most of the companies adhere to environmental requirements and legislations imposed in Europe, Japan, or USA (Zailani, Eltayeb, Hsu, & Tan, 2012) and environmental standards such as REACH, WEEE or RoHS (Eltayeb et al., 2010). Therefore, further investigation is required to identify the relationship of regulatory pressure in influencing company to integrate environmental thinking at each stage of product life cycle. Hence, the following hypothesis are proposed:

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Hypothesis 4 (H4): Regulatory Pressure positively influences the implementation of Green SCM within ISO 14001 manufacturing firms in Malaysia.

Green SCM Performance Outcomes: Environmental and Technological Performance

Performance measurement defines company's parameter to monitor, control and achieve specific objectives and outcome (Gunasekaran, Patel, & McGaughey, 2004). It provides a directive for the company to implement the desired practices, evaluate their execution, reveal the effects of the implementation and determine future actions or corrective plans (Ramayah, Siew, Ahmad, Halim, & May-Chiun, 2013). The improvement of the environmental performance is highly correlated to the factors that drive the emergence of Green SCM in an organization (Hsu & Hu, 2008). The implementation of GSCM practices in manufacturing sector shows favorable to significant achievement in environmental performance (Chien & Shih, 2007; Kenneth et al., 2012; Rao & Holt, 2005; Testa & Iraldo, 2010; Yan Li, 2011; Zhu et al., 2010; Zhu, Sarkis, & Lai, 2007b).

With reference to Malaysian context, companies that implement Green SCM attained significant positive outcome on the environmental performance in terms of enhancement in environmental compliance, reduction of emissions, harmful materials and wastes (Eltayeb et al., 2010; Eltayeb, Zailani, & Ramayah, 2011; Wan Hasrulnizzam Wan Mahmood et al., 2013). Hence, internal proactive environmental strategy and external institutional drivers will greatly influence the firm's environmental performance (Zailani et al., 2012). Despite that, Green SCM contributes to an insignificant outcome on environmental performance within the green practices of waste reduction (Azevedo, Carvalho, & Cruz Machado, 2011), reverse logistics and green purchasing (Eltayeb et al., 2011).

The relationship between GSCM and performance outcomes has been subject to numerous studies but the results are not conclusive since it varies according to the internal and external factors, firm characteristics, and geographical locations. The inconclusive result raises the question of what are the actual environmental outcomes that can be realized from implementing green practices in supply chains. As such, it highlights the need for in-depth studies of the relationship between GSCM and performance (Zhu, Sarkis, & Lai, 2007a). Besides that, a more rigorous research on environmental management is needed by researchers who are geographically located in Asian regions, as well as research with specific focus on Asian regions itself. (Seuring, Sarkis, Müller, & Rao, 2008). Hence, there is still a need to provide more empirical evidence on environmental performance within manufacturing sector in Malaysia The following hypotheses are therefore proposed:

Hypothesis 5 (H5): The implementation of Green SCM has positive influence on the environmental performance within ISO 14001 manufacturing firms in Malaysia.

The IT industry seems to have acknowledged and reacted to the role of IT in pursuing environmental sustainability. There are limited literatures and findings reported for industrial sectors as compared to IT sector (Faucheux & Nicolaï, 2011; Jenkin et al., 2011; F Loeser et al., 2012; Melville, 2010). In operations and manufacturing functions, environmental benefits from incorporating green information technologies and systems have begun to surface (A. J. W. Chen et al., 2008; R. T. Watson, Boudreau, & Chen, 2010). The use of Information Technologies and Systems (IT&S) are considered as prerequisite for an effective control of a complex and interconnected supply chains. IT&S are used as a decoupling

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

point to improve the performance of supply chain (Mason-Jones & Towill, 1999; Sundarakani, Tan, & Over, 2012). IT&S are regarded as organization resource (F. Wu, Yeniyurt, Kim, & Cavusgil, 2006) and organization capability (Molla et al., 2011) that required strategically for an organization to succeed in green movement. Information technologies and systems are the essential tools that enable automation, simulation, coordination, integration and optimization of functions throughout the supply chain (Auramo et al., 2005; I. J. Chen & Paulraj, 2004).

Greening of IT will assist in minimization of the environmental impacts with reduced power or energy consumption, carbon emissions and electronic wastes that will improve considerably power usage of office equipment, infrastructures, data center and facilities (Faucheux & Nicolaï, 2011; Molla, Deng, & Corbitt, 2010). Whilst, greening of IS will improve systems performance and usage, reporting capabilities, increases remote collaboration and interactions that reduce the impacts from logistics, track environmental information (such as toxicity, energy and water usage and wastes production) as well as monitoring and reporting environment baselines inputs (energy, water, materials) and outputs (waste, Greenhouse Gas (GHG) emissions) (Melville, 2010; R. Watson et al., 2008).

Green IT&S comprise a vast number of methods, metrics and perspectives, however, the scope and underlying measures still stayed vague and not well described (Erek, 2011). Organization are still using uncoordinated and improper environmental metrics to measure environmental impacts of IT in data centers, office environment as well as in industrial operations (Erek, 2011). Therefore, consumption of energy by IT equipment and hardware are poorly or roughly estimated, since mechanism used to measure it remains unclear. The lack of standardized procedures have caused difficulties for the organizations and government in monitoring, evaluating and controlling the environmental impacts from information technologies and systems. Recently, Green Grid presented a set of metrics and indices that can be formally adopted by organizations to measure on improvements of energy consumption resource efficiency of information technology in business processes, offices and data centers.

Organization were expected to switch to Green IT trend by year 2010, since the potentials of Green IT are very much appealing (Mines, 2008). Nevertheless, the assimilation of green IT&S as one of the environmental-friendly components within the organization's environmental initiatives are still poorly managed and integrated (Erek, 2011; Fabian Loeser & Erek, 2011). Hence, the extent of Green IT adoption and actual realization of the benefits are unknown to the organization, vendors, government and researchers. (Jamaludin, Hartini Ahmad, & Ramayah, 2012). Thus, further investigation with empirical evidence is essential in determining the effects of green information technologies and systems have on Green SCM, and its associated outcome coined as Technological performance. The following hypotheses are therefore proposed:

Hypothesis 6 (H6): The implementation of Green SCM has positive influence on the technological performance within ISO 14001 manufacturing firms in Malaysia.

METHODOLOGY

The important aspect in the data collection process is pilot study, which is defined as a small-scale trial run of all the procedures planned for use in the main study (Monette, Sullivan, & DeJong, 2002). The pilot study adopted the four-stage pre-testing as recommended (Dillman, 2000). The four stage methods comprises of: (1) item generation for questionnaires which are adapted from literatures, (2) cognitive

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

interview to obtain expert review on the questionnaire design; (3) semi-structured interview with representative of ISO14001 manufacturing firms to obtain preliminary understanding on factors, outcomes and green practices currently adopted within the organization; and (4) pilot survey questionnaire distributed to measure items validity and reliability.

Firstly, previous literatures were reviewed to identify the pertinent as well as relevant constructs and measures to be used in designing the questionnaire. The first draft of the questionnaire was developed with each item measured on a seven-point Likert scale. The questionnaire was reviewed by academician from similar areas. The interview sessions unstructured in nature, and were carried out at their office. The content of the questionnaires were satisfactory as it included the constructs and items to be investigated. The expert took almost 30-40 minutes to complete the questionnaire.

The recorded time indicates the need to shorten the questionnaire. This will allow the participants to take reasonable time of 10-15 minutes to respond to the questionnaire. The other comments recorded were on length, layout and measurement scale of seven Likert points. A lengthy questionnaire with unorganized layout have demotivating effect to the respondents from participating or completing the questionnaire. Moreover, seven point Likert scale with the given label might be confusing to some participants. The expert raises the concerns based on industrial practitioners' work nature and busy schedule. Hence, the changes suggested are required to improve the quality, and to ensure good participations in the main study.

The respondents for cognitive interview, semi-structured interview and distribution of final draft of the survey questionnaire are selected based on purposive sampling. The sample population are ISO 14001 manufacturing firms. These participants are expected to have embarked on green practices in their operations. Therefore, ISO 14001 manufacturing firms are in the best position to provide the required information (Kumar, Salim, & Ramayah, 2013). The information on the manufacturing firms has been obtained from Federation of Malaysia Manufacturers Perak Directory of year 2012. The ISO 14001 certification details were cross checked from SIRIM QAS website and companies' websites to ensure that they are practicing green activities.

The firms were approached using telephone calls and emails, but poor responses were received. Many of the manufacturing firms responded with various reasons such as the person in charge being on leave, on business trip and busy. While, some refused to participate due to confidentiality of the information disclosed. Furthermore, an official approval from Human Resources Department or Public and Trade Affair Department was required before the manufacturing firms could participate in the study. The tedious and time consuming approval process hindered the respondents from participating.

Nevertheless, upon further persuasions, follow up and assurance of the confidentiality of the information provided, three of ISO 14001 manufacturing firms from Ipoh gave their consensus to participate in the interview process. Whilst, survey questionnaire was distributed to ISO 14001 manufacturers located in Perak and Kulim regions. The survey questionnaire was collected with assistance of two enumerators for each region.

The improved version of survey questionnaire, also known as 2nd draft was re-tested during cognitive interviewing process. The cognitive interviewing method is considered as one of the imperative methods in the pilot study. Cognitive interviewing allows researchers to identify sources of response errors and accuracy of questions answered (Willis, 2005) as well as respondents' comprehension on the questions as intended (Dillman, 2000).

The two techniques that were used during cognitive interviewing process are think-aloud and probing questions. Each session took approximately one and half hour. The representatives were encouraged

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

to express their thoughts as they were answering the questionnaire. Moreover, they are encouraged to paraphrase the questions by repeating the question in their own words. This is to ensure that wordings of the questions are being understood in the way intended and possible suggestions on the alternative wordings are encouraged. The body language portrayed was recorded too. The representatives are being probed with relevant questions to their earlier reactions, problems faced and comments provided.

This probing actions are to (1) identify the interpretation and assumptions made on the questions, (2) terms/concepts that were misunderstood, (3) questions that were inappropriate or had insufficient information, and (5) language used that caused misapprehension of the questions. In addition, the participants were also required to categorize each item according to their groups in order to reduce any item ambiguity and simultaneously improve the validity of the measures. It is a procedural remedy to control common method variance as recommended in (Podsakoff, P.M., MacKenzie, Lee, & Podsakoff, 2003).

The survey questionnaire was amended and corrected as suggested. The improved questionnaire is drafted as the 3rd version, and once again undergoes final check to ensure that the content, layout, grammar, spelling and arrangement of questions are all in the right order with three representatives. Since, the questionnaire achieved good remarks and was completed within reasonable time, all the items for the constructs are kept for a full scale pilot study with 60 ISO 14001 manufacturing firms that are located in Perak and Kulim states.

RESULTS AND DISCUSSION

Pre-Test Interview Analysis

During the pilot study, researcher conducted semi-structured interview with three ISO 14001 representatives in order to conduct preliminary investigation and obtain initial understanding on, (1) factors that influence ISO 14001 manufacturing firms to embark on green movement in supply chains, (2) role of information technologies and systems in supply chain as well as in improving environmental footprint in a manufacturing firm, (3) to identify environmental-friendly practices in supply chains, and (4) subsequent impacts on the company's performance from implementing those eco-friendly activities. Each session was recorded with the consent of the participant. Each interview session took about an hour for each company. This section reports on the preliminary findings from semi-structured interviews conducted during pilot study.

Green Supply Chain Management

The first interview session was with Managing Director (MD) of Company A, which is a European-based company that produces energy-efficient air filters for commercial and industrial use. The MD explained that the company is continuously researching and working towards producing green products. Apart from that, the company practice environment conscious activities at every stage of the product life cycle, which includes activities from downstream, in production and upstream.

Company A: "As stated in the sustainability report, our products are green because, firstly we build the products using environmental friendly and biodegradable materials. Secondly, resources used

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

to produce the products are economically save. Thirdly, the life-time of the products is stretched to a longer time. These three steps have allowed us to minimize wastes that reduce the impact to the environment."

Company B is an American-based company that produces household gloves, industrial rubber gloves and high-risk gloves. The Production Director (PD) describe the compliance to the green movement are directly influence with green policies from parent company and internal efforts to reduce ecological impacts to the community and surroundings:

Company B: "With the assistance from in-house R & D, we are looking at ways to make our processes and products more environmental-friendly. We provide clear guidelines to our suppliers on the green requirements and compliance needed. However, only few of our suppliers are certified. We sell the waste to other companies that build tires and toys' parts, which reduces amount of wastes to landfill. Our newly invented packages use less resources, are easier to be produced, disposed and biodegradable."

The third interview session was with Operation Manager of Company C. Company C produces foil and hot stamping for decorative and security industries. The manager highlighted that the raw materials used in the production are according to the environmental standard, as well as directives from sisters companies and customers:

Company C: "The raw materials used must be according to requirements and chemical safety of REACH standard. Those wastes that can be reused will be inputted to distillation machines to check on the chemical composition, before being reused in other processes. These have saved us on cost incurred for scheduled wastes. However, those that are not recyclable will be safely disposed using third party services."

The brief transcribed interviews included reveal preliminary anticipation of ISO 14001 manufacturing firms in in implementing green practices in supply chain. Looking each stage of supply chain, the three representative enlighten in terms of, (1) opt for materials or components that are less hazardous with minimal impacts on environment, (2) design of products with reduced consumption of energy, extended product life time, use of biodegradable materials and minimization on the amount of resources used, (3) optimize in the packaging with minimal resources used, safe disposal and biodegradability of components in the packages/boxes, (4) improvements in products distribution and transportation through eco-logistics with mode that reduces air pollution and energy emission, (5) End-Of-Life (EOL) products undergo safe disposal as well as incineration of product remains and wastes via third party services. It is discovered that the firms are still far off from using recyclable and recycled materials in the development and production of the product.

Technological Drivers – IT and IS in SCM

As explained in previous section, internal factors which are top management support and internal commitment, whilst, external factors of regulatory and stakeholders pressure are the important drivers that motivate a firm to implement Green SCM. Nonetheless, technological components, particularly eco-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

friendly information technologies and systems are poorly consider in greening the activities, processes and operations throughout the supply chain. The three representatives interviewed highlighted on the importance of information technologies and systems as an enabler for seamless relationships at each stage of the product life cycle:

Company A: "Information technology and systems are part and parcel of our daily tools which are the catalysts to run processes efficiently, to communicate effectively, and to operate the whole business smoothly."
Company B: "IT is a necessity since different processes in supply chains need various different technology components, hardware, software, application and network to communicate to each other."
Company C: "In our company, ICT are utilized in streamlining essential activities in our business."

The above quotes clearly indicated the role of information technologies and systems as the enablers that drive businesses operations smoothly and soundly. Companies are obliged to reengineer supply chain, and deploy right information technologies and systems. This give the company the capability to facilitate seamless interaction with suppliers, accommodating customer requirements, and reacting proficiently to intensified race with competitors (Sundarakani et al., 2012).

Technological Context – Green IT and Green IS in SCM

Next, the companies' representatives were enquired on the extent of eco-friendly information technologies and systems are adopted in the firm:

Company A: "I believe that environmental friendly information technology and systems play an important role in today's supply chain management. IT can be a tool to get an organization moving towards environmental sustainability, but is difficult for us to quantify the ecological and financial gained. Some internal metrics are used to calculate. But, we have not completely measured the efficiency on the energy consumed, waste or emissions produced from IT infrastructure, hardware or system applications. This is neither a routine for us nor is a KPI."
Company B: "Moving towards sustainable IT and IS are long journey ahead. Investment in applications and software is easily justifiable as compared to IT hardware. The cost of greening IT is high. It is difficult for us to show the values it will bring to the business. We are still an infant in this context as compared to sustainable manufacturing practices."
Company C: "The process of greening of IT and IS are costly with vague impacts to the environment, operation and monetary benefit. It may takes extensive period of time for positive return."

Therefore, with incorporation of Green IT and Green IS solutions into everyday supply chain activities, organization's ability to make sound environmental decisions is greatly advanced. Green IT and Green IS must be one of the core elements of any organization's green strategy. On the other hand, most companies still fail to explicitly recognize and integrate Green IT and Green IS components into their sustainability plans (Hodges & White, 2009; F Loeser et al., 2012). This situation is mainly due to lack of environmental awareness, technological know-how and sense of urgency in minimizing ecological footprints from facilities, office equipment, data center as well as system application. Apart from human

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

and financial resources, physical resources such as information technologies and systems are crucial for companies to successfully implement green practices in supply chain (Lee, 2008).

Organizational and Environmental Context - Internal and External Factors

The most significant driver that motivates EMS ISO 140001 certified manufacturing firms in Malaysia are regulations, expected business benefits, customer pressures and corporate social responsibility (Eltayeb et al., 2010). In this section, the interview with the companies revealed the influential factors that motivate the adoption of green practices in their operations and supply chain processes.

As quoted by Managing Director of Company A, the influential factors are top management support, employee commitment and external stakeholders:

Company A: "Firstly, continuous support from top management and parent company. The continuous improvement is a must as long as you have the right people, right system in place. It must be done through targets, review meetings, audits, corrective actions with sufficient resources, R&D, money. The constant dialogues with our stakeholders and good relationship with our customers and suppliers have profile us as green enterprise."

In company B, the act of greening is voluntary, and meets international environmental directives. The Production Director emphasized that strong commitment from management and employees are the vital factors that motivate an innovation, such as green movement in an organization:

Company B: "I very much believe that our green practice is voluntary since there is no push from local laws. Our management is very supportive and our employees are committed. We do it systematically with proper records of internal and external audits. It is not a requirement for our suppliers to be certified, but we comply with our customer's requirements. We do encourage our suppliers towards environmentally friendly practice and to be certified."

The Operation Manager of Company C gave emphasis on compliance legislation and internal commitment. These are main factors that contribute to the company certification on ISO 14001:

Company C: "We sell lots of our products to our sister companies and our subsidiaries. We do comply with environmental law and some other international body's directives. It is not compulsory by Malaysian law to be ISO14001 certified. We have do get good support from our parent company. However, cost and budget are always management's biggest concern."

Green practices in SCM are view as an initial strategy for firms to comply with environmental requirements and legislation imposed in most industrialized nations (Hu & Hsu, 2010). The most essential factor for an organization are availability of organizational internal resources, management commitment, cross-departmental support, strong employee involvement, internal knowledge sharing, relevant environmental trainings offered and qualified personnel assigned in handling environmental issues and green initiatives (Lee, 2008; Sarkis, Gonzalez-Torre, & Adenso-Diaz, 2010; Zhu et al., 2008a) as well as eco-friendly proactive culture (Walker, Sisto, & McBain, 2008). Furthermore, the implementation of

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

green practices in supply chain requires long term investments which are costly with unforeseen return (Sarkis et al., 2010).

The necessity of a transparent regulation will induce organization to review their supply chain in order to ensure compliance to laws and environmental directives (G.-C. Wu et al., 2012). Policy makers and government agencies must play a proactive role in formulating relevant environmental standards and legislations) that has a profound impact (Zailani et al., 2012). This action will influence organizations toward green movement along with close monitoring of the progress in achieving environmental sustainability. Therefore, a company must be able to minimize the risks and uncertainty from internal resources, while closely respond to the government regulations, international environmental protection, and industry standards (G.-C. Wu et al., 2012).

Performance Outcomes: Environmental Performance

In many of the previous study reported that organizations that adopts green practices achieves good to significant improvement in their environmental performance. Those companies have successfully accomplish one or more benefits in terms of reduction on air emission produce, energy and water consume, toxic materials consume, amount of materials used as well as waste disposal volume (Zhu & Geng, 2010). The performance outcomes attained will varies between organization depending on the nature of business and size of the firm:

Company A: "Our current green movement throughout the supply chain has resulted in (1) significant increase in energy efficiency and reduced of carbon emission, (2) reduced consumption of hazardous materials and components, (3) reduced waste production and (4) increase process efficiency and product quality that leads to introduction new green product line.. The current water usage throughout the production is very minimal. We are still working towards environmental conscious packaging, waste management and logistics. Every year we carry out activities that promote green practices as well as programs to assist the ones in need and within our local community."

Company B: "We have (1) minimized the consumption of landfill waste and packaging, (2) used environmental friendly materials according to international standards, (3) Considerable amount of energy saving and (4) new green product line is introduced. We used lots of water throughout the production. The water wastes undergo treatments before being disposed. We are looking at ways to reuse the water. Our biggest achievement is on the packaging. The new packaging reduces the overall packaging material waste, as much as 81.9%.

Company C: "The materials used are according to REACH guidelines, therefore it is environmentally acceptable. This also increases our product quality. We managed to reduce to an extent the production of emissions and wastes. We have reasonably improved the environmental situation of our plant."

Green SCM concept is increasingly and widely diffused among companies that are seeking to improve their environmental performance (Testa, 2010). Most companies in developing countries adopted green solutions within the business operations with the intention to reduce the negative environmental effects rather than adopting a proactive approach to reduce the sources of environmental problems (Anbumozhi & Kanda, 2005). Therefore, manufacturing firms in different nations (e.g. Western vs. Asian countries) may face different pressures that have resulted in different environmental outcomes. Therefore, with the

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

right internal support and proper regulation, firms are able to preemptively implement green practices in SCM for significant environmental performance without relying on end-of-the-pipe solutions.

Performance Outcomes: Technological Performance

As concluded from the pilot test with the three representatives, the impacts of IT and IS on reducing environmental issues within the supply chain or other processes still equivocal and insignificant to the management of the firm:

Company A: "The different parts of SCM processes have different requirements of hardware, software and applications. Some of these applications improve decision making, allow flexibility and enhance overall performance of SCM. Greening of IT and IS are highly dependent on the trade-off between benefit gained and cost incurred. We need to identify the company's critical areas for ecological improvement. With paperless, energy-efficient hardware/components, energy-efficient lighting and facilities equipment, virtualization, we are able to capture and contribute to environmental gains. We comply with directives such as Energy Stars, WEEE and safe e-waste disposal. Currently, we are still lacking in quantify the efficiency on energy consumed, waste or emissions produced from the IT infrastructure, equipment and applications installed. It is not part of our job routine too. We are not aware of any specific metrics to measure it. The ones developed in-house are not comprehensive. It will be great if parent company or internal management see the importance to quantify them as soon as they are implemented. It is possible as long as is taken into consideration within the internal audit process and firm's KPI."

Company B: "IT and IS are required to streamline the processes in SCM, that will result in better productivity, quality and visibility. Moving towards sustainable IT and IS will be a journey for us. We are still new to it, and it is not as significant as compared to sustainable manufacturing practices. We are taking little steps to install environmental friendly infrastructures, equipment, hardware, and system applications. We are very much dependent on software and applications. Those investments are much obvious to justify as compared to IT infrastructure and equipment. For us, virtualization technology is an obvious step for a company to implement green technologies. We often measure environmental indicators from supply chains as compared to IT infrastructure, equipment and facilities. We observe certain standards such Energy Star and EPEAT. We dispose e-waste in an environmentally friendly manner, whereby some are recycle and reuse, and others are managed by 3rd party vendor. Hopefully, with the budget and resources allocated, we will focus on installing, monitoring, measuring, and reporting systematically our green initiatives.

Company C: "The uses of IT and IS are critical and a prerequisite for seamless relationships throughout SCM processes, from the downstream till upstream. Without them, we will be in mess. We are working towards paperless office, use less electricity power and safe disposal of electronic waste. The entire greening processes are costly, and difficult to rationalize to the top management. We need to balance out between environmental and financial concerns. There are no specific metric used to measure eco-friendly activities related to IT and IS. But, we are trying to comply with certain standard like Energy Star."

The study observed that information technologies and systems are the foundation for the companies to run the business operations and processes smoothly. The technology improves the availability, vis-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

ibility and timely distribution of information to customers, and simultaneously increase the production efficiency at each stage of the supply chain. The participants have successfully implemented methods to safely dispose their e-waste whereby consumable items are recycled, and others are disposed for safe landfilling and incineration at the disposal reserve areas by third party companies. The firms gain revenue from selling of the waste products that are recyclable. The realization on green information technologies and systems within an organization will simultaneously lower the energy and utility costs, waste disposal costs and consumable items, in which leads to a more tangible saving in costs and resources (Mithas et al., 2010; R. T. Watson et al., 2010).

Therefore, with a strong support from management and availability of financial resources, the companies are able to purchase energy efficient computer systems, as well as replacing current systems with energy efficient systems. Whilst, some look at implementing latest technology such as virtualization and cloud computing to reduce the power consumption. The companies place more importance on use of software and applications such as collaboration tools, telecommuting, telepresence and video conferencing tools to reduce travelling, as well as maximize the efficiency of supply chain processes in reducing total energy consumption.

The three companies interviewed are lacking in adopting metrics, standards or framework to measure their IT functions, its positive and negative impacts to the environment. Although, there are numbers internationally agreed standards for Green IT&S measurement, but, it must be supplemented with internal framework that includes clear targets and measurement items related to IT&S. (United Nations Conference on Trade and Development UNCTAD, 2011). Companies that invest highly in green information technologies and systems are able to enjoy financial and environmental gains through systematic implementation measurement (Mithas et al., 2010).

The measurement of the relationship between Information Technologies and Systems with the environment is a relatively new topic (United Nations Conference on Trade and Development UNCTAD, 2011). The direct impacts can easily be demonstrated and measured by use of scientific knowledge such as metrics with mathematical calculation. However, in some context, the impact is harder to captured and assessed. Despite the importance of the field, empirical evidence on the impact of information technologies and systems on environmental outcomes is lacking, where many gaps still remain uninvestigated with regard to developing countries (United Nations Conference on Trade and Development UNCTAD, 2011). The evidence from developing countries is limited as compared to developed countries, since there is a greater barrier in obtaining the required data. Moreover, the evidence from developed countries cannot be generalized to the developing countries.

Pre-Test Questionnaire Analysis

The aim of pilot testing the questionnaire is to determine and subsequently improve the validity and reliability of the questionnaire. Pilot test give advance sign on possible instruments, methods or sampling issues to be resolved before proceeding to the main study (Teijlingen van, Rennie, Hundley, & Graham, 2001). The important of pilot testing is highlighted in De Vaus (pg. 54) "Do not take the risk (De Vaus, 1993). Pilot test first." The sample size for pilot test, is explained in (Sudman, 1983), that "20 to 50 cases is usually sufficient to discover the major flaws in a questionnaire before they damage the main study" (pg. 181), which also highlighted in Sekaran & Bougie (2009). For this study, a total of 37 responses were received out of 60 manufacturing firms. There are five incomplete questionnaire, therefore are discarded in total calculation. For the pilot study, a total of 32 questionnaires were used as the dataset

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

to increase reliability, decrease measurement error, and improve the validity of each construct a well as item measurement, as suggested in (Dillman, 2000).

Table 1 presented respondents' profile that were involved in the pilot study. The majority of respondents hold an executive position (16 respondents or 50.0%) as compared to other positions which comprised of 13 respondents (40.6%) for managerial positions and 3 respondents for the director positions (9.4%). This combination of positions makes a total of 32 respondents that participated in this study. It can be concluded that majority of the respondents in this study (20 respondents or 62.5% from the total sample size) worked at the information technology department. The remaining 12 respondents (37.5%) were employed at the operation department.

In terms of industry sectors, electronics industry has an equal number of respondents as rubber and plastic products industry, which are seven. The respondent's distribution between chemicals and chemical products industry was the same number with machinery equipment industry. These both industries consisted of 3 respondents (9.4%) from the total respondents. One of the respondent belong to the metal products industry and the remaining 11 respondents represented other industries such as automotive parts, stationery, paper & packaging, food & beverages industries. The majority of the respondents are from Multi-National Company (MNC) which represent the total 71.9%. From the total of 32 respondents, 9 firms were categorized as Small and Medium Sized Enterprises (SME).

The reliability of the measurement items is measured in ensuring the quality of the research instrument used in this study. The analysis of Cronbach's Alpha-Coefficient was performed in order to access the reliability of the measurement. The widely accepted social science cut-off of alpha value is 0.70 or higher for a set of items to be considered as a reliable scale, however, some use 0.75 or 0.80 while others are as lenient as 0.60. (Nunnally & Bernstein, 1994).

Table 1. Summary results of respondent profiles

Respondents Profile	n	%
Position		
Director	3	9.4
Manager	13	40.6
Executive	16	50.0
Department		
Operation Department	12	37.5
Information Technology	20	62.5
Industry		
Electrical and Electronics Products	7	21.9
Chemicals and Chemical Products	3	9.4
Rubber and Plastics Products	7	21.9
Metal Products	1	3.1
Machinery Equipment	3	9.4
Others	11	34.4
Firm Size		
SME (0 – 150 employees)	9	28.1
MNC (151 employees and above)	23	71.9

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The Cronbach's Alpha values are quite sensitive to the number of items in the scale, in which will caused the Cronbach's Alpha values to fall below 0.60. For the pilot study, it is much appropriate to report mean inter-item correlation for the items. The optimal range for the inter-item correlation is 0.20 to 0.40 (Briggs & Cheek, 1986). Table 2 presented on reliability analysis of the measurement items used in this study.

There were substantial variations in Cronbach's Alpha values for all variables, ranging from 0.611 to 0.878. Given that alpha values greater than 0.60 are generally considered to indicate a reliable set of items. It is indicated that Regulatory Pressure has the lowest value of reliability value, which is 0.611. However, this variable is still considered acceptable and reliable since the value is above 0.60 and the mean inter-item correlation was above 0.20 (mean inter-item correlation of 0.269). In addition, the variables for Internal Commitment and Technological Performance were also indicated as the reliable grouped items (0.744 and 0.769 respectively). Furthermore, Green Supply Chain Management (GSCM), Green IT, Green IS, and Environmental Performance has a reliable set of items grouped to measure the variables accordingly (0.861, 0.850, 0.845, and 0.878 respectively). Since all the measurement items met the threshold value of the reliability analysis (Cronbach's Alpha > 0.60 and mean inter-item correlation range of 0.20 to 0.40), it is concluded that, all the measurements items are acceptable, valid and reliable to be used in full scale main study.

The normality test was also performed in order to test the assumption of distribution. The variables are normally distributed as long as the value of Skewness and Kurtosis statistics are within the range of ±2.0 (Pallant, 2010). Normal Q-Q plots is also one of the methods used to measure the normality of the variable. If majority of the observed values (smaller dots) lie on a straight line in the plot, then, that variable is consider as approximately normally distributed (Pallant, 2010; Sheridan, Steed, & Ong, 2010). Table 3 illustrated on Skewness and Kurtosis statistics. As presented, all the interested variables in this study were in the range of ± 2.00, in which indicate normal distributed items. In addition, majority of the observed values lie on the straight line in the Q-Q plot, in which explained on the nature of normally distributed items. Most of the criteria used to measure the normality distribution are successfully met, therefore it concludes that the items and data collected for the pilot study are normally distributed.

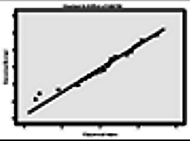
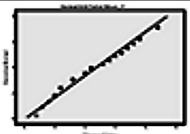
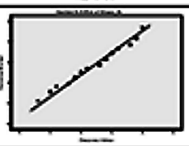
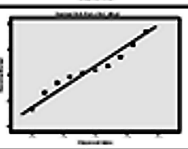
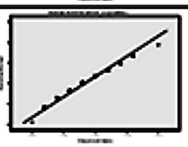
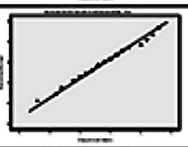
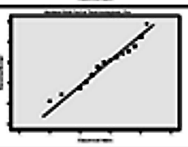
Next, Pearson's correlation was used to investigate the relationship between the variables of interest, and research hypotheses since normality assumption of the variable are met (Field, 2009). This correlation analysis takes a value between ranges of -1.00 to +1.00. The sign at the front of the value indicates the direction of the correlation as either positive or negative (Bluman, 2012; Field, 2009). The coefficient

Table 2. Summary of reliability analysis

Variable	Cronbach's Alpha	Number of Items	Mean Inter-Item Correlation
Green Supply Chain Management (GSCM)	0.861	14	-
Green IT	0.850	8	-
Green IS	0.845	8	-
Internal Commitment	0.744	5	-
Regulatory Pressure	0.611	5	0.269
Environmental Performance	0.878	8	-
Technological Performance	0.769	8	-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 3. Summary of normality distribution

Variable	Skewness Statistic	Kurtosis Statistic	Q-Q plot	Decision
Green Supply Chain Management (GSCM)	-0.529	0.485		Normally Distributed
Green IT	0.151	-1.027		Normally Distributed
Green IS	-0.257	-0.727		Normally Distributed
Internal Commitment	0.162	-1.529		Normally Distributed
Regulatory Pressure	0.374	-0.567		Normally Distributed
Environmental Performance	-0.031	-0.646		Normally Distributed
Technological Performance	-0.259	-0.477		Normally Distributed

correlation of 0.2 or above is consider satisfactory. The strength of the correlation is measure based on its coefficient. The coefficient correlation more than 0.81 to 1.0 indicates excellent strength, coefficient between 0.61 to 0.80 indicates very good strength, coefficient between 0.41 to 0.60 indicates a good correlation strength, the coefficient between 0.21 to 0.40 measures a fair strength, and correlation coefficient less than 0.20 shows a poor correlation (Bluman, 2012).

As shown in Table 4, bivariate correlation between all independent variables, which are Green IT ($r(32) = 0.858$, $p < .001$), Green IS ($r(32) = 0.766$, $p < .001$), Internal Commitment ($r(32) = 0.720$, $p < .001$), and Regulatory Pressure ($r(32) = 0.607$, $p < 0.001$), show a significant positive bivariate correlation to Green SCM. Therefore, an increase in Green IT, Green IS, Internal Commitment, or Regulatory Pressure, then Green SCM implementation within the organization will increases correspondingly since they are bivariate correlated.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 4. Summary of Pearson correlation

Variables	1	2	3	4	5	6	7
1	1.00						
2	.804**	1.00					
3	.826**	.882**	1.00				
4	.650**	.699**	.588**	1.00			
5	.858**	.766**	.720**	.607**	1.00		
6	.897**	.812**	.847**	.635**	.856**	1.00	
7	.842**	.712**	.680**	.699**	.853**	.816**	1.00

Note: 1) Green IT; 2) Green IS; 3) Internal Commitment; 4) Regulatory Pressure; 5) Green Supply Chain Management (Green SCM); 6) Environmental Performance; 7) Technological Performance, **$p < 0.001$, $n = 32$

On other hand, it is also indicated that Green IT ($r(32) = 0.897$, $p < 0.001$), Green IS ($r(32) = 0.812$, $p < 0.001$), Internal Commitment ($r(32) = 0.847$, $p < 0.001$), Regulatory Pressure ($r(32) = 0.635$, $p < 0.001$), and Green SCM ($r(32) = 0.856$, $p < 0.001$) portray a significant positive bivariate correlation to Environmental Performance. This analysis indicates that positive effect in Green IT, Green IS, Internal Commitment or External Pressure increases with Green GSCM, then it will positively increase the influence on the outcome of environmental performance as they are bivariate associated.

The same scenario is observed for technological performance. Hence, Green IT ($r(32) = 0.842$, $p < 0.001$), Green IS ($r(32) = 0.712$, $p < 0.001$), Internal Commitment ($r(32) = 0.680$, $p < 0.001$), Regulatory Pressure ($r(32) = 0.699$, $p < 0.001$), and Green SCM ($r(32) = 0.853$, $p < 0.001$) are statistically bivariate positive correlated to technological performance. This is understood if any of the independent variable listed above has a positive influence on Green SCM implementation, then, it increases the technological performance of the firm.

Moreover, environmental and technological performance are bivariate correlated since these two variables achieved ($r(32) = 0.816$, $p < 0.001$) value between the two. Consequently, if the level of the environmental performance increases, then the technological performance will orderly increases. As a conclusion, the results obtained deduced that all variables are found to have a positive bivariate correlation to each other ($p < 0.001$). The strength of bivariate correlation was categorized from good to excellent correlation (Correlation range: 0.588 to 0.897), as presented in Table 4.

CONCLUSION AND FUTURE WORK

The systematic review of the literatures demonstrates that many of the studies on GSCM explain that top management support, employees involvement, regulations, government support and customer/supplier pressures are influential factors that motivate the adoption of green practices. The act of greening IT and IS have huge potential in addressing broader environmental issues in organizations, including supply chains and logistics. Although, information technologies and systems were embedded in supply chain processes for decades, but, the effects of greening and environmental sustainability from IT&S still remain vague and lacking in research. The existing research on Green IT and Green IS are very much fragmented with inadequate focus on evaluation of Green IT and Green IS potential as the enablers for business and environmental sustainability.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The findings obtained from pilot test demonstrated few important findings: (1) Validity and reliability of the measurement items in the survey questionnaires are achieved; (2) The companies opt for materials that are less hazardous, development of products with reduced consumption of energy, minimization on the amount of materials and resources, use of biodegradable materials for the products and packaging, longer life time of the product and safe disposal/incineration of product remains and wastes; (3) The companies are still far off from using recyclable and recycled materials in the development of the product or, packaging, or even recovering products that reach End-Of-Life (EOL); (4) The companies clearly indicated the role of information technologies and systems as the enablers that drive businesses, operations and processes seamlessly, smoothly and soundly; (5) Information technologies and systems components are mostly ignored in the process of greening or assessing environmental problems since it is not part of the company's environmental strategy, or performance indicators; (6) Those companies that are currently implementing eco-friendly information technologies and systems fail to report their findings and figures in the company websites or sustainability report; (7) The companies with influential internal management and strong dedication from all levels, as well as transparent and supportive environmental legislations are the motivating ingredients in moving towards green manufacturing or green enterprise; (8) Companies that are proactively implement green practices in SCM will achieve significant environmental performance as compared to those companies who still rely on end-of-the-pipe solutions; (9) Most of the companies have successfully implemented methods to safely dispose their e-waste whereby consumable items are recycled, and others are disposed for safe land filling and incineration at the disposal reserve areas by government and third party companies; (10) Companies gain earning from selling wastes and simultaneously improve the environmental situation of the firm; (11) Availability of financial resources will allow the companies to purchase energy efficient computer systems, and replacing current systems with energy efficient systems; (12) The companies enlisted importance on use of information systems and applications such as collaboration tools, telecommuting, telepresence and video conferencing tools to reduce travelling, as well as to maximize the efficiency of supply chain processes in reducing total energy consume; (13) Companies are still lacking in term of measuring the performance from technological aspects; (14) Unstandardized metrics and calculation used to measure the IT functions has led to inability for companies to quantify the negative and positive outcomes.

This study attempts to contribute in the following. First, green practices among manufacturing companies in Malaysia is rising yet the previous findings presented mainly focused on organizational and environmental factors in influencing Green SCM implementation. Many of the organizations disregard the incorporation of information technologies and systems components in addressing environmental issues within the supply chain and business operations. Secondly, to our best knowledge, this is the first attempt to explain Green IT and Green IS as the technological components of TOE framework in rationalizing the drivers that influence Green SCM implementation. This is an enlightening study in bridging multi-field of green areas of research. Thirdly, the newly introduced component known as Technological performance aims to address the specific performance resulted in the implementation of Green IT and IS in the supply chain itself, which in actuality are often neglected in the environmental assessment.

The next step of the research is to improve the theoretical foundation of the research model and test this model empirically through a large scale survey among ISO 14001 manufacturing companies in a developing country known as Malaysia. The findings will provide guidance to new manufacturers that choose to venture in green movement, to existing manufactures who face impediments to improve company's environmental performance, and to government in assisting, monitoring and regulating companies towards environmental sustainability.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

ACKNOWLEDGMENT

The author convey their appreciation to the Universiti Teknologi PETRONAS for the scholar and funding. The author also express their deep gratitude to Associate. Professor Dr P.D.D Dominic, Professor T. Ramayah, and respected reviewers for the enlightening feedbacks, comments, suggestions.

REFERENCES

Abidin, Z. Z., & Jelani, N. (2011). *The Impact of Climate Change and The Need For Official Statistics in Malaysia*.

Anbumozhi, V., & Kanda, Y. (2005). *Greening the production and supply chains in Asia: Is there a role for voluntary initiatives*. IGES Kansai Research Centre KRC.

Auramo, J., Inkiläinen, A., Kauremaa, J., Kemppainen, K., Kärkkäinen, M., Laukkanen, S., ... Tanskanen, K. (2005). The roles of information technology in supply chain management. *Proceedings of the 17th Annual NOFOMA Conference*, Copenhagen, Denmark, June 9-10 (pp. 1–16).

Azevedo, S. G., Carvalho, H., & Cruz Machado, V. (2011). The influence of green practices on supply chain performance: A case study approach. *Transportation Research Part E, Logistics and Transportation Review*, *47*(6), 850–871. doi:10.1016/j.tre.2011.05.017

Bluman, A. G. (2012). *Elementary Statistics: A Step By Step Approach (8th ed.)*. New York: McGraw-Hill Publications.

Boudreau, M. C., Watson, R. T., & Chen, A. (2008). From Green IT to Green IS. In B. Biros et al. (Ed.), The Organizational Benefits of Green IT (pp. 79–91). Arlington, MA: Cutter Information LLC.

Briggs, S., & Cheek, J. (1986). The Role of Factor Analysis in the Development and Evaluation of Personality Scales. *Journal of Personality*, *54*(1), 106–148. doi:10.1111/j.1467-6494.1986.tb00391.x

Brooks, S., Wang, X., & Sarker, S. (2012). Unpacking Green IS: A Review of the Existing Literature and Directions for the Future. In J. vom Brocke, S. Seidel, & J. Recker (Eds.), *Green Business Process Management Towards the Sustainable Enterprise* (pp. 15–37). Berlin, Heidelberg: Springer Berlin Heidelberg. doi:10.1007/978-3-642-27488-6_2

Cai, S., Chen, X., & Bose, I. (2013). Exploring the role of IT for environmental sustainability in China: An empirical analysis. *International Journal of Production Economics*, *146*(2), 491–500. doi:10.1016/j.ijpe.2013.01.030

Chen, A. J., Watson, R. T., Boudreau, M.-C., & Karahanna, E. (2009). Organizational adoption of green IS & IT: an institutional perspective. *Proceedings of the International Conference on Information Systems*, Phoenix, USA (pp. 1–17).

Chen, A. J., Watson, R. T., Boudreau, M.-C., & Karahanna, E. (2010). An Institutional Perspective On The Adoption of Green IS. *Australian Journal of Information Systems*, *17*(1), 23–45.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chen, A. J. W., Boudreau, M.-C., & Watson, R. T. (2008). Information systems and ecological sustainability. *Journal of Systems and Information Technology*, *10*(3), 186–201. doi:10.1108/13287260810916907

Chen, I. J., & Paulraj, A. (2004). Towards a theory of supply chain management: The constructs and measurements. *Journal of Operations Management*, *22*(2), 119–150. doi:10.1016/j.jom.2003.12.007

Chien, M. K., & Shih, L. H. (2007). An empirical study of the implementation of green supply chain management practices in the electrical and electronic industry and their relation to organizational performances. *International Journal of Environmental Science and Technology*, *4*(3), 383–394.

De Vaus, D. A. (1993). *Surveys in Social Research (3rd ed.)*. UCL Press London.

Dedrick, J. (2010). Green IS: Concepts and Issues for Information Systems Research. *Communications of the Association for Information Systems*, *27*(1), 173–184.

Diabat, A., & Govindan, K. (2011). An analysis of the drivers affecting the implementation of green supply chain management. *Resources, Conservation and Recycling*, *55*(6), 659–667. doi:10.1016/j.resconrec.2010.12.002

Dillman, D. (2000). *Mail and Internet Surveys: The Tailored Design Method* (2nd ed.). New York: Wiley.

Dwyer, C., & Hasan, H. (2012). Emergent Solutions for Global Climate Change: Lessons from Green IS Research. [IJSODIT]. *International Journal of Social and Organizational Dynamics in IT*, *2*(2), 18–33. doi:10.4018/ijsodit.2012040102

Elliot, S., & Binney, D. (2008). Environmentally sustainable ICT: developing corporate capabilities and an industry-relevant is research agenda. *Proceedings of the Pacific Asia Conference on Information Systems (PACIS)*, Suzhou, China.

Eltayeb, T. K., & Zailani, S. (2009). Going Green through green supply chain initiatives towards environmental sustainability. *Operations and Supply Management*, *2*(2), 93–110.

Eltayeb, T. K., Zailani, S., & Filho, W. (2010). Green business among certified companies in Malaysia towards environmental sustainability: Benchmarking on the drivers, initiatives and outcomes. *International Journal Environmental Technology and Management*, *12*(1), 95–125.

Eltayeb, T. K., Zailani, S., & Ramayah, T. (2011). Green supply chain initiatives among certified companies in Malaysia and environmental sustainability: Investigating the outcomes. *Resources, Conservation and Recycling*, *55*(5), 495–506. doi:10.1016/j.resconrec.2010.09.003

Erek, K. (2011). From green IT to sustainable information systems management: Managing and measuring sustainability in IT organisations. *European, Mediterranean & Middle Eastern Conference on Information Systems* (Vol. 2011, pp. 766–781).

Fasanghari, M., Roudsari, F. H., & Chaharsooghi, S. K. (2008). Assessing the impact of information technology on supply chain management. In World Applied Sciences Journal (Vol. 4, pp. 87–93). doi:10.1109/ISECS.2008.208

Faucheux, S., & Nicolaï, I. (2011). IT for green and green IT: A proposed typology of eco-innovation. *Ecological Economics*, *70*(11), 2020–2027. doi:10.1016/j.ecolecon.2011.05.019

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Field, A. (2009). *Discovering Statistics Using SPSS* (3rd ed.). London: SAGE Publications.

Gholami, R., Sulaiman, A. B., Ramayah, T., & Molla, A. (2013). Senior managers' perception on green information systems (IS) adoption and environmental performance: Results from a field survey. *Information & Management*, *50*(7), 431–438. doi:10.1016/j.im.2013.01.004

Green, K. W. Jr, Zelbst, P. J., Meacham, J., & Bhadauria, V. S. (2012). Green supply chain management practices: Impact on performance. *Supply Chain Management: An International Journal*, *17*(3), 290–305. doi:10.1108/13598541211227126

Guang, S. V., Lenny, S. C. K., Baldwin, J., & Cucchiella, F. (2012). Natural resource based green supply chain management. *Supply Chain Management: An International Journal*, *17*(1), 54–67. doi:10.1108/13598541211212203

Gunasekaran, A., Patel, C., & McGaughey, R. (2004). A framework for supply chain performance measurement. *International Journal of Production Economics*, *87*(3), 333–347. doi:10.1016/j.ijpe.2003.08.003

Haanaes, K., Balagopal, B., Arthur, D., Kong, M. T., Velken, I., Kruschwitz, N., & Hoplins, M. S. (2011). First look: The second annual sustainability & innovation survey. *Sloan Management Review*, *52*(2), 76–84.

Hanim Mohamad Zailani, S., Eltayeb, T. K., Hsu, C.-C., & Choon Tan, K. (2012). The impact of external institutional drivers and internal strategy on environmental performance. *International Journal of Operations & Production Management*, *32*(6), 721–745. doi:10.1108/01443571211230943

Hart, S. L. (1995). A Natural-Resource-Based View of the Firm. *Academy of Management Review*, *20*(4), 986.

Hodges, R., & White, W. (2009). Go Green in ICT. *GreenTech News*, 1–2.

Holt, D., & Ghobadian, A. (2009). An empirical study of green supply chain management practices amongst UK manufacturers. *Journal of Manufacturing Technology Management*, *20*(7), 933–956. doi:10.1108/17410380910984212

Hsu, C., & Hu, A. (2008). Green supply chain management in the electronic industry. *International Journal of Environmental Science and Technology*, *5*(2), 205–216. doi:10.1007/BF03326014

Hu, A. H., & Hsu, C.-W. (2010). Critical factors for implementing green supply chain management practice: An empirical study of electrical and electronics industries in Taiwan. *Management Research Review*, *33*(6), 586–608. doi:10.1108/01409171011050208

Ilgen, D. R., Hollenbeck, J. R., Johnson, M., & Jundt, D. (2005). Teams in organizations: From input-process-output models to IMOI models. *Annual Review of Psychology*, *56*(1), 517–543. doi:10.1146/annurev.psych.56.091103.070250 PMID:15709945

Ishak, N. A., & Ahmad, H. (2010). Emerging Themes of the Leadership and Green Innovation of the Government-Linked Companies. *IBIMA Business Review*, *2011*, 1–9. doi:10.5171/2011.507312

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Jamaludin, N., Hartini, A., & Ramayah, T. (2012). Profitability vs Sustainability: Preliminary Findings on Green Innovation Adoption in Information Technology Usage. *Proceedings of the 3rd International Conference on Technology and Operations Management (ICTOM)* (pp. 978–979).

Jenkin, T. A., Webster, J., & McShane, L. (2011). An agenda for "Green" information technology and systems research. *Information and Organization*, *21*(1), 17–40. doi:10.1016/j.infoandorg.2010.09.003

Kohli, A. S., & Hawkins, E. (2015). Motivators to Adopt Green Supply Chain Initiatives. *International Journal of Information Systems and Supply Chain Management*, *8*(4), 1–13. doi:10.4018/ijisscm.2015100101

Kumar, M., Salim, A. T., & Ramayah, T. (2013). Business Research Methods. Oxford Fajar / Oxford University Press.

Lau, K. H., & Huang, H. (2012). A Survey-Based Study on ICT Adoption in the Third-Party Logistics Industry. *International Journal of Information Systems and Supply Chain Management*, *5*(4), 65–85. doi:10.4018/jisscm.2012100104

Lee, S. Y. (2008). Drivers for the participation of small and medium-sized suppliers in green supply chain initiatives. *Supply Chain Management*, *13*(3), 185–198. doi:10.1108/13598540810871235

Li, G., Yang, H., Sun, L., & Sohal, A. S. (2009). The impact of IT implementation on supply chain integration and performance. *International Journal of Production Economics*, *120*(1), 125–138. doi:10.1016/j.ijpe.2008.07.017

Li, Y. (2011). Research on the Performance Measurement of Green Supply Chain Management in China. *Journal of Sustainable Development*, *4*(3), 101–107. doi:10.5539/jsd.v4n3p101

Loeser, F., & Erek, K. (2011). Aligning Green IT with Environmental Strategies: Development of a Conceptual Framework that Leverages Sustainability and Firm Competitiveness. *Proceedings* of the *2011 Americas Conference on Information Systems (AMCIS)* (Vol. 59, pp. 1–9).

Loeser, F., Grimm, D., Erek, K., & Zarnekow, R. (2012). Information and Communication Technologies for Sustainable Manufacturing: Evaluating the Capabilities of ICT with a Sustainability Balanced Scorecard. *Proceedings of the 10th Global Conference on Sustainable Manufacturing* (pp. 429–434).

Mahmood, W.H.W., Ab Rahman, M.N., Deros, B.M., Jusoff, K., Saptari, A., Ebrahim, Z., … Jano, Z. (2013). Manufacturing Performance in Green Supply Chain Management. *World Applied Sciences Journal*, *21*, 76–84.

Markandya, A., & Halsnaes, K. (2004). Developing countries and climate change. In A. D. Owen & N. Hanley (Eds.), The Economics of Climate Change (pp. 239–258). Routledge, Taylor & Francis Group, London and New York.

Mason-Jones, R., & Towill, D. (1999). Using the information decoupling point to improve supply chain performance. *The International Journal of Logistics Management*, *2*(10), 13–26. doi:10.1108/09574099910805969

Melville, N. P. (2010). Information Systems Innovation For Environmental Sustainability. *MIS Quaterly*, *34*(1), 1–21.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

MGCC. (2012). *Market Watch 2012*. The Environmental Sector in Malaysia.

MIDA. (2012). *Malaysia Investment Performance 2012: Investment for Transformation*.

Mines, C. (2008). *The dawn of green IT services. A market overview of sustainability consulting for IT organizations*. Forrester Research Report.

Mithas, S., Jiban, K., & Roy, P. K. (2010). Green Information Technology, Energy Efficiency, and Profits: Evidence from an Emerging Economy. *Proceedings of the International Conference on Information Systems Proceedings* (pp. 1–20).

Molla, A. (2009). Organizational motivations for Green IT: Exploring Green IT matrix and motivation models. *Proceedings of the Pacific Asia Conference on Information Systems (PACIS)*.

Molla, A. (2013). Identifying IT sustainability performance drivers: Instrument development and validation. In Information Systems Frontiers (pp. 1–19).

Molla, A., Cooper, V., & Pittayachawan, S. (2011). Green IT Readiness (G-Readiness) of Organizations: An Exploratory Analysis of a Construct and Instrument. *Communications of the Association for Information Systems*, *29*(4), 67–96.

Molla, A., Deng, H., & Corbitt, B. (2010). *IT for Green: A Framework For Assessing The Capability Of The IT Industry*.

Monette, D. R., Sullivan, T. J., & DeJong, C. R. (2002). Applied Social Research. Orlando, FL: Harcourt Press.

Murugesan, S. (2008). Harnessing Green IT: Principles and Practices. *IT Professional*, *10*(1), 24–33. doi:10.1109/MITP.2008.10

Nunnally, J., & Bernstein, I. (1994). Psychometric Theory (3rd ed.). N. Y. McGraw-Hill, Ed.

Oliveira, T., & Martins, M. (2011). Literature review of Information Technology Adoption Models at Firm Level. *The Electronic Journal Information Systems Evaluation*, *14*(1), 110–121.

Pallant, J. (2010). *SPSS Survival Manual* (4th ed.). New York: McGraw-Hill Publications.

PIKOM. (2012). *ICT Strategic Review 2012/13: Innovation for Digital Opportunities*.

Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *The Journal of Psychology*, *99*(5), 879–903. PMID:14516251

Ramayah, T., Siew, K. K., Ahmad, N. H., Halim, H. A., & May-Chiun, L. (2013). An Exploratory Study of Green IT Adoption Issues among SMEs. *Life Science Journal*, *10*(12), 246–255.

Rao, P., & Holt, D. (2005). Do green supply chains lead to competitiveness and economic performance? *International Journal of Operations & Production Management*, *25*(9), 898–916. doi:10.1108/01443570510613956

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Rusli, K. A., Rahman, A. A., & Ho, J. A. (2012). Green Supply Chain Management in Developing Countries : A Study of Factors and Practices in Malaysia. *Proceedings of the UMT 11th International Annual Symposium on Sustainability Science and Management* (pp. 278–285).

Sami El-Khasawneh, B. (2012). Challenges and remedies of manufacturing enterprises in developing countries: Jordan as a case study. *Journal of Manufacturing Technology Management*, *23*(3), 328–350. doi:10.1108/17410381211217407

Sarkis, J., Gonzalez-Torre, P., & Adenso-Diaz, B. (2010). Stakeholder pressure and the adoption of environmental practices: The mediating effect of training. *Journal of Operations Management*, *28*(2), 163–176. doi:10.1016/j.jom.2009.10.001

Sekaran, U., & Bougie, R. (2009). *Research Method for Business: A Skill Building Approach* (5th ed.). New York: John Wiley and Sons Publications.

Seuring, S., Sarkis, J., Müller, M., & Rao, P. (2008). Sustainability and supply chain management – An introduction to the special issue. *Journal of Cleaner Production*, *16*(15), 1545–1551. doi:10.1016/j.jclepro.2008.02.002

Sheridan, C. J., Steed, L., & Ong, C. (2010). *SPSS Version 17.0 for Windows: Analysis without Anguish*. Australia: John Wiley and Sons Publications.

Srivastava, S. K. (2007). Green supply-chain management: A state-of-the-art literature review. *International Journal of Management Reviews*, *9*(1), 53–58. doi:10.1111/j.1468-2370.2007.00202.x

Sudman, S. (1983). P. H. Rossi, J. D. Wright, & A. B. Anderson, (Eds.), *Applied Sampling in Handbook of Survey Research.* San Diego, CA: Academic Press, Inc.

Sundarakani, B., Tan, A. W. K., & Van Over, D. (2012). Enhancing the Supply Chain Management performance using Information Technology: Some evidence from UAE companies. *International Journal of Logistics Systems and Management*, *11*(3), 306–324. doi:10.1504/IJLSM.2012.045916

Testa, F., & Iraldo, F. (2010). Shadows and lights of GSCM (Green Supply Chain Management): Determinants and effects of these practices based on a multi-national study. *Journal of Cleaner Production*, *18*(10-11), 953–962. doi:10.1016/j.jclepro.2010.03.005

Tornatzky, L. G., & Fleischer, M. (1990). *The processes of technological innovation. Lexington Books*. Lexington: Massachussetts.

Vachon, S., & Klassen, R. D. (2006). Extending green practices across the supply chain: The impact of upstream and downstream integration. *International Journal of Operations & Production Management*, *26*(7), 795–821. doi:10.1108/01443570610672248

van Teijlingen, E. R., Rennie, A.-M., Hundley, V., & Graham, W. (2001). The importance of conducting and reporting pilot studies: The example of the Scottish Births Survey. *Journal of Advanced Nursing*, *34*(3), 289–295. doi:10.1046/j.1365-2648.2001.01757.x PMID:11328433

Walker, H., Sisto, L. D., & McBain, D. (2008). Drivers and barriers to environmental supply chain management practices: Lessons from the public and private sectors. *Journal of Purchasing and Supply Management*, *14*(1), 69–85. doi:10.1016/j.pursup.2008.01.007

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Watson, R., Boudreau, M., Chen, A., & Huber, M. (2008). Green IS: Building Sustainable Business Practices. *Information Systems* (pp. 1–15). Athens, GA: Global Text Project.

Watson, R. T., Boudreau, M.-C., & Chen, A. J. (2010). Information Systems and Environmentally Sustainable Development: Energy Informatics and New Directions for IS Community. *Management Information Systems Quarterly*, *34*(1), 23–38.

Weng, M.-H., & Lin, C.-Y. (2011). Determinants of green innovation adoption for small and medium-size enterprises (SMEs). *African Journal of Business Management*, *5*(22), 9154–9163.

Willis, G. B. (2005). *Cognitive Interviewing: A Tool for Improving Questionnaire Design*. Thousand Oaks, CA: Sage Publications.

Wu, F., Yeniyurt, S., Kim, D., & Cavusgil, S. T. (2006). The impact of information technology on supply chain capabilities and firm performance: A resource-based view. *Industrial Marketing Management*, *35*(4), 493–504. doi:10.1016/j.indmarman.2005.05.003

Wu, G.-C., Ding, J.-H., & Chen, P.-S. (2012). The effects of GSCM drivers and institutional pressures on GSCM practices in Taiwan's textile and apparel industry. *International Journal of Production Economics*, *135*(2), 618–636. doi:10.1016/j.ijpe.2011.05.023

Zhu, Q., & Geng, Y. (2010). Drivers and barriers of extended supply chain practices for energy saving and emission reduction among Chinese manufacturers. *Journal of Cleaner Production*, *40*, 1–7.

Zhu, Q., Geng, Y., Fujita, T., & Hashimoto, S. (2010). Green supply chain management in leading manufacturers: Case studies in Japanese large companies. *Management Research Review*, *33*(4), 380–392. doi:10.1108/01409171011030471

Zhu, Q., & Sarkis, J. (2006). An inter-sectoral comparison of green supply chain management in China: Drivers and practices. *Journal of Cleaner Production*, *14*(5), 472–486. doi:10.1016/j.jclepro.2005.01.003

Zhu, Q., Sarkis, J., & Lai, K. (2007a). Green supply chain management: Pressures, practices and performance within the Chinese automobile industry. *Journal of Cleaner Production*, *15*(11-12), 1041–1052. doi:10.1016/j.jclepro.2006.05.021

Zhu, Q., Sarkis, J., & Lai, K. (2007b). Initiatives and outcomes of green supply chain management implementation by Chinese manufacturers. *Journal of Environmental Management*, *85*(1), 179–189. doi:10.1016/j.jenvman.2006.09.003 PMID:17084502

Zhu, Q., Sarkis, J., & Lai, K. (2008a). Confirmation of a measurement model for green supply chain management practices implementation. *International Journal of Production Economics*, *111*(2), 261–273. doi:10.1016/j.ijpe.2006.11.029

Zhu, Q., Sarkis, J., & Lai, K. (2008b). Green supply chain management implications for "closing the loop.". *Transportation Research Part E, Logistics and Transportation Review*, *44*(1), 1–18. doi:10.1016/j.tre.2006.06.003

This research was previously published in the International Journal of Information Systems and Supply Chain Management (IJISSCM), 9(2); edited by John Wang, pages 35-60, copyright year 2016 by IGI Publishing (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 38
Green Investments and Returns:
A Developing Country Perspective

Nabila Nisha
North South University, Bangladesh

ABSTRACT

A vital issue that must be considered by all functional areas in recent times is green safety and sustainable ecological balance. To be part of this environment-friendly investment, even the banking sectors of the most environmentally affected countries in the world invest voluntarily in social and environmental activities that targets socially-responsive business and ethics in the form of green banking. Green banking mainly involves the environmental and social responsibility of banks in terms of the contribution they make towards ensuring sustainability of the environment and ecological system, through the wide range of financial products and services that they offer. This chapter will primarily focus on the present status of the banks in complying with the green banking policy to save the environment as well as to increase financial sustainability from the perspective of a developing country like Bangladesh.

INTRODUCTION

Global warming or the 'Green House Effect' has made many organizations environmentally conscious. As a result, green investments today are at the forefront of a significant number of business operations across the world. Green investments generally call for companies to finance green technology and pollution reducing projects that can lessen the impact of their operations on the environment, thereby leading towards an overall sustainability. In line with this global development and as a response to environmental degradation, financial sectors of many developed and developing countries have adopted green banking policies to address this issue of sustainable business practices. Green banking involves the environmental and social responsibility of banks in terms of the contribution they make towards ensuring sustainability of the environment and ecological system, through their in-house operations and the wide range of financial products and services that they offer. This chapter sheds some light into the present status of the banks in complying with the green banking policy to save the environment as well as to increase financial sustainability from the perspective of a developing country. To pursue this purpose,

DOI: 10.4018/978-1-5225-7915-1.ch038

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

conceptual research models and a survey questionnaire based on the models were developed to study the general perception of bankers regarding environmental safety and the concept of green banking, along with the current range of green products and services being offered in Bangladesh. Responses from the survey were also used to examine bankers' attitude towards the adoption of green banking initiatives in a developing country like Bangladesh. Findings of this chapter will provide further insights into understanding the environmental responsibility and the environmental performance through the perception and attitude of bankers. Moreover, this study can assist various commercial banks to take into account varied perspectives of bankers while considering the idea of investing in green banking or other forms of green investments in order to aid the sustainable development of all financial products and services in Bangladesh.

BACKGROUND

In recent years, the eminent problem of global warming has finally shifted the attention of business practices of all functional areas to climate change, resource efficiency and environmentally conscious issues. As such, initiatives related to green safety and sustainable ecological balance is growing in support. To be part of this environment-friendly investment, most of the companies today focus more upon socially-responsible approaches rather than the traditional profit maximization (The Financial Express, 15 July, 2015). In other words, business practices has moved away from the 'profit, profit and profit' motive to the objective of 'planet, people and profit'. A recent report by OECD claimed such socially-responsible approaches as green investments or investments that are broadly related to the sustainability of the environment (Inderst, Kaminker & Stewart, 2012).

Green investments can be made by companies to their underlying technology, projects or ventures as well as their financial products and services (Croce, Kaminker & Stewart, 2011). For instance, any investments in renewable energy, recycling and waste management, water management, energy efficiency or environmental technologies are various ways of appearing 'green' in the market (The Daily Observer, May 26, 2015). Besides, going paperless to save the environment is another approach to define 'greenness' for specific goods and services.

Although green investments are a global initiative, these eco-friendly policies play a special role particularly for those developing countries which are more vulnerable to climate changes and where natural calamities are a common phenomenon (The Financial Express, 29 July, 2013). One such example is that of Bangladesh, which is a low carbon emitting country and has historically suffered huge losses due to changes in climate patterns. As a result of these adverse effects and to initiate a progressive step worldwide, the central bank of the country, Bangladesh Bank, has shown a profound commitment towards the vision of green investments and has opted towards congenial business operations that are sustainable towards the environment (Ahmad, Zayed & Harun, 2013). Prominent examples of green investments in Bangladesh include the use of natural non-toxic materials and recycled wastes in the ceramics sector; environment-friendly buildings and land projects using the highest standards of green technology, effective wastage management and efficient energy systems, organic compounds for building materials, and eco-friendly paints by the real estate sector; tree planting initiatives, the use of renewable energy and installation of eco-friendly solar panels, introduction of environment-friendly public transports, etc (The Financial Express, 1 August, 2015). Moreover, Bangladesh Bank is also going to commence a

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

new Export Development Fund worth about US$ 500 million to support environment-friendly industrial and development projects in the country, as a global response to save the environment (The Financial Express, 15 February, 2015).

Environmental degradation has become such a pressing issue today that even the financial sectors need to address this universal issue. This is because financial institutions, particularly banks, play a vital role in the economic system of a country and generally affects all types of business practices through their financing activities. Thus, banks should contribute to the saving of the environment by considering environmental aspects as part of their lending and investing principles, which would then divert industries to invest in environmental management and the use of appropriate green technologies (Masukujjaman & Aktar, 2013). In fact, banks these days are quite pro-active in terms of green investments on the global front. Adoption of eco-friendly banking practices and in-house operations, broadly known as green banking, is a prime example of green investments by the banking sector (The Daily Observer, May 26, 2015).

Green banking mainly focuses on two aspects: green revolution of internal operations through the consumption of renewable energy, digitalization and other measures that can reduce the emission of carbon mark from the banking activities and the use of environment-friendly financing like sustainable banking, ethical banking, green mortgages, green loans, green credit cards, mobile banking, online banking, etc. (Inderst et al., 2012). Adoption of such green banking initiatives can be found in many developed economies across the world. For example, HSBC has developed cheaper air and road travel incentives as a green choice for environmentalists and this has been aimed at saving paper by receiving no paper statements and doing no paper marketing. The UK Green Investment Bank, on the other hand, finances green projects on commercial terms and helps fund the creation of new energy and waste infrastructure across the country, thereby reducing a substantial amount of greenhouse gas emissions (Hossain, Ahmed & Nisha, 2015). Hang Seng Bank from Hong Kong introduced an integrated system that reduces the use of papers to save the environment and provides a comprehensive range of banking and general insurance products and services that can be availed either through mobiles or internet. Additionally, banks worldwide use energy-wise Green Machines, which source power from clean, emission-free methods such as wind power and invests hugely for local environment and wildlife projects in their community (Hossain et al., 2015). Even the introduction of green channel counters and green finance portfolios by the State Bank of India and Bank of Indonesia are different forms of green banking initiatives that can be observed from the global front.

The banking sector of Bangladesh is also equally contributing to green investments and has successfully adopted various forms of green banking policies that is being applied by the central bank as well as the leading commercial banks of the country. It thus becomes important to gain insights into the green banking activities that is being adopted in Bangladesh both for in-house operations and financing activities of the banks. In particular, outlooks of bankers with regard to such initiatives of green investments by the financial sector need to be examined in order to understand and assess their social responsiveness in the context of Bangladesh.

ISSUES, CONTROVERSIES AND PROBLEMS

The banking industry is an integral component of the financial system of Bangladesh and plays a crucial role in the economic development of the country. Over the last 30 years, there has been a steady growth

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

in this sector, as several private and foreign banks entered the country and led to the development of the country's financial architecture. Currently, this industry consists of four state-owned banks, four specialized banks, thirty-one private commercial banks, eight Islami Shariah based private commercial banks, and nine foreign commercial banks (Hossain et al., 2015). All these scheduled banks are solely monitored and regulated by the central bank of the country - Bangladesh Bank, which formulates and implements policies and guidelines related to various financing and banking issues.

One such guideline issued by Bangladesh Bank during 2011 is related to environmental risk management and green banking. The guidelines of this Green Banking Policy aimed to ensure environment-friendly business practices by banks and financial institutions by incorporating environmental risks into Core Risk Management (CRM), thereby promoting sustainable financial and economic growth across the entire country. This step by Bangladesh Bank is a profound commitment towards the vision of green world through green initiatives in Bangladesh. In fact, it is probably the only central bank which has issued such an indicative guideline for green banking in the South-Asian continent.

Under this Green Banking Policy, Bangladesh Bank initially selected ten commercial banks in Bangladesh for implementing green banking practices on the basis of their CAMELS rating and Risk Based Capital Adequacy (RBCA) measurement (The Daily Observer, May 26, 2015). The central bank authority then instructed these banks to consider the following major activities under green banking: Green Banking Unit, Green Banking Policy, Green Banking Budget, Online banking, Mobile and Internet banking, Allotment of funds in green financing and Environment risk rating. Over time, all the scheduled banks of Bangladesh initiated their own Green Banking Policy Guidelines approved by their respective Board of Directors as well as have Green Banking Unit (GBU) for pursuing Green Banking activities. They even have their own Green Office Guide for conducting various in-house green activities today. For instance, a glance at the current major green house activities of banks in Bangladesh reveal the use of

e-statement for customers instead of paper statement, making online communications, using more daylight instead of electric lights or using energy saving bulbs such as LED lights, video/audio conferencing instead of physical travel, sharing electronic files, voice mail, and e-mail instead of paper memos, using papers on both sides, common use of table stationeries instead of individual use and efficient use of printer cartridges, photocopy toner, office stationary, etc. Additionally, Bangladesh Bank introduced a number of refinance lending for renewable energy generation, effluent treatment plants and energy efficient kilns for manufacturing bricks. A revolving refinancing fund has also been placed in the areas of solar irrigation pumps, solar home systems, biogas plants, effluent treatment plants, brick kiln and solar photo voltaic module assembling plants, etc – with the sole aim of promoting green investments in Bangladesh.

However, amidst all these green investments and green banking developments in the country, banks have been facing major challenges in the implementation of this Green Banking Policy. The foremost challenge has essentially been the 'mandated' implementation of green banking initiatives by the banks. Since it has been made mandatory by the central bank, despite having inhibitions about it, all scheduled banks of Bangladesh had to implement various methods of green banking within their operational structures for both their banking transactions and in-house activities. The lack of the option of voluntariness in this regard has met with certain resistance from the top management as well as the operational staff of the banks. Change in the working environment and the alternate provision of banking services under green banking resulted in problems like coordination among all concerned authorities for green banking, proper awareness and effective implementation, immediate concentration on lending policies and procedures of the banking sector, high costs of implementation, conflict among management and bank-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

ers, etc. As such, it becomes imperative to examine the thought process of bankers towards the concept and implementation of the Green Banking Policy, since they are the ones who are at the forefront of execution of the green banking initiatives in the banking sector.

With regard to green banking, a limited number of studies have been conducted in the context of Bangladesh. For instance, Masukujjaman and Aktar (2013) highlighted the green banking road map in Bangladesh, the status of its implementation and also explored the activities of commercial banks in comparison with global green banking initiatives. The study concluded that Bangladesh is far behind their counterparts from the developed countries, but as of now, most of the banks are in a transition to green banking in the country. Ullah (2013) then conducted a comparative analysis among different types of banks operating in Bangladesh and tried to conclude whether the banks have properly adopted the Green Banking Policy guided by the Bangladesh Bank. Findings by Ullah (2013) claimed that only public and foreign commercial banks have invested in green banking projects whereas the initiatives of state-owned commercial banks or state-owned specialized development banks are nothing remarkable to be reported. Next, Ahmad et al. (2013) explored the green banking activities of all commercial banks in Bangladesh and attempted to determine the reasons behind adopting green banking from the perspective of bank employees. Six factors namely economic factor, policy guideline, loan demand, stakeholder pressure, environmental interest and legal factor were found to be the major influencers regarding the adoption of green banking by the commercial banks. Shakil, Azam and Raju (2014) also did an evaluation of green banking practices among the scheduled banks of Bangladesh and found that while some banks has taken certain green banking initiatives, there are still a good number of banks which are in the first phase of the Green Banking policy guideline set by Bangladesh Bank. Findings by Shakil et al. (2014) further stated that it is due to large initial cost and lack of governmental and technical support, that green banking practices is not implemented on a large scale in Bangladesh.

Furthermore, there are a number of local studies which were conducted related to various aspects of green banking practices in Bangladesh. While Masum (2015) highlighted the need for green banking in Bangladesh, Hossain and Ahmed (2015) outlined the phases of implementation under the Green Banking Policy guidelines set by the Bangladesh Bank. Next, Hossain et al. (2015) explored consumer attitudes and perceptions towards green banking in Bangladesh and Hossain, Rahim & Hussain (2015) analyzed the future of green banking for the country. With respect to promoting a greener economy, studies by Nisha, Idrish & Hossain (2015) did an empirical analysis to understand the factors behind consumer acceptance and use of mobile banking services in Bangladesh. In addition, Hossain, Jilani & Haque (2015) evaluated the option of Islamic finance as a greener alternative for the banking sector of Bangladesh. Overall, if a conclusion is drawn from these past studies, it can be observed that only one significant research of Ahmad et al. (2013) considered the perspective of bank employees towards the concept of green banking. In view of everything, this is a crucial aspect that needs to be further studied.

As such, this study focuses on the examination of the perception of bankers towards environmental issues and green investments, thereby highlighting their attitude for green banking initiatives, its products and services and the future potential of such practices in the context of Bangladesh. The method of Structural Equation Modeling (SEM) was mainly applied to investigate the underlying relationships related to the perceptions and attitudes of bankers towards green banking practices in the country. SEM has the ability to isolate observational error from measurement of latent variables like the proposed constructs in this study. Thus, the use of SEM for evaluating the perceptions and attitudes of bank employees is the unique contribution of this chapter, since to the best of the author's knowledge SEM has not been used for any green banking research in the context of the bankers in Bangladesh.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

RESEARCH MODEL AND HYPOTHESES

This chapter seeks to explore the extent to which bankers' perceptions about the environment, particularly the environment of Bangladesh, as well as their general perception about green investments influence their attitudes towards green banking approaches. Moreover, this research claims that the attitude of bankers will ultimately shape their reasons for using green banking and its related products and services and will also determine the future potential of such green banking initiatives from the bankers' perspectives.

In order to quantify these relationships, two research models were developed. The first model explored the relationship of factors such as bankers' general perceptions of environment and green investments with their attitude towards various forms of green banking initiatives currently being undertaken in Bangladesh. The second proposed model, on the other hand, investigated the extent to which the bankers' attitude towards green banking influenced their reasons for using green banking, its related products and services as well as their perceptions about the future potential of green banking approaches in Bangladesh.

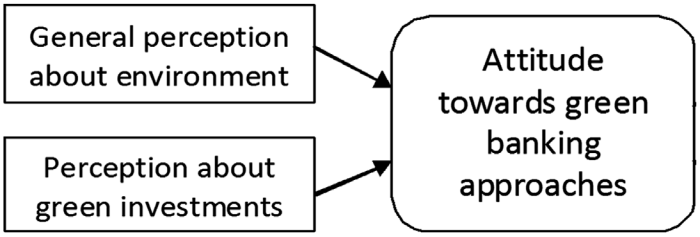
Next, a three-part methodology was utilized to understand these relationships conceptualized in the two research models. This methodology consisted of a survey instrument development, an Exploratory Factor Analysis (EFA), a Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM) to further confirm correlations and inferred causal relationships among the factors of the two models. Surveys were conducted using focus groups and walk-through assessments of selected commercial banks from where the bankers' perspectives were obtained. Once the survey instruments were created, industry experts like bank officials and managers were requested to review the questionnaire before the survey data were collected in person.

The responses from the questionnaires were then analyzed using SPSS Statistics Base and through their descriptive statistics, outliers were identified that might have resulted from possible data entry errors. The survey data was split into two parts following the outlier identification and an exploratory factor analysis was run on one dataset to determine the underlying factor structures. Finally, using the results of the exploratory factor analysis, the user-friendly interface of SPSS Amos was used to run a confirmatory factor analysis, using the second dataset to examine the reliability and validity of the measurement models without identifying the directional relationship among the factors. The two hypothesized models were then drawn to examine the underlying directional relationships among bankers' perception and attitude towards the green banking activities of the Bangladesh banking sector. See Figure 1 and Figure 2.

The hypothesized models and the proposed hypotheses are given below:

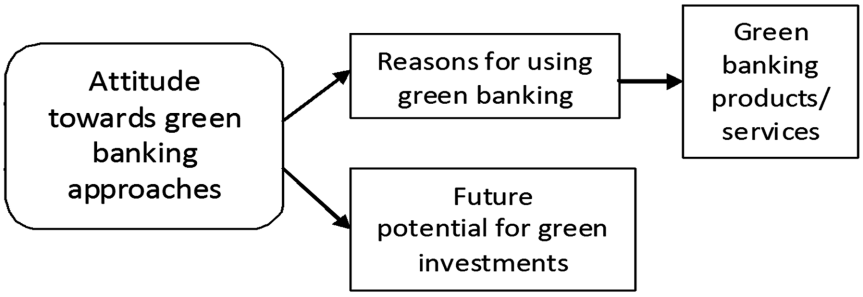
H1: General perception about the environment significantly affects the attitude of bankers towards green banking.

Figure 1. Proposed research structure 1



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 2. Proposed research structure 2



H2: Perception about green investments significantly affects the attitude of bankers towards green banking.
H3: Attitude of bankers towards green banking approaches significantly affects their reasons for using green banking.
H4: Attitude of bankers towards green banking approaches significantly affects the future potential of green banking initiatives.
H5: Reasons by bankers for using green banking significantly affect the concept of green banking products and services.

RESEARCH METHOD

To investigate the two research models, methods and techniques employed for data collection involved a primary research. The primary research involved gathering of data by conducting survey of a representative convenience sample of 800 bankers from selected commercial banks operating in the capital city of Bangladesh - Dhaka. The bank representatives were particularly surveyed and interviewed regarding the green banking initiatives employed by their banks. The survey required developing and circulating questionnaires for the bankers by presenting the information in quantifiable terms, in order to gauge the impact of their perception of environment and green investments upon their attitudes towards green banking initiatives and how this attitude was influencing their reasons for using, offerings and future potential of green banking products and services.

As such, the questionnaire was designed to enable the respondents to rate, on a Likert scale of 1 to 5, the extent to which they are aware of and care about environmental changes, the extent to which they think that the environment of Bangladesh is adversely affected due to climatic changes and whether they believe that Bangladesh needs to take precautionary measures regarding environmental issues in the form of green investments. This questionnaire also sought to find out the respondents' attitude towards green banking initiatives, in terms of their interest and support for such practices, their reasons for using green banking, their perception of future potential of green banking in Bangladesh as well as their perception about the different types of green banking products and services that commercial banks currently operating in Bangladesh offer. After a three-week survey, 733 completed and usable responses were finally obtained from the survey.

The two conceptual research models were then tested using the structural equation modeling (SEM) facilitates of SmartPLS (version 2.0). Through partial least squares (PLS) method, first the measurement

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

models were examined to assess the reliability and validity of all variables and then, the structural models were analyzed to examine the relationships hypothesized in the two research models.

MEASUREMENT MODEL ANALYSIS

Results from the measurement models are presented in Table 1 and Table 2 and it includes information about the reliability, validity, correlations and factor loadings. The composite reliabilities of the constructs ranged between 0.700 and 1.000, which exceeds the 0.7 recommended cut-off values (Nunnally & Bernstein, 1994). The average variance extracted (AVE) was greater than 0.5 in all cases and greater than each square correlations, which indicates that all the three models have both convergent validity and discriminant validity (Fornell & Larcker, 1981). Moreover, the internal consistency reliabilities (ICRs) of multi-item scales modeled with reflective indicators was 0.75 or greater, suggesting adequate reliability. The pattern of loadings and cross-loadings also supported internal consistency and discriminant validity, with some exceptions: two items from each construct of general perception about environment and perception about green investments from research model 1; and, one item from each construct of reasons for using green banking and future potential of green banking and two items from green banking products and services under research model 2 were deleted, due to their low loadings and high cross-loadings.

STRUCTURAL MODEL ANALYSIS

The path coefficients and significance levels in the structural models are presented in Figure 3 and Figure 4. The construct of general perception about environment (0.192, $p<0.05$) from research model 1 displayed a significant path towards the attitude of bankers for green banking approaches while the perception of green investments (0.122, $p>0.05$) showed an insignificant path in shaping the attitude of bankers.

On the other hand, the construct of attitude of bankers for green banking approaches in research model 2 reported a significant and positive path towards reasons for using green banking initiatives (0.407, $p<0.05$) and future potential for green banking (0.380, $p<0.05$). However, the same behavioral path was not seen regarding green banking products and services (0.296, $p>0.05$), which were found to be insignificant in the model.

Therefore, all hypotheses with the exception of H2 from research model 1 and H5 from research model 2, are supported. As such, it can be stated that the hypothesized relationships between environment and the attitude of bankers towards green banking, along with the reasons for using green banking and its future potential being shaped by the bankers' attitude have been rightly proved.

SOLUTIONS AND RECOMMENDATIONS

This study has revealed quite a few understandings towards the perception and attitude of bankers regarding the concept of green banking, its related products and services and its future potential in Bangladesh. Findings of the study show that bankers are quite well-informed about the general conditions of the world environment and they have clear ideas about global warming and the impact that climate changes

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 1. Factor loadings, composite reliability and AVEs

Research Model 1				
Constructs	**Items**	**Factor Loadings**	**Composite Reliability**	**AVE**
General perception about environment (GEP)	GLOBWAR	0.865	0.899	0.786
	CLIMCHANGE	0.836		
	ENVCARE	0.700		
	ENVSUST	0.848		
	BDENVVUL	0.924		
	BDCALAMITY	1.000		
Perception about green investments (PGI)	GIAWARE	0.700	0.707	0.608
	GITYPES	0.714		
Attitude of bankers towards green banking (AGB)	GBACT	0.903	0.829	0.695
	SPREADGB	0.758		
	GBMANDATES	0.882		
Research Model 2				
Constructs	**Items**	**Factor Loadings**	**Composite Reliability**	**AVE**
Attitude of bankers towards green banking (AGB)	GBACT	0.865	0.825	0.706
	SPREADGB	0.809		
	GBMANDATES	0.789		
Reasons for using green banking (RGB)	SOCIALRES	0.782	0.778	0.699
	ENVCON	0.814		
	RISKMIN	0.674		
	IMAGEIMPRO	0.733		
	GOVPRE	0.609		
	STKPRE	0.887		
	CBPRE	0.846		
	SUSTDEVRES	0.753		
Future potential for green banking initiatives (FP)	GBFUTUREOV	0.767	0.804	0.673
	GBINFUTURE	0.870		
	GBPOLDEV	0.740		
Green banking products/services (GBP)	EBSERVICE	0.845	0.754	0.607
	MOBBSERV	0.706		
	OFFAUTO	0.772	0.829	0.709
	ECOMM	0.908		
	PLESSTRANS	0.810	0.808	0.784
	GFINPROJ	0.767		
	GENSOURCE	0.713		

Table 1 Notes

1. GLOBWAR (global warming), CLIMCHANGE (climate changes), ENVCARE (environmental care), ENVSUST (environmental sustainability), BDENVVUL (Bangladesh environmental vulnerability), BDCALAMITY (Bangladesh natural calamities).

2. GIAWARE (green investments awareness), GITYPES (types of green investments).

3. GBACT (green banking act), SPREADGB (spread of green banking initiatives), GBMANDATES (mandates for green banking policy).

4. SOCIALRES (social responsibility), ENVCON (conservation of environment), RISKMIN (risk minimization), IMAGEIMPRO (improve industry image), GOVPRE (pressure from the government), STKPRE (pressure from the stakeholders like customers or employees), CBPRE (pressure from the central bank), SUSTDEVRES (sustainable development of resources).

5. GBFUTUREOV (overall future for green banking), GBINFUTURE (future initiatives of green banking), GBPOLDEV (policy developments for green banking).

6. EBSERVICE (electronic banking service), MOBBSERV (mobile banking service), OFFAUTO (office automation), ECOMM (electronic means of communications), PLESSTRANS (paperless transactions), GFINPROJ (green financing projects), GENSOURCE (green energy sources).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 2. Measurement models estimations

	ICRs	GEP	PGI	AGB	RGB	FP	GBP
GEP	0.843	**0.866**					
PGI	0.851	0.413	**0.887**				
AGB	0.809	0.354	0.368	**0.836**			
RGB	0.887	0.423	0.338	0.310	**0.734**		
FP	0.894	0.316	0.578	0.244	0.524	**0.847**	
GBP	0.835	0.285	0.033	0.133	0.562	0.441	**0.788**

Table 2 Notes

1. GEP (general perception about environment), PGI (perception about green investments), AGB (attitude of bankers towards green banking), RGB (reasons for using green banking), FP (future potential for green banking initiatives), GBP (green banking products/ services).

2. Diagonal elements represent the AVEs, while off-diagonal elements represent the square correlations.

Figure 3. Results of structural equation modeling 1

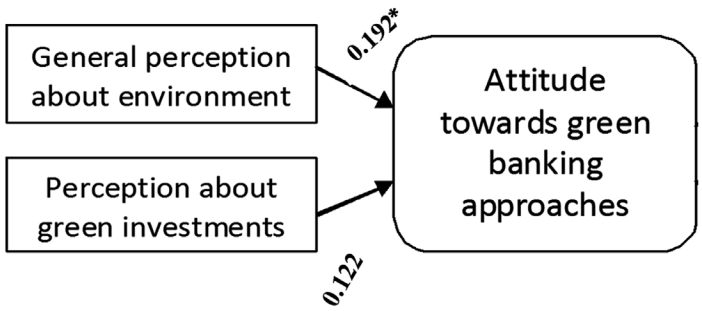
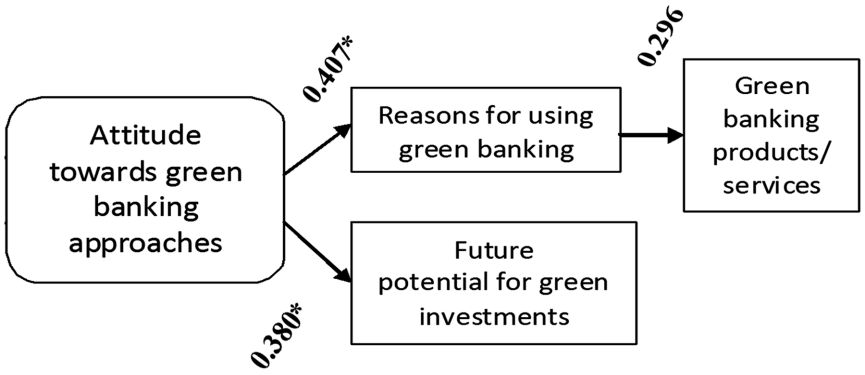


Figure 4. Results of structural equation modeling 2



can have upon the environment. Moreover, a good number of bankers displayed interest and agreement regarding the care and sustainability of the environment that is being promoted today worldwide. Most of the bankers were even found to be aware of the vulnerability of environmental conditions in Bangladesh and how this degradation was inviting natural calamities to the country. As such, it can be deduced from the survey results that bankers in Bangladesh are clearly in favor of saving the environment.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

However, most of the bankers did not know that a broad term used to refer to methods of environmental sustainability is actually the green investments. Some of them could identify ways to care for the environment or sustain resources like saving power, gas or water, reduced use of papers or controlling pollution, but a majority of the bankers did not have vivid ideas as to what can be varied ways of green technologies or green investments. As such, the central bank of Bangladesh in association with the government can fund documentaries wherein facts about global warming and different types of green investments can be displayed to create awareness and to educate the bankers as well as the general people of the country. This will help to change the perception of people towards green investments and bankers can get more ideas regarding the use of green financing like green bonds or green asset classes in their institutions. Survey results at this point give an impression that bankers actually opted for the use of green banking as part of their in-house activities and external functions only because the central bank of Bangladesh mandated the use and application of the Green Banking Policy. This implies that although bankers did care for the environment and were interested to sustain resources, they did not have adequate knowledge regarding the overall concept of green investments.

To further analyze the situation and attitude of bankers, the survey then probed onto the reasons as to why bankers accepted the use of green banking in their institutions. Results indicated that a majority of the bankers agreed that green banking techniques were being applied into their institutions to comply with the mandated policy of the central bank. To add more, some bankers feel that rather than being socially responsible or caring for the environment, employment of green banking in some selected banks of Bangladesh is just an act of image resurrection and a result of stakeholder pressure. For instance, some bankers claimed that using green banking helps to attract international customers to the bank to a large extent since being socially responsible is a concern for many of the clients today. Nonetheless, at least green banking techniques are being used and that is a major takeaway for a developing country like Bangladesh. Bankers, however, claimed that the reasons why green banking are being used in their banks did not have anything to do with the products and services that are currently being offered under green banking in the country. For example, survey results reported that electronic communication and office automation have been willingly accepted by bankers as part of

in-house green banking approaches. This is because bankers feel such techniques made work life easier and convenient for them and if in the process, it helps to save the environment as well then it is an added advantage for the banking sector. On the other hand, most of the bankers stated that electronic banking, mobile banking or the use of ATMs and credit/debit cards might be methods of green banking but it has been mostly accepted by both customers and the bankers because banking transactions become a lot easier with such services. At this point, it can be deduced that the attitude of bankers towards green banking products and services is quite positive and the reasons for using green banking in their institutions did not define their attitude towards the use of its related products and services.

Moreover, bankers evidently came up with various ideas regarding the future potential of green banking in the banking sector as well as other industries of Bangladesh. For instance, some bankers feel that the commercial banks should provide more loans at lower interest rates to eco-friendly industries or pro-environmental projects undertaken by any industry. This will help to spread the concept of green banking to other sectors of the country. Banks can also encourage borrowing facilities to those industries which plan to fund the implementation of solar energy programmes, green plantations, micro and macro level hydro projects, bio-mass electricity or bio-gas projects for the country. A majority of the bankers further stated that both the central bank and commercial bank authorities can impose restrictions on establishment of any industry or projects without using the green banking methodologies. Survey results

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

thus indicated that the attitude of bankers in Bangladesh mostly is in favor of creating awareness and spreading green banking approaches, not only in the financial sector but to other major industry settings of the country as well.

Findings of this chapter are mostly in line with the results reported by Ahmad et al. (2013) and Ullah (2013). Ahmad et al. (2013) claimed that policy guidelines by the central bank and stakeholder pressure are two major influencing factors for the commercial banks of Bangladesh to adopt green banking; while, Ullah (2013) stated through a comparative analysis of the country's commercial banks that brand image is a prime reason why the financial sector opts for green banking approaches in Bangladesh. Overall, it can be concluded that acceptance of green banking in both internal and external activities of banks in Bangladesh may have been acts of image improvement, pressure from central bank and stakeholders or just another progressive step to match with the developed economies. However, since every step counts, green banking approaches in Bangladesh can be treated as another small contribution to green investments, environmental care and sustainability and a better global environment from this side of the world.

All these recent developments in green banking initiatives by the banking sector of Bangladesh like online services, internet or mobile banking, office automation or electronic communications, conveys much significance. Already through various in-house green banking methods, banks are attempting to reduce the use of paper inside their offices and in their transactional activities, but since the present era is that of computers, more automation can be achieved by the banks. For instance, all communications regarding loan applications, credit proposals and their approvals can be conveniently done through electronic means which not only eliminates the use of paper but also saves time. Even the issuance of circulars from the central bank or from other commercial or foreign banks can be easily converted into electronic circulars, which can be reproduced and circulated through emails to all other urban and rural branches of the banks. Communications between different departments, branches and head office of the bank can also be efficiently done through this electronic means of circulation which will clearly eliminate the use of papers and save the environment. It is therefore imperative that the government of Bangladesh mandates the use of electronic means for all intra-bank, inter-bank and central bank communications. Such a step by the government will further their vision of a 'Digital Bangladesh' in the country as well (Islam & Khair, 2012).

Banks nowadays widely encourage the use of internet banking, mobile banking and the use of electronic bank statements in Bangladesh. However, papers like deposit slips or cheque books are still in use. Introduction of bank cards with secured chip and pin numbers can replace the use of such documents for banking transactions. A major challenge in such an initiative might be the unavailability of proper technological infrastructure and resources, but government support in the form of financial assistance to improve the facilitating conditions of the country can aid the banking sector to introduce such socially responsive business practices. Additionally, banks can establish an online resource center to eliminate the use of any hard copy for bank manuals, reference books, client circulars, etc.

Implementation of all green banking initiatives is a long-term project and like everywhere in the world, any such environmental-friendly measures are expensive (The Financial Express, 29 July, 2013). However, to safeguard the environment from the impacts of global warming and climatic changes, it is necessary to implement various forms of green investments and green technologies to mitigate any environmental hazards. In the context of Bangladesh, a positive perception for the environment and an equally positive attitude of bankers towards the use and future potential of green banking approaches for in-house and external activities of the banking sector, clearly paves the way of implementing other

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

forms of green investments in the country. The government and the central bank of Bangladesh should thus be more forthcoming in this regard by making budgetary allocations to promote green industries and by providing more financing facility for extensively implementing green investments in the financial sector, ultimately encouraging other industries of the country to participate as well.

FUTURE RESEARCH DIRECTIONS

The present study is solely based upon the green banking initiatives of some selected commercial banks of Bangladesh. Future research can examine the forms of green banking activities adopted by the central bank or the nationalized banks of the country. A similar research can also be conducted for a different developing country to do a more in-depth analysis of green investment approaches. Moreover, this study has mainly emphasized on the assessment of the perceptions and attitudes of bankers towards green banking. A longitudinal study can be adopted in future works to examine a different research model in order to examine the factors that can influence the adoption of green banking from the perspective of customers. This will provide a better insight into the perceptions of users and can help to enhance the understanding of individual users' intention to adopt green banking services in the context of Bangladesh.

CONCLUSION

The primary objective of this chapter is to provide a conceptual model that determines the perception of bankers towards environment, green investments and their attitude towards green banking that defines the reasons for using its related products/services and the future potential of such initiatives. Lack of studies in the area of bankers' perceptions and attitudes towards environmental safety and the concept of green banking is a major reason why such study is required to obtain a clear picture of the present status of commercial banks and their role in the adoption of green banking practices, particularly in developing countries. Thus, the findings of the current study are expected to make a significant contribution to the emerging literature on green banking studies by going beyond comparative analysis of banks and employing variables to assess the perception and attitude of bankers, who are mainly the people involved in the implementation and execution of green baking approaches. Results reveal that the perception of bankers towards environmental protection, care and sustainability was quite positive, but despite their agreement about environmental safety the bankers displayed limited knowledge about the concept and related methods of green investments. A more deterministic role that defines the attitude of bankers towards green banking has been mainly identified as image improvement and/or pressure from the central bank and stakeholders of the banking sector. In contrast, since green banking initiatives has made banking transactions easier to avail and working conditions more convenient for the bankers, no matter whatever the reason is for the individual banks to adopt green banking practices, bankers mostly are in favor of such initiatives and its related products/services. A significant number of bankers also gave a lot of insights regarding the future potential of green banking practices for the commercial banks of Bangladesh. Since the findings of this research are perceptual in nature, the attitude of bankers can be further influenced by appropriate documentaries to create awareness regarding global warming,

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

environmental safety issues and green investments. Moreover, the intervention of government through budgetary allocations for green banking and increased involvement of the central bank to promote financing facilities for green initiatives can enable a more positive, supportive and encouraging attitude of bankers towards green banking practices in Bangladesh.

REFERENCES

Ahmad, F., Zayed, N. M., & Harun, M. A. (2013). Factors behind the adoption of green banking by Bangladeshi commercial banks. *ASA University Review*, *7*(2), 241–255.

Croce, R. D., Kaminker, C., & Stewart, F. (2011). *The role of pension funds in financing green growth initiatives.* OECD Working Papers on Finance, Insurance and Private Pensions, No.10, OECD Publishing.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *JMR, Journal of Marketing Research*, *18*(1), 39–50. doi:10.2307/3151312

Gani, M. O. (2013, July 29). Green banking: Concept and policy guidelines. *The Financial Express*.

Hossain, M. Z., & Ahmed, M. (2015). Green banking in Bangladesh. In Green Banking in Bangladesh and Beyond, (pp. 17-47). Zaman Printing and Packaging.

Hossain, M. Z., Ahmed, M., & Nisha, N. (2015). Consumer attitudes and perception towards green banking in Bangladesh. In Green Banking in Bangladesh and Beyond, (pp. 48-76). Zaman Printing and Packaging.

Hossain, M. Z., Jilani, S. N., & Haque, H. (2015). Islamic finance as a greener alternative. In Green Banking in Bangladesh and Beyond, (pp. 201-217). Zaman Printing and Packaging.

Hossain, M. Z., Rahim, M. A., & Hussain, T. (2015). The future of green banking in Bangladesh. In Green Banking in Bangladesh and Beyond, (pp. 77-88). Zaman Printing and Packaging.

Inderst, G., Kaminker, C., & Stewart, F. (2012). *Defining and measuring green investments: Implications for institutional investors' asset allocations.* OECD Working Papers on Finance, Insurance and Private Pensions, No.24, OECD Publishing.

Islam, M. J., & Khair, R. (2012). Preparation of e-Government in Bangladesh: An exploratory analysis. *JU Journal of Information Technology*, *1*, 19–26.

Islam, M. T. (2015, May 26). Green banking and its present scenario in Bangladesh. *The Daily Observer*.

Masukujjaman, M., & Aktar, S. (2013). Green banking in Bangladesh: A commitment towards the global initiatives. *Journal of Business and Technology*, *8*(1&2), 17–40.

Masum, M. (2015). The need for Green banking in Bangladesh. In Green Banking in Bangladesh and Beyond, (pp. 3-16). Zaman Printing and Packaging.

Nisha, N., Idrish, S., & Hossain, M. Z. (2015). Consumer acceptance and use of mobile banking services in Bangladesh. In Green Banking in Bangladesh and Beyond, (pp. 155-182). Zaman Printing and Packaging.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric Theory*. New York: McGraw-Hill.

Roy, J. K. (2015a, August 1). Green stocks: Green investment, green return. *The Financial Express*.

Roy, J. K. (2015b, July 15). Promoting green businesses in Bangladesh. *The Financial Express*.

Shakil, M. H., Azam, M. K. G., & Raju, M. S. H. (2014). An evaluation of green banking practices in Bangladesh. *European Journal of Business and Management*, *6*(31), 8–16.

The Financial Express (2015, February 15). BB to create $500m fund for green industries. *The Financial Express*.

Ullah, M. M. (2013). Green banking in Bangladesh – A comparative analysis. *World Review of Business Research*, *3*(4), 74–83.

ADDITIONAL READING

Bahl, S. (2012). Green banking - The new strategic imperative. *Asian Journal of Research in Business Economics and Management*, *2*(2), 176–185.

Bahl, S. (2012). The role of green banking in sustainable growth. *International Journal of Marketing*. *Financial Services and Management Research*, *1*(2), 27–35.

Bihari, S. C. (2010). Green banking towards socially responsible banking in India. *International Journal of Business Insights & Transformation*, *4*(1), 82–87.

Biswas, N. (2011). Sustainable green banking approach: The need of the hour. *Business Spectrum*, *1*(1), 32–38.

Dash, R.N. (2008). Sustainable 'Green' Banking: The Story of Triodos Bank. *Cab Calling*, 26-29.

Goyal, K. A., & Joshi, V. (2011). A study of social and ethical issues in banking industry. *International Journal of Economics and Research*, *2*(5), 49–57.

Kaeufer, K. (2010). *Banking as a Vehicle for Socio-economic Development and Change: Case Studies of Socially Responsible and Green Banks*. Cambridge, MA: Presencing Institute.

Sahoo, P., & Nayak, B. P. (2008). *Green banking in India*. Institute of Economic Growth.

KEY TERMS AND DEFINITIONS

Commercial Bank: A financial institution that accepts deposits and provides loans to the general public. It also provides basic banking services to industries and can fund industry-specific projects as well.

Environmental-Friendly: Any practice that reduces any harmful impact on the environment.

Global Warming: Rapid change in the eco-system that brings about a change in the climate and which can have a direct impact on biodiversity, agriculture, forestry, dry land, water resources and human health.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Green Banking Unit: An operational unit in an organization which consists of employees from various departments and the main function of this unit is to design, evaluate and administer activities related to green banking initiatives of that organization.

Green Banking: An approach that promotes environmental-friendly practices and reduces carbon footprint from banking practices. This can be achieved in many ways such as reduced use of paper through the use of online banking instead of branch banking.

Green Finance: Any financial instruments, investments or projects that are climate change specific and primarily related to renewable energy, environmental technology or sustainability related markets.

Green Investments: Investments that focus their attention to climate change, resource efficiency and the safeguarding of the environment as a whole.

Social Responsibility: Any act or practice that works for the overall benefit of the society and focuses more on the improvement of the economy and eco-system rather than just the maximization of profits.

Sustainable Development: Any practice that has a sole aim to preserve natural resources for the betterment of the environment and eco-system.

This research was previously published in Measuring Sustainable Development and Green Investments in Contemporary Economies edited by Mihai Mieila, pages 1-21, copyright year 2017 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 39
Why Do Companies Engage in Green Marketing?
Alternative Green Marketing Strategies and the Motivations for the Green Marketing Approach

Özge Kirezli
Istanbul Bilgi University, Turkey

Melis Kaytaz Yiğit
University of Marmara, Turkey

ABSTRACT

In recent years, consumers and the business world have deemed environmental issues to be more important, and green marketing has become a competitive advantage involved in corporate strategies. This chapter aims to study the concept of green marketing in the business world. First, according to literature, evolving green marketing definitions are described in detail, and the importance of green marketing approach it assessed. Then, since green marketing approach must be integrated with corporate strategies, four green marketing strategic models are presented and discussed. The chapter concludes with a discussion of the implications for green marketing of motivating factors such as pressure from consumers, NGOs and environmental organizations, legislative authorities, cost and profit considerations and competition between companies.

INTRODUCTION

The business world is experiencing a paradigm shift that requires new strategies and approaches to deal with competition and the changing needs of consumers who are becoming more conscious all the time. Companies have acknowledged that the only way to retain a positive position in consumers' minds is to enhance their image in areas that they appreciate. This is the basic explanation of modern business's

DOI: 10.4018/978-1-5225-7915-1.ch039

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

focus on sustainability, social responsibility and green practices. The market system made it necessary for businesses to involve nature in their business plans due to society's perception of the potential threat of its depletion.

Western societies began to perceive the harmful and devastating effects of industrialization and development in the early 1960s (Ghoshal, 2005). As Apel (1980) noted industrial revolution, our scientific and technological civilization, has presented all nations, races, and cultures, regardless of their group-specific, culturally relative moral traditions, with a common ethical problem, the sustainability of nature. For the first time in the history of the mankind, human beings are faced with the task of accepting collective responsibility for the consequences of their actions on a world-wide scale. This is made more specific in the Potsdam Institute for Climate Change's study of irreversible processes in the world caused by pollution, unplanned and unsustainable production and consumption systems. On the other hand, the amount of greenhouse gasses rose by 70% between 1970 and 2004, and global temperatures have risen by 0.76°C (1.36°F) since the 1850s (Vorholz, 2009). Environmental consciousness, therefore, arose first as a response to these problems respectively in industrial and developed societies. The idea of sustainability, which lies at the core of green marketing, dates back more than forty years, to the new mandate adopted by the International Union for Conservation of Nature and Natural Resources (IUCN) in 1969. Sustainability was also a key theme of the 1972 United Nations Conference on the Human Environment in Stockholm (IUCN Report, 2006). The concept was intended to suggest that it was possible to achieve economic growth and industrialization without environmental damage. Since then, this idea has been accepted and appreciated by industry, consumers and NGOs. However, translating this concern into action to protect the environment and integrating it with the principles of marketing were ideas that emerged in the 1970s (Peattie, 2001).

The term green marketing describes a business's efforts to design, promote, price and distribute products that will not harm the environment (Pride and Ferrell, 1993). Clearly, there are a wide variety of considerations to be addressed by companies that choose to embrace a green marketing agenda. Among them are concerns such as: developing offerings that conserve energy and other natural resources in their production process (Porter, 1991), creating advertisements and other promotional messages that accurately reflect the company's concern for the environment (Kangun et al., 1991), setting prices for green products that balance consumers' sensitivity to cost against their willingness to pay more for environmental safety (Chase, 1991; Jay 1990), reducing pollutants and conserving resources in the transportation of products to market (Bohlen et al., 1993) and a host of other marketing decisions.

Thus, the question to be asked is how businesses should act when motivated by these concepts. Chamorro and Banegil (2006) emphasize that the goals of the philosophy behind green marketing cannot be achieved by simply setting up a marketing department to apply the techniques of green marketing. Respect for the environment needs to be reflected in all of the business's behavior, not only in commercial aspects (Chamorro & Banegil, 2006; Ottman, 1993, 1998; Coddington, 1993; McDonagh & Prothero, 1993; Peattie & Charter, 1994; Sheth & Parvatiyar, 1995; Wasik, 1996; Polonsky et al., 1997). Moreover, to get the entire business to be concerned about the environmental impact of their activities, the environment should become one of the determining values of its organizational culture. There are two concepts that justify this claim (Chamorro and Banegil, 2006). First, the environmental impact of a product can rarely be eliminated if environmental aspects are not taken into account by other functional areas of the business that affect the end product's ecological quality, such as design, supplies and production. Second, the majority of green purchasers do not just buy a green product, they

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

are also buying the producer's green image. As Peattie (1999) says, the business itself becomes part of the product consumed; product and business form the total product. For this reason, the manufacturer of a green product should ensure that all its other business activities are also green (Pujari and Wright, 1999). If a business markets its products as green while simultaneously ignoring other dimensions of its ecological impact, it will have little credibility with consumers and will risk being endlessly criticized by pressure groups (Peattie & Charter, 1994).

The currency of the issue and the fact that it binds a variety of parties, such as industries, marketing, governments and consumers, motivate the authors to provide a coherent picture of green marketing approach in modern organizations in the contemporary business world. After a brief introduction in the second part, this chapter offers a detailed review of the literature on green marketing, the concept of sustainability in the business world and the perspectives of consumers and environmental organizations. Then, businesses' motivations for green marketing are presented in terms of pressure by consumers, NGOs and environmental organizations, legislation, cost and profit considerations, corporate environmental responsibility and competition. The conclusion is a general discussion about the topic and its implications for both the academic and marketing worlds.

GREEN MARKETING: THEORETICAL BACKGROUND

The past decade has seen a growing awareness of the widespread environmental degradation that faces current and future generations. This awareness has increased to the extent that environmentalism has been identified as potentially, "the biggest business issue of the 1990s" (Kirkpatrick, 1990). According to another view, the concepts of sustainability and green marketing have been known for a long time, but not necessarily by their current names. For example, in the early 1970s, Kotler and Zaltman (1971) proposed the idea of social marketing, which encompassed environmentalism. While their idea was originally developed as a response to a natural disaster, it is not news that green marketing has gained ground recently and it is closely linked to environmentalism (Chamorro et al., 2007; Peattie, 2001) and the green consumer (McDonald and Oates, 2006; McEachern & McClean, 2002; Cope & Winward, 1991; MacKenzie, 1991). When the aim of satisfying human needs and desires is paired with technological advances, the result is two-fold. Humanity has enjoyed technological advances' improvements in living conditions, but on the other hand, over hundreds of years production and trade have polluted and depleted natural resources. Especially in the last thirty years, both industry and society have begun to worry about the potential outcomes of underestimating the importance of the scarcity of natural environments (Straughan & Roberts, 1999). This section analyzes the concept of green marketing, starting with basic definitions and background and continuing with the significance and usefulness of the concept in the business and consumer world.

Henion (1976) was first to define green marketing as: "the implementation of marketing programs directed at the environmentally conscious market segment" (Banerjee, 1999, 18). This definition has three key components:

1. It is a subset of the overall marketing activity,
2. It examines both positive and negative activities, and
3. A narrow range of environmental issues are examined.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

While this definition is a useful starting point, to be comprehensive green marketing needs to be more broadly defined (Polonsky, 1995, 2). Fuller (1999, 4) defines green marketing as: "the process of planning, implementing and controlling development, pricing, promotion, and distribution in a manner that satisfies the following three criteria:

1. Customer needs are met,
2. Organizational goals are attained, and
3. The process is compatible with ecosystems."

Peattie's even broader definition sees green marketing as: "the holistic management process responsible for identifying, anticipating and satisfying the needs of consumers and society in a profitable and sustainable way" (Peattie, 1995, 563). Two key issues are emphasized by this definition: environmental sustainability and holistic thinking. Holistic thinking is used to describe a strategy that looks at marketing efforts as a whole to develop a holistic marketing plan by coordinating all marketing efforts. Environmental sustainability has been defined as meeting the needs of the present without compromising the ability of future generations to do so.

Mintu et al. (1993, 17) define green marketing as: "the application of marketing tools to facilitate exchanges that satisfy organizational and individual goals in such a way that the preservation, protection, and conservation of the physical environment is upheld." Green marketing imparts an ecologically proactive role to marketing organizations. It fosters not only sensitivity to the effects that marketing activities may have on the natural environment, but also encourages practices that reduce or minimize any detrimental effects.

According to Polonsky (1994) green or environmental marketing consists of all activities, designed to generate and facilitate any exchange intended to satisfy human needs and desires, such that their satisfaction occurs with minimum detrimental impact on the natural environment. This definition also includes the protection of natural environment by attempting to minimize the detrimental impact that exchange has on the environment. This second point is very important since human consumption is by its very nature destructive to the natural environment. To be more accurate, products that are marketed with green claims should be called "less environmentally harmful," rather than "environmental friendly." Thus, green marketing should try to minimize environmental harm, not necessarily to eliminate it.

Stanton et al. (1994, 636) claim that green marketing is: "any marketing activity of a firm that is intended to create a positive impact or lessen the negative impact of a product on the environment in order to capitalize on consumers' concerns about environmental issues." Pride and Ferrell (2010, 23) define green marketing as: "a strategic process involving stakeholder assessment to create meaningful long-term relationship with customers while maintaining, supporting, and enhancing the natural environment." Briefly, green marketing refers to activities that satisfy customer needs and desires in such a way that when their fulfillment occurs, negative environmental impact is minimized throughout the entire process, from product development to consumption and disposal. A general comparison between traditional green marketing approach and green marketing is presented by Figure 1.

World population is projected to double in the next 40 years, and when environmental pollution and scarce natural resources are considered in conjunction with this estimate, it can be seen that humanity is approaching an extinction threat (Polonsky, 1995). Thus, the united efforts of both society and industry engender the concept of green marketing. Until the twenty-first century, concern for the physical environment as a strategic marketing issue has evolved through several distinct stages. Tracing the evolution

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 1. Comparison of traditional marketing and green marketing
Source: Antonio Chamorro & Tomas Banegil, 2006

	Traditional Marketing	Green Marketing
Parties Involved in Exchange	Firm and customer	Firm, customer and environment
Objectives	Customer satisfaction Satisfaction of firm objectives	Customer satisfaction Satisfaction of firm objectives Minimisinf ecologcal impact caused
Corporate Responsibility	Economic responsibility	Social responsibility
Reaach of Marketing Decisions	From manufacture to product use	Entire product value chain from otaining raw materials to post consumption
Ecological Demands	Legal requirements	Beyon law: design for environment
Green Pressure Groups	Confrontation or passive attitude	Open relationship and collaboration

of green marketing, Peattie (2001) identified three phases: ecological green marketing (1970s), environmental green marketing (1980s) and sustainable green marketing (1990s), which are shown in Figure 2.

Ecological and environmental green marketing were the initial forms of green marketing; however, the bond between sustainability and green marketing is the fundamental characteristic of the latest stage in its development. The term "sustainability" was first used in 1972 by the World Commission on Environment and Development" (also known as the Brundtland Commission). It was defined as economic development that meets the needs of the present generation without compromising the ability of future generations to do so (UNGA Report, 2001). At first, the definition was not clear enough, but it cleverly

Figure 2. Stages of green marketing
Source: Data driven from Peattie, 2001

Stages of Green Marketing	Time Frame	Characteristics	Consequences
Ecological Green Marketing	1960s and 1970s	· Emphasis on pollution and resource depletion · Identifying problematic sectors: automobiles, oil and agro-chemicals · Concerning a minority	· Increased environmental regulation and law · Need for legal and technical staff
Environmental Green Marketing	1980s	· Publication of the Brundtland Report · Reduce environmental damage by green consumers · Using green marketing opportunities as a competitive advantage	· The rise of the green consumer · Innovation in clean production systems · New terms of eco-performance, environmental quality
Sustainable Green Marketing	1990s	· Meet the full environmental costs of production and consumption to create a sustainable economy. · Radical changes in the way people live, produce and consume	· Intense social concern for industry and consumers · New terms of quality of life, sustainable models · Integrated efforts to seek solutions involving suppliers, consumers and even competitors

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

captured two fundamental issues, the problem of the environmental degradation that so commonly accompanies economic growth and the enduring need for such growth to alleviate poverty. While there is no standard definition of corporate sustainability, some authors have made attempts to define it, rather vaguely, as: "demonstrating the inclusion of social and environmental concerns in business operations and in interactions with stakeholders" (van Marrewijk & Were, 2003, 107). So more than just taking ecological degradation into account, the interest was shifted to the potential harm caused by humanity to humanity. The core of sustainability thinking has become the idea of its three dimensions, environmental, social and economic sustainability.

Van dam and Apeldoorn (1996) perceive sustainable marketing as a way to determine feasible tradeoffs between business and environmental concerns. Undoubtedly, the concept of sustainability is significant from multiple angles, and unlike green marketing, sustainable marketing is a macro marketing concept (Fisk,1998). Although this chapter only considers the business side, it would be quite beneficial to discuss the ramifications of the concept for a variety of parties, including the world economic system as a whole, marketers, consumers and legal authorities. Peattie (2001, 140) perceives its significance by its natural ability to join the concepts of physical environment, society and the economy and to recognized their interdependence. Morrison (2003) also indicates that for corporations sustainability involves: "an integration of social, environmental, and economic accountability for the purpose of forging a new framework within which leaders make decisions and assume the accompanying responsibilities." Previously, these were seen as separate issues for interests to be traded off (in particular, environmental protection and economic growth were presented as a choice).

Belz (2006, 21–22) identifies some dimensions of sustainability marketing:

- **Socio-Ecological Problems:** The analysis and identification of ecological and social problems are points of departure in sustainability marketing. Social and ecological concerns are core concepts at the heart of sustainable marketing.
- **Intersection of Social and Individual Benefits:** Sustainability marketing aims to create no harm to the environment, while at the same time ensuring customer satisfaction.
- **Transformational Facets:** By dealing with public and political issues and changing business practices in favor of sustainability, companies build the conditions for the successful marketing of sustainable products.

VISUALIZING DIVERSE GREEN MARKETING STRATEGIES

Integrating sustainability with green marketing will undoubtedly require more effort than developing less harmful products and cleaner production processes. A single action or set of discrete actions are insufficient to embrace the entire philosophy of green marketing. Although these activities are tactically essential to the overall success of the greening program, green marketing is a holistic and integrated approach that continually reevaluates how firms can achieve corporate objectives and meet consumer needs while minimizing long-term ecological harm, as Peattie (1995, 563) emphasizes. This section analyzes green marketing strategically.

The growing global importance of environmental issues forces companies to consider their overall corporate strategy and establish converging objectives among different functions. It involves an enriched way of looking at marketing, its objectives, and its strategies that even goes beyond social marketing

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

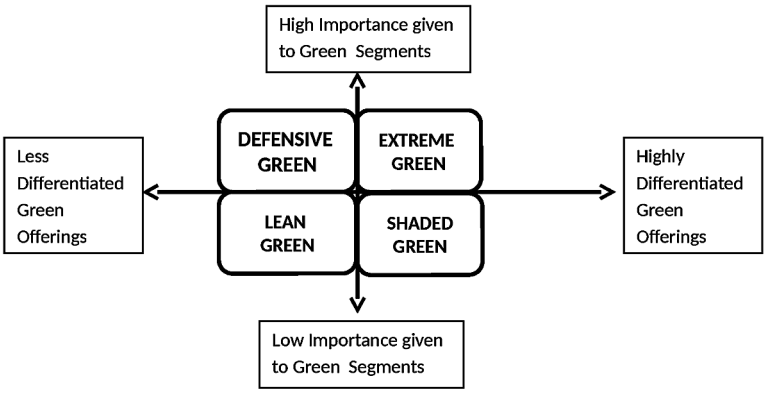
(Kilbourne, 1998; Prothero, 1998; Peattie, 1995). Current practices also support the undeclared consensus that the transformation from industrial era marketing to sustainable green marketing is necessary to ensure the sustainability of the entire economic system.

Appraisals of green marketing strategies involve distinct views, so this section presents four models of its strategical implications: Shrivastava's (1995) "The Implications of Porter's Forces in Green Marketing," Prakash's (2002) "Greening Strategies," Ginsberg and Bloom's (2004) "The Green Marketing Strategy," and Kotler's (2005) four levels of environmentally sustainable strategies.

1. **Shrivastava's Implications of Porter's Forces in Green Marketing:** According to Shrivastava (1995, 949) it is possible to derive modified strategies from Porter's generic competitive forces: least-cost leadership, focus and differentiation. By applying these sustainability principles, ecologically sustainable generic strategies were presented as a new paradigm.
    a. **Ecologically Sustainable Least-Cost Strategy:** Products and processes are designed to assure improved environmental quality. Large scale operations are appreciated due to the savings they entail. Basic training on safety and environmental issues should also be given to employees. Building green partnerships or alliances are another way to improve ecological efficiency.
    b. **Ecologically Sustainable Differentiation Strategy:** Product attributes such as ingredients are packaging are modified to create differentiation. Environmentally safe packaging serves as a critical issue. Manufacturing facilities are of moderate size, and special training is given to employees in this strategy. Companies tend to work with many vendors to deal with waste management, transportation costs and reduce packaging. Technology transfer of environmentally safe production systems is desirable; however, this is an expensive strategy.
    c. **Ecologically Sustainable Niche Strategy:** Apart from including environmental considerations in technology development and use, new product development and process improvements, firms can also serve niche markets of environmentally conscious consumers. If a company works with limited vendors, it is assumed to improve the environmental quality of the products due to customized offerings. Extensive technological possibilities are important in terms of competitive advantage, but are relatively expensive and may not be environmentally safe.
2. **Prakash's Greening Strategies:** Prakash (2002) suggests that companies are likely to engage in green marketing strategies in three ways: value-adding processes; management systems and products. Value adding modifies or reengineers current systems to reduce negative environmental impact. Management systems set environmental objectives to measure environmental performance. However, if these objectives are not quantifiable and easy to measure, it is quite difficult to monitor progress. The first two strategies are companywide, but the third one adopts a micro perspective and deals with specific products as green products. Focusing on the performance of products is thought to be important in several ways (Prakash, 2002, 286; Charter, 1992): by reusing products and developing products for reuse; by repairing and extending product life cycles, by recycling and converting products into raw materials, and by reducing or generating less waste.
3. **Ginsberg and Bloom's "The Green Marketing Strategy":** According to Ginsberg and Bloom (2004, 80), there is no single green marketing strategy that is right for all corporations, and strategies should be derived from the likely size of an industry's green market and companies' ability to differentiate their products as green. Hence, they offer four strategies that range from the relatively passive lean green strategy to the more active and aggressive extreme green approach (Figure 3).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 3. Ginsberg and Bloom's green marketing strategy matrix
Source: Ginsberg & Bloom, 2004



a. **Lean Green:** Companies that adopt this strategy do not consider publicizing or communicating their green initiatives, their interest is reducing costs and improving efficiencies by activities designed to reduce negative environmental impact. In other words, attaining the competitive advantage of lower costs is the key issue for lean greens. The main drive is compliance with regulations and finding preventive solutions for the long term. Last but not least, lean greens are reluctant to advertise their green identity and do not promote green activities or products.
b. **Defensive Green:** This strategy uses green marketing as a response to competition, to a crisis or as a precaution. Defensive greens have identified green niche segments as important customers who cannot be lost. Since they do not have the competitive advantage of differentiated green products, extensive promotion is likely to be a waste of resources. Sponsoring small environmentally-friendly events and programs or PR activities are good for them, if they are attacked by regulatory authorities, NGOs or competitors.
c. **Shaded Green:** Shaded greens make substantial financial and non-financial commitments by investing in long-term, system wide and environmentally-friendly products and processes. These companies have achieved the competitive advantage of being able to differentiate their products as green, but choose not to do so, and in order to make money, they stress other functional attributes. Shaded greens promote their products' tangible benefits to the customer, and their green benefits are perceived as secondary.
d. **Extreme Green:** Extreme greens have ethical values and are highly interested in integrating environmental issues into business. Achieving green strategies is often the initial driving force for these companies. They use life-cycle pricing approaches, total quality management and manufacturing standards that are safe for the environment. Extreme greens' products and services usually serve niche markets.

4. **Kotler's Environmental Sustainability Strategies:** The first three green strategies have been presented in sequential order, and Kotler's (2005) perspective unifies them all in the most interpretative approach. He suggested four approaches to environmental sustainability, which are:
   a. **Pollution Control and Prevention:** Cleaning up waste after it has been created or minimizing waste through green marketing programs or by developing safer biodegradable or recyclable products and/or packaging.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

b. **Product Stewardship:** Minimizing environmental impacts throughout the full product life cycle by designing products that are easier to recover, reuse or recycle.
c. **New Environmental Technologies:** Investing in research and development to pre-empt fully sustainable strategies, for example developing environmentally biodegradable cleaning products that also work at low temperatures and thus save energy.
d. **Sustainability Vision:** Developing a framework to show how the company's products, service, processes and policies comply with pollution control and prevention, product stewardship and new environmental technologies.

5. **Green Marketing Strategies Proposed by the Authors:** As literature suggest, there exist various forms of greening strategies. In a broader concept it is possible to classify strategic approaches in 3 views, which are Authentic Green Marketing, Relational Green Marketing and Egoistic Green Marketing. The details of each type are discussed below.
   a. **Authentic Green Marketing:** Companies adopting that strategy have tight ethical values and consider environment as a necessary factor of production. This strategy requires a holistic approach, with all actions of the firm coordinated to integrate environmental issues across all functional areas. The vision is not just complying with the regulations or promoting the company as "socially responsible", but to make a contribution by developing sustainable creative solutions to current ecological and social problems. The company shows tendency to integrate green views in company's mission and vision, moreover in operations, that is to be reflected by elements in marketing mix; product, price, promotion and place.
   b. **Relational Green Marketing:** Financial or non-financial investments to green marketing are undoubtedly, important for companies, when opportunistic costs of these are to be thought. So sometimes, companies may not be satisfied by doing ethical actions for the world, for the humanity, they desire to achieve extra benefits. In that perspective, they use green marketing as a promotional tool to enhance company's image. Green wash threat occur within that strategy. The company may choose to mention green objectives in mission and vision, but the operational reflection is weaker than "Authentic Green Marketing". A limited perspective in green marketing mix adaptation is to be seen in that type, beside product approach, promotion or place adaptation could be seen.
   c. **Egoistic Green Marketing:** Like Ginsberg and Bloom's "Lean Green" Strategy, companies aim to consider green marketing only method to ensure lower-costs. Low cost issue may be handled internally, through revise of operations to enhance efficiency, new process designs, product modifications (re-fillable, re-useable, recyclable) or externally, to comply legal obligation avoid negative consequences like penalties, extra taxes, or even consumer boycotts. In other words, realization of that strategy depends only on marketing mix's "product" element.

MOTIVATIONS FOR GREEN MARKETING APPROACH

Society also has critical impact on companies, and as Vale (2005) arguers, nowadays companies cannot succeed without taking a variety of stakeholders into account in their strategical and tactical approaches. Esty and Winston (2006) point out that not only are the relations between consumer, organization and natural environment being redefined, but the effects of each party on the others are being interpreted as pressure by a variety of stakeholders, including producers, legal authorities, pressure groups (environ-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

mentalists), NGOs, consumers, competitors and suppliers. Considering market actors in the development environmental marketing strategy will help industrial marketers to achieve their strategic objectives. Polonsky (1995) argues that that if firms are being forced by legislation to modify their behavior, they would benefit from understanding why changes in public policy occur and how legislators are motivated. As the most powerful stakeholders, as decision makers, consumers determine the fate of companies by holding the power to buy or not buy, and green marketing offers a proactive strategy that can enable companies to cater the market by selling nature-friendly products and services that reduce or minimize any detrimental impact on environment. Polonsky adds that (1995) for companies' desire for the competitive advantages of green marketing is based on the assumption that the consumers prefer environmental products and options. Therefore, consumers and the competition are both relevant stakeholders that need to be considered when firms develop their environmental marketing strategies. Lantos (2001) underlines the need for a balance and cooperation between the diverse groups that affect greening strategy; however, uncertainty remains about how to achieve this balance.

Companies accept their responsibility to minimize harm to the environment and improve their processes and products to become green (Hart & Ahura, 1997, 67). Undoubtedly, their practices are an important question for analysis; however, the forces that drive companies to go green can be more attractive to the parties involved in green marketing. The literature suggests several reasons for businesses' increased use of green marketing (Polonsky, 1995, 31):

- Companies see green marketing as an opportunity to fulfill their objectives and achieve competitive advantage (Polonsky, 1995,Keller 1987, Shearer, 1990).
- Companies feel social responsibility and obliged to behave ethically (Polonsky, 1995).
- Legislative authorities are forcing firms to be more responsible (Polonsky, 1995).
- Competitors' green activities pressure firms to change their own activities (Polonsky, 1995).
- Cost and profit opportunities associated with recycling, waste disposal, reductions in material usage and the elimination of packaging force companies to change their attitudes and hence behavior (Polonsky, 1995, Azzone & Manzini, 1994).

Other factors can be added to this list, such as pressure by consumers, NGOs and environmental organizations. Each of these motives will be discussed in more detail as part of companies' perceptions of green marketing philosophies.

Non-Governmental Organizations (NGO's): Associations Pressure

NGOs are institutions that work for the benefit of the society regardless of their interest. Environmental problems are getting worse day by day, creating the need for voluntary organizations and international NGOs. In the realm of international development, NGOs have been characterized as the new "favored child" of official development agencies and proclaimed a "magic bullet" for targeting and fixing the problems that have befallen the development process (Edwards & Hulme, 1996).

Arts (2002) interprets the relationships between business and non-governmental organizations, especially environmental organizations (NGOs), as antagonistic in nature since they have competing objectives. In other words, the conflict between the two parties is caused the negative effects of industry on the environment, which are harshly criticized by NGOs. Hence, clashes on environmental issues occur between NGOs and companies, and the tension is not just between industry and NGOs, but also between

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

legal authorities and NGOs. Governments are criticized by NGOs for their slow, bureaucratic negotiations, which lead to the postponement of measures, vague compromises and a lack of implementation (Bendell & Murphey, 2000).

Already in the late 1980s and early 1990s, green alliances, collaborative partnerships between environmental NGOs and businesses that pursue mutually beneficial ecological goals, became popular phenomena, both in practice and in American academic literature (Stafford et al., 2000).

It is important to know whether or not these alliances successfully contribute to the existing legislative authorities for policy making and regulation. Arts (2002, 28) found two potential answers to this question:

- An optimistic view is that they function well to provide solutions to problematic issues, like emissions control, or enhancing recycling by establishing more flexible and cost-effective green alliances with businesses.
- A pessimistic view would consider them temporary solutions rather than sustainable long-term operations.

Green alliances are strategic tools for the environment, society and business. Mendleson and Polonsky (1995, 9) described the benefits for businesses of green alliances between NGOs and companies, and claim that they:

- Increase consumer belief in green products and their claims,
- Provide businesses with access to environmental information,
- Give marketers access to new markets,
- Provide positive publicity and reduce public criticism, and
- Educate consumers about key environmental issues relating to businesses and their products (Coddington, 1993; Mendleson, 1994).

Since the 1970s, when environmental concern emerged as an issue, numerous NGOs have been founded for the purposes of environmental protection and improvement. Figure 4 shows examples that are either well known for their activities or have been at work for a long time, along with their objectives and practices, and foundation date.

Legislative Authorities

Governments want to protect consumers and society from the threat of resource depletion, and according to Polonsky (1994) this occurs in several ways:

1. Curtailing the production of harmful goods and by-products,
2. Modifying consumer and industry use and consumption of harmful goods, and
3. Ensuring that all types of consumers have the ability to evaluate the environmental consequences of the production, consumption and disposal of goods.

Governments impose new laws, regulations and proposals on businesses in response to increasing environmental concern, and may enact even more restrictive controls if businesses fail to modify their behavior (Mathur & Marhur, 2000). Researchers believe that sustainable development can be achieved only

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 4. International environmental organizations
Adapted from http://library.duke.edu/research/subject/guides/ngo_guide/ngo_links/environment.html

NAME OF NGO	SINCE	OBJECTIVES	ACTIVITIES
Greenpeace	1971	ensure the ability of the earth to nurture life in all its diversity	campaigns, regional/global projects, activating publics against harmful operations
UNEP (United Nations Environment Programme)	1972	to assess in environmental issues at the global and regional level	global reports, regional/global projects, supporting new technologies
Center for International Climate and Environmental Research	1990	to conduct research and provide reports, information and expert advice about issues related to global climate change and international climate policy	research, reports on environment, regional/global projects
European Environment Agency (EEA)	1994	to establish a network for the monitoring of the European environment.	European Topic Centre on Air and Climate Change ;Renewable energy
Center for Environmental Research and Conservation	1994	to proliferate a deeper understanding of ecology in order to inform political, social and economic decision making	seminars, research and regional/global projects
Intergovernmental Panel on Climate Change (IPCC)	1998	to assess information; human-induced climate change, the impacts of human-induced climate change and options for adaptation and mitigation.	publishings of special reports on topics relevant to the implementation of environmental laws

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

by proactive corporate marketing and active government intervention. They suggest a two-dimensional shift in the approach to ecological problems: from consumption marketing to sustainable marketing and from the invisible hand to the more visible hand of government (Karna et al., 2003; Sheth & Parvatiyar, 1995). As a consequence, there may be a greater role for government to play in establishing sustainable behavior. Brennan and Binney (2008) advocate a tripartite approach to green marketing practices composed of legislation, education and enforcement.

In short, the role of government is to regulate businesses at the most concrete level. Porter and van der Linde (1995, 128) describe the need for regulations comprehensively;

- To create pressure for green innovations and to increase the likelihood that product innovations and process innovations in general will be environmentally friendly.
- To improve environmental quality in cases in which innovation and the resulting improvements in resource productivity do not meet the cost of compliance.
- To alert and inform companies about likely resource inefficiencies and potential areas for technological improvement.
- To establish demand for environmental improvement until companies and consumers are better able to perceive and measure the resource inefficiencies of pollution.

When environmental problems emerged globally, governments were perceived as saviors due their legislative capabilities. Hence government's role as the protector of consumers and society has significant implications for green marketing. According to Polonsky (1994), regulations imposed by legal authorities assist consumers by reducing the production of products that are hazardous to environment, modifying or eliminating consumer use of harmful products and ensuring that all consumers have sufficient information to evaluate products' environmental score cards.

Porter and van der Linde (1995) evaluate the current situation as a transitional phase of industrial history in which companies are still inexperienced in handling environmental problems creatively. Consumers, too, are unaware that resource inefficiency means that they must pay for the cost of pollution. So regulation, as a strategic tool of governments, is essential for shaping the economy. Alternatively, the right to pollute might be turned into a tradable commodity the supply of which governments can control by imposing taxes for excesses (Sinding, 2000; Tietenberg, 1985). However, producers in pollution-intensive industries generally have difficulty passing the costs of compliance on to consumers due to the elasticity of demand (Dean & Brown, 1995).

According to a study by Lau and Srinivasan (1997), the driving force for better environmental performance is largely the fear of penalties that can be imposed by governments when environmental laws are violated. Hence, legislative authorities serve as a threat that ensures compliance to the law by industry.

Government and legal authorities are undoubtedly significant actors in terms of creating and improving green standards and hence green strategies. The typical instruments that are imposed by them are: taxes (emission taxes), fees, subsidies, regulations and standards (Kotler, 2005, 126). As an initial solution, governments can levy taxes to correct externalities or offer subsidies to reduce pollution (Sinding, 2000, 80). The logic of these taxes is to impose some kind of cost for taking advantage of the environment.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Customer Pressure

The role of legislative authorities has a considerable effect on industry, but the results may be limited if environmental concern is not shared by the public. Consumers, as decision makers in the market place, can no longer be separated from environmental issues. The shift in consumer's interest or at least awareness of social and ethical issues can be explained by a few developments in the global economy. The most comprehensive explanation is the rise of environmental problems, such as pollution and mass extinctions and climate change. Negative attitudes towards industrialists portray them as the cause of these problems. In other words, global environmental problems are triggered by globalization, unbalanced power and insensitive practices, and consumers criticize multinational corporations' abuse of nature (Zinkhan & Carlson, 1995). Auger et al. (2003) put forward the interesting opinion that the availability of higher quality products had given consumers the power to evaluate products based on non-traditional attributes such as a product's ethical identity, environmental friendliness or additional benefits.

Mintel (1994) reports a significant willingness among consumers to let their buying patterns be affected by a wide range of ethical issues. These issues include human rights, labor relations, land rights, the environment, irresponsible marketing, fair trade, nuclear power and animal testing. However, Rex and Baumann (2006) criticize the consistency of consumers' attitudes toward ethical purchasing since it varies by the type of product or brand. Ethical consumption is a general term that symbolizes the tendency to consume socially acceptable products. Green generally refers to consumers' who have specifically environmental concerns (Bohlen et al., 2003) that are distinct from a broader range of social concerns. Similarly, Peattie (2001, 132) defined green consumers as those who tend to avoid products that:

- Endanger the health of consumers or others,
- Significantly damage the environment in production, use or disposal,
- Consume disproportionately large amounts of resources,
- Cause unnecessary waste through over-packaging, excess features or unduly short lifespan,
- Use materials derived from endangered species or habitats,
- Involve cruelty to animals,
- Adversely affect other countries.

Cost and Profit Consideration

Green marketing was always seen as a concern for or an approach to the environment that stressed the efficient use of resources, but companies may not always be motivated by the concept of social responsibility and choose to prioritize internal issues such as cost savings or extra profits as motivational factors (Polonsky, 1994).

According to Yurman, innovative approaches can help new industries in two ways:

1. A firm develops a technology for reducing waste and sells it to other firms, or
2. A waste recycling or removal industry develops (Polonsky, 1995; Yurman, 1994).

Polonsky (1994) claims that companies could choose creative solutions, instead of merely reducing waste, for instance when businesses try to find markets or uses for their waste materials, and one

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

business's waste becomes another's manufacturing input. On the other hand, managers have recognized that it is necessary to better understand the drivers of both costs and profits and the actions that they can take to affect them. Popular management frameworks such as balanced scorecard and value-based management rely on a better understanding of the drivers of value to aid managers in making decisions to improve corporate value creation (Epstein & Roy, 2001; Kaplan & Norton, 2000).

Recent work by Epstein and Westbrook has developed the action-profit linkage model that investigated the causal relationships and linkages within organizations and the levers that managers can pull to improve both customer and corporate profitability and improve corporate performance (Epstein & Westbrook, 2001). All of these models depend on a careful identification and measurement of the drivers of performance. However, the identification and measurement of social and environmental strategies is particularly difficult since they are usually linked to long time horizons, a high level of uncertainty and impacts that are often difficult to quantify (Epstein & Roy, 2001).

Corporate Environmental Responsibility: Social Pressure

Environmental regulations and policies mitigate many problems related to natural resources; however, Shrivastava (1995, 937) drew attention to the necessity of voluntary efforts to address industrially induced ecological problems. Companies must realize that they are part of the wider community and behave in an environmentally responsible way. They set themselves environmental objectives as well as corporate and profit objectives. In some cases, concern for environmental issues has been integrated into company's organizational cultures. Companies who manufacture products can make a further contribution to environmental improvements by encouraging their suppliers to be more environmentally responsible. Growing concern for the environment has changed the perspective of the stakeholders. Managers are increasingly asking how to improve sustainability performance, and, more specifically, how they can identify, manage and measure the drivers of improved sustainability performance and how social performance affects overall long-term corporate goals (Epstein & Roy, 2001, 586).

Corporate responsibility is often divided into economic, social, and environmental categories like the categories proposed for the popular concept of sustainable development (Karna et al., 2003; Peattie, 1995). Nevertheless, there is no single accepted definition of corporate social responsibility. It is related to business decision making linked to ethical values, compliance with law, and respect for people, communities and the environment (Karna et al., 2003). The environmental dimension is the core issue of green marketing and over time, companies are becoming committed to being socially responsible in the environmental dimension, too. Today we can find social responsibility reports on the websites of corporations (Ginsberg & Bloom, 2004). In other words, businesses have realized that they must be prepared to provide their customers with information about the environmental impact of their products and operations (Ottman & Terry, 1998).

The literature on corporate social performance, responsibility and responsiveness also shows that businesses have social responsibilities that may or may not reinforce the profit objective (Prakash, 2002; Wood & Jones, 1995). Business green their products and policies because they wish to be socially responsible—"it's the right thing to do." This may or may not generate quantifiable profits in the short run. However, in the long run, socially responsible policies have economic payoffs (Hart & Ahuja, 1997).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Competitive Pressure

Global competition and continuous improvements have eliminated the differences between products and brands so that majority of the offerings can be accepted as identical. (Christensen, 1995). Competitors serve as important market actors that stimulate companies to establish or maintain a competitive position. In many cases, businesses compete with companies that promote environmental behavior. For example Xerox's launch of "Revive 100% Recycled Paper" was intended to address the introduction of recycled photocopier paper by other manufacturers (Polonsky, 1994). Likewise, Esty and Winston (2006) claim that even if no industry organization is driving change, one company's leadership and brave action can change the competitive market in a variety of ways. For example, in 1990, Heinz launched a project intended to stop dolphin deaths, which stimulated other actors to engage in similar activities.

With consumers, business customers and governments demonstrating increasing concern about environmental issues, companies recognize the importance—and potential benefits—of dealing with these concerns. Companies that market goods with environmentally responsible characteristics are likely to have a competitive advantage over companies without green credentials. In the 1990s, the view that green strategies can give a competitive advantage was promulgated by authors such as Elkington (1994), Azzone and Bertele (1994) and Porter and van der Linde (1995) (Peattie, 2008). Porter and van der Linde perceived that search for environmentally superior solutions may lead to innovation and the creation of more efficient and effective technologies. Even though environmental legislation creates new challenges for companies, which stimulated them to innovate and achieve improvements in competitive, as well as environmental, performance. This is what Varadarajan (1992) termed "enviropreneurial marketing" (Peattie, 2008). In enviropreneurial marketing challenges in the environment, such as resource depletion or pollution, are seen as an opportunity instead of a threat, and according to this philosophy, negative external factors drive companies to explore and innovate in ways that give them a competitive advantage and also benefit consumers and the environment.

Polonsky (1994) argued that companies can use two green marketing strategies, can take two perspectives:

1. They can use the fact that they are environmentally responsible as a marketing tool, or
2. They can become responsible without promoting this fact.

There are examples of businesses that use both strategies. Coca-Cola exemplifies the second strategy by investing large sums of money in various recycling activities and modifying their packaging to minimize its environmental impact. While being concerned about the environment, Coca-Cola has not used this concern as a marketing tool. Many consumers may not realize that Coca-Cola is a very environmentally committed organization. Another business that is very environmentally responsible, but does not promote this fact, at least outside the organization, is Walt Disney World, which has an extensive waste management program and infrastructure in place. Yet these facilities are not highlighted in their general tourist promotional activities (Polonsky & Rosenberger, 2001; Murphy, 1985). As an example of the first strategy, Body Shop heavily promotes the fact that they are environmentally responsible, and the company offers consumers environmentally responsible alternatives to conventional cosmetic products. This philosophy is directly tied to its overall corporate culture, rather than simply being a competitive tool. However, this leads to the threat of greenwashing.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Greenpeace coined the term, greenwashing in 1991 to "describe corporate deceptions, exaggerations and cosmetic changes undertaken purely as public relations ploys" (Muldoon, 2006). The public is worried about green washing, which was practiced in the 1980s and early 1990s, so new standards and certifications had been put in place to facilitate the recognition of green products by consumers (Ginsberg & Bloom, 2004). Greenwashing is a deceptive use of green PR or green marketing. The term, green sheen, has similarly been used to describe organizations that attempt to show that they are adopting practices beneficial to the environment. For example, Procter & Gamble and Wal-Mart were severely criticized for putting a green label on a brand of paper towels made of non-recycled paper and packaged in plastic, simply because the inner tube for the towel was made of recycled paper (Laroche et al., 2001).

CONCLUSION

Industrialization stimulated increased the well-being of societies and improved conditions in the eighteenth century, leading countries to exploit resources for production and consumption without considering the potential social outcomes. Since the 1950s, industrialization had resulted in exponential increases in the human consumption of resources and health, wealth and population. That is to say, the post-war baby-boom led to an excessive need for energy resources, goods and services in many societies. The scarcity of resources under the pressure of rapid consumption became obvious. The research and development focused-progress of countries and societies engendered the inevitable dilemma of benefiting from the environment or exploiting it.

However, benefiting from nature was seen as a one-way approach, and humanity ignored the issue of renewing resources that were being consumed. The primary principle of economics, resource scarcity, was neglected until nature called for aid. According to Bahro (1996), ecological problems signify the dead end of capitalism. Thus, consumption without attempts to renew natural resources is unfortunately threatening the well-being of future generations. In a reactive manner, societies tried to identify environmental problems and offer solutions to maintain the ongoing relationship between humanity and nature.

In the 1990s, academics and researchers started to seriously discuss the implications of neglecting the sustainability of the entire system (Peattie, 2001; Van Dam and Apeldoorn, 1996). However, rather than criticizing the issue from limited viewpoints, in a broader sense the term, sustainability, binds consumers, NGO's and enterprises, since the solution is to engender a synergistic power that involves all these parties. Synergistic power means that, consumers, corporations, institutions and governments work together to minimize detrimental effects on the environment, and to foster the sustainability of common resources (air, water supplies and land), raw materials and product availability. Since then, consumers question the consequences of their purchasing patterns, in other words, the potential harms caused by their decisions, whereas companies have reorganized their business structures and operations to satisfy changing consumer demands.

During the last thirty years, this concern has intensified, our understanding of the interaction between the economy and the environment has developed, and our ideas about what might constitute green marketing have evolved. The business world has been dramatically changed, altered by business enterprises, consumers and environmental organizations, which interrogated public actions that affect the environment (Edward & Wilmot, 2008). Thus, niche areas emerged: environment ally friendly products (products that can be reused, refilled or recycled), tighter emissions controls and energy efficient operations that emphasize the integrating role of the environment in all production or trade processes (Kotler, 1999, 58).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Previous studies worldwide have either focused on the consumer's world—attitudes, values, purchasing habits —or on enterprises reorganizing themselves with greening strategies intended to minimize environmental pollution, the manufacture and use of energy efficient products and investments in the well-being of nature and society. This ends up with the problem of creating a common and well known definition of green business (Peattie, 2008, 563). What is considered green by one organization may not be by others. Furthermore, the definition of green business is undermined by the proliferation of green labeling and standards, which lead consumers to consider green labels simply a marketing tool with little substance behind them.

Acknowledging the crucial role enterprises have in the economic system, a comprehensive look at green marketing for business in terms of alternative strategies and motivations for green practices is sorely needed. Visualizing their motivations and questioning the actors involved in their green marketing efforts would help to define the notion of sustainability from an organizational perspective and contribute to uniting the stakeholders' efforts in green marketing and sustainability. This is the perspective that led this chapter to conceptualize the influences on modern companies' adoption of green strategies as six separate entities:

1. NGOs,
2. Legislative authorities,
3. Consumers,
4. Cost-profit considerations,
5. Corporate environmental responsibility and
6. Competition.

For business, green alliances can reveal new business opportunities, improve (environmental) performance and enhance reputations, while NGOs may achieve more environmental gains by cooperating with businesses rather than governments (Glasbergen & Groenenberg, 2001). In fact, both parties are disappointed in governmental policy making. For NGOs, governments are generally not effective enough in combating environmental problems. Governments are, according to NGOs, too involved in slow, bureaucratic, (inter-)national negotiation processes, which leads to the postponement of measures, vague compromises and a lack of implementation. Another motivating factor is the fact that legislations and regulations already exist for companies. Governments—as the sole law-making authorities—may assist consumers in some areas, by reducing the production of products that are hazardous to the environment, curtailing the use of harmful products and ensuring that all consumers have sufficient information to evaluate products' environmental score cards (Polonsky,1994). In addition, governments can also insist that suppliers address environmental issues. Thus, in many industries, technologies and production systems have been improved to create less pollution and conserve resources (Peattie, 2001).

Consumers' heightened attention to environmental issues is a challenge to businesses. Auger et al. (2003) hold the interesting opinion that the availability of higher quality products has given consumers ultimate power to evaluate products based on non-traditional attributes such as products' ethical identities, environmental friendliness or additional benefits. This means that, companies' strategies need to take these ethical consumers into consideration.

On the other hand, as another motivation as chance for cost reduction, Epstein and Roy (2001) claim that green marketing practices may lead to cost reductions in terms of less packaging, material substitu-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

tions, low energy consumption during production and reduced water disposal. The positive social effect of these activities is also a favorable outcome for companies.

Last but not the least, cooperation with competitors, purchasers or environmental groups has been identified as a potentially important means of developing and accessing green marketing resources and competences not otherwise readily available to individual businesses (Crane, 2000). Competitive pressure or cooperation can be another trigger for engaging in green marketing strategies.

In conclusion, sustainable green marketing establishes the environmental pillar of the concept of sustainability. A sustainable approach to consumption and production involves enjoying the environment as well as granting the same standard to future generations (Peattie, 2008). Belz (2006) regard the current paradigm shift as an evolution of marketing towards "transformational sustainability marketing" in which social, physical and environmental problems are as important as customer needs in marketing theory. The basic difference in this approach is the urgent need to integrate social and environmental issues into marketing strategies. Similarly, Hart (1995) mentioned the threat of understanding sustainability merely as pollution control. He claimed that even if companies were to achieve zero emissions by the year 2000, the world would remain stressed by carrying capacity and the potential destruction of farmlands, fisheries and forests. Thus, sustainability acquired a global perspective and began to promote the synergistic effect that companies, governments and environmental groups could produce even if some stakeholders were more concerned about sustaining the economy, while others were more concerned about sustaining the natural environment. This provided new opportunities for partnerships and collaborations.

REFERENCES

Apel, K. O. (1980). *Toward a Transformation of Philosophy*. Boston: Routledge.

Arts, B. (2002). Green Alliances of Business and NGOs. New Styles of Self-Regulation or 'Dead-End Roads? Corporate Social Responsibility and Environmental Management Corp. *Soc. Responsib. Environ. Mgmt.*, *9*, 26–36. doi:10.1002/csr.3

Auger, P., Burke, P., Devinney, T. M., & Louviere, J. J. (2003). What will Consumers Pay for Social Product Features? *Journal of Business Ethics*, *43*(3), 281–304. doi:10.1023/A:1022212816261

Azzone, G., & Bettele, U. (1994). Exploiting Green Strategies for Competitive Advantage. *Journal of Management*, *17*(1), 99–120.

Azzone, G., & Manzini, A. (1994). Measuring Strategic Environmental Performance. *Business Strategy and the Environment*, *3*(1), 1–4. doi:10.1002/bse.3280030101

Bahro, R. (1996). *Nasıl Sosyalizm? Hangi Yeşil? Niçin Tinsellik? 2. Basım (Çeviri Bora, T.)*. İstanbul: Ayrıntı Yayınları.

Banerjee, S. B. (1999). *Corporate Environmentalism and the Greening of Strategic Marketing: Implications for Marketing Theory and Practice. In Greener Marketing: A Global perspective on greening marketing practice* (pp. 16–41). Sheffield, UK: Greanleaf Publishing Limited.

Belz, F. M. (2006). Marketing in the 21st Century. *Business Strategy and the Environment*, *15*(2), 139–144. doi:10.1002/bse.529

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Bendell, J., & Murphy, D. (2000). Planting the Seeds of Change: Business–NGO Relations on Tropical Deforestation. In J. Bendell (Ed.), *Terms of Endearment. Business, NGOs and Sustainable Development* (pp. 65–78). Sheffield, UK: Greenleaf. doi:10.9774/GLEAF.978-1-907643-14-9_6

Bohlen, G., Diamantopolous, A., & Schlegelmilch, B. (1993). Consumer Perceptions of the Environmental Impact of an Industrial Service. *Marketing Intelligence & Planning*, *11*(1), 37–48. doi:10.1108/02634509310024155

Brennan, L., & Binney, W. (2008). Is it Green Marketing, Greenwash or Hogwash? We Need to Know if We Want to Change Things. *Partnerships, Proof and Practice - International Nonprofit and Social Marketing Conference - Proceedings. 18*.

Chamorro, A., & Banegil, T. M. (2006). Green Marketing Philosophy: A Study of Spanish Fims with Ecolabels. *Corporate Social Responsibility and Environmental Management*, *12*(1), 11–24. doi:10.1002/csr.83

Chamorro, A., Rubio, S., & Francisco, J. M. (2007). *Characteristics of Research On Green Marketing*. Business Strategy and the Environment Bus. Strat. Env.

Chase, D. (1991). P&G Gets Top Marks in AA Survey. *Advertising Age*, 8–10.

Christensen, P. D. (1995). The Environment: It's not Time to Relax. *The McKinsey Quarterly*, *4*, 146–154.

Coddington, W. (1993). *Environmental Marketing: Positive Strategies for Reaching the Green Consumer*. New York: McGraw-Hill.

Cope, D. and Winward J. (1991). Information Failures in Green Consumerism. *Consumer Policy Review, 1*(2), 83.

Crane, A. (2000). Corporate Greening as Amoralization. *Organization Studies*, *21*(4), 673–696. doi:10.1177/0170840600214001

Dean, T., & Brown, R. (1995). Pollution Regulation as a Barrier to New Firm Entry: Initial Evidence and Implications for Future Research. Academy of Management Journal, 38(1), 258-303.

Edward, P., & Willmott, H. (2008). Corporate Citizenship: Rise or Demise of a Myth? *Academy of Management Review*, *33*(3), 771–775. doi:10.5465/AMR.2008.32465773

Edwards, M., & Hulme, D. (1996). *Beyond the Magic Bullet: NGO Performance and Accountability in the Post-Cold War World*. Hartford, CT: Kumarian.

Elkington, J. (1994). Toward the Sustainable Corporation: Win-Win-Win Business Strategies for Sustainable Development. *California Management Review*, *36*(2), 91–100. doi:10.2307/41165746

Epstein, M. J., & Roy, M. J. (2001). Sustainability in Action: Identifying and Measuring the Key Performance Drivers. *Long Range Planning*, *34*(5), 585–604. doi:10.1016/S0024-6301(01)00084-X

Epstein, M. J. and Westbrook, R. A. (2001). Linking Actions to Profits in Strategic Decision Making. *MIT Sloan Management Review*, 39-49.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Esty, D. A., & Winston, A. (2006). *Green to Gold: How Smart Companies Use Environmental Strategies to Innovate, Create Value, and Build Competitive Advantage*. Yale University Press.

Fisk, G. (1998). Green Marketing: Multiplier for Appropriate Technology Transfer? *Journal of Marketing Management.*, *14*(6), 657–676. doi:10.1362/026725798784867725

Fuller, D. A. (1999). *Sustainable Marketing: Managerial-Ecological Issues*. London: Sage Publications.

Ghoshal, S. (2005). Bad Management Theories are Destroying Good Management Practices. *Academy of Management: Learning & Education Journal.*, *4*(1), 75–91.

Ginsberg, J.M., & Bloom, P. (2004). Choosing the Right Green Marketing Strategy. *MIT Sloan Management Review*, 79-84.

Glasbergen, P., & Groenenberg, R. (2001). Environmental Partnership in Sustainable Energy. *European Environment*, *11*(1), 1–13. doi:10.1002/eet.246

Hart, S. L., & Ahuja, G. (1997). Does it Pay to be Green? *Business Strategy and the Environment*, *5*, 31–37.

Henion, K. E. (1976). *Ecolgical Marketing*. Columbus, OH: Ohio Grid Inc.

Jay, L. (1990). Green about the Tills: Markets Discover the Eco-Consumer. *Management Review*, *79*, 24–29.

Kangun, N., Carlson, L., & Grove, S. J. (1991). Environmental Advertising Claims: A Preliminary Investigation. *Journal of Public Policy & Marketing*, *10*, 47–58.

Kaplan, R. S., & Norton, D. P. (2000). Having Trouble with your Strategy? Then Map It. *Harvard Business Review*, 167–176. PMID:11143152

Karna, J., Hansen, E., & Juslin, H. (2003). Social Responsibility in Environmental Marketing Planning. *European Journal of Marketing*, *37*(5/6), 848–873. doi:10.1108/03090560310465170

Kilbourne, W. E. (1998). Green Marketing: A Theoretical Perspective. *Journal of Marketing Management.*, *14*(6), 641–655. doi:10.1362/026725798784867743

Kirkpatrick, D. (1990). Environmentalism: The New Crusade. *Fortune.*, *121*(12), 44–51.

Kotler, P. (1999). *Marketing Management* (10th ed.). Millennium Edition.

Kotler, P., Saunders, J., & Armstrong, G. (2005). *Principles of marketing* (4th ed.). Harlow, UK: Financial Times Prentice Hall.

Kotler, P., & Zaltman, G. (1971). Social Marketing: An approach to Planned Social Change. *Journal of Marketing*, *35*(3), 3–12. doi:10.2307/1249783 PMID:12276120

Lantos, G. P. (2001). The Boundaries of Strategic Corporate Responsibility. Journal of Consumer Marketing. *Journal of Consumer Marketing*, *18*(6), 503–520. doi:10.1108/EUM0000000006155

Lau, R., & Srinivasan, R. (1997). Strategic Issues of Environmental Management. *South Dakota Business Review.*, *56*(2), 1–4.

MacKenzie, D. (1991). The Rise of the Green Consumer. *Consumer Policy Review, 1*(2), 69.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Mathur, L. K., & Marhur, I. (2000). An Analysis of the Wealth Effects of Green Marketing Strategies. *Journal of Business Research*, *50*(2), 193–200. doi:10.1016/S0148-2963(99)00032-6

McDonagh, P., & Prothero, A. (1993). Environmental Marketing: Some Practical Guidelines for Managers. *Irish Marketing Review.*, *6*, 120–126.

McDonald, S., & Oates, C. T. (2006). Sustainability: Consumer Perceptions and Marketing Strategies. *Business Strategy and the Environment*, *15*(3), 157–170. doi:10.1002/bse.524

McEachern, M., & McClean, P. (2002). Organic Purchasing Motivations and Attitudes: Are hey Ethical. *International Journal of Consumer Studies*, *26*(2), 85–92. doi:10.1046/j.1470-6431.2002.00199.x

Mendleson, N. (1994). Environmental Marketing Business Partnering at AFC Developing Strategic Alliances. *Environmental Marketing: Critical Success Strategies for Reaching the Green Consumer. Proceedings of the 1994 Conference*.

Mintel, R. (1994). *The Green Consumer* (Vols. 1-2). London: Mintel Research.

Mintu, A. T., & Lozada, H. R. (1993). Green Marketing Education: A Call for Action. *Marketing Education Review*, *3*(3), 17–23. doi:10.1080/10528008.1993.11488420

Morrison, J. L. (2003). Organizational Change for Corporate Sustainability: A Guide for Leaders and Change Agents of the Future. *Journal of Education for Business*, *79*(2), 124–126.

Muldoon, A. (2006). Where the Green Is: Examining the Paradox of Environmentally Conscious Consumption. *Electronic Green Journal, 1*(23). Retrieved from: http:/www.escholarship.org/uc/item/00t326gx

Murphy, K. L. (1985). CoRporate Performance and Managerial Remuneration: An Empirical Analysis. *Journal of Accounting and Economics*, *7*(1-3), 1–3. doi:10.1016/0165-4101(85)90026-6

Ottman, J., & Terry, V. (1998). Strategic Marketing of Greener Products. *Journal of Sustainable Product Design.*, *5*, 53–57.

Ottman, J. A. (1993). *Green Marketing: Challenges and Opportunities for the New Marketing Age*. Lincolnwood, IL: NTC.

Peattie, K. (1990). Trapping versus Substance in the Greening of Marketing Planning. *Journal of Strategic Marketing*, *7*(2), 131–148. doi:10.1080/096525499346486

Peattie, K. (1995). *Environmental Marketing Management: Meeting the Green Challenge*. London: Pitman Publishing.

Peattie, K. (1999). Trappings versus Substance in The Greening of Marketing Planning. *Journal of Strategic Marketing*, *7*(2), 131–148. doi:10.1080/096525499346486

Peattie, K. (2001). Towards Sustainability: The Third Age of Green Marketing. *Marketing Review.*, *2*(2), 129–146. doi:10.1362/1469347012569869

Peattie, K. (2008). Green Marketing. In Marketing Book. Elsevier.

Peattie, K., & Charter, M. (1994). Green Marketing. In P. McDonagh & A. Prothero (Eds.), *Green Management, a Reader*. London: Dryden.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Polonsky, M. J. (1994). An Introduction to Green Marketing. *Electronic Green Journal, 1*(2).

Polonsky, M. J. (1995). A Stakeholder Theory Approach to Designing Environmental Marketing Strategy. *Journal of Business and Industrial Marketing*, *10*(3), 29–46. doi:10.1108/08858629510096201

Polonsky, M. J., Carlson, L., Grove, S., & Kangun, N. (1997). International Environmental Marketing Claims: Real Changes or Simple Posturing? *International Marketing Review*, *14*(4), 218–232.

Polonsky, M. J., & Rosenberger, P. J. III. (2001). Reevaluating Green Marketing: A Strategic Approach. *Business Horizons*, *44*(September–October), 21–30. doi:10.1016/S0007-6813(01)80057-4

Porter, M. E. (1991). America's Green Strategy. *Scientific American*, *264*, 168.

Porter, M. E., & van der Linde, C. (1995). Green and Competitive: Ending the Stalemate. *Harvard Business Review*, *73*(5), 120–133.

Prakash, A. (2002). Green Marketing, Public Policy and Managerial Strategies. *Strategy and Environment.*, *11*(3), 285–297. doi:10.1002/bse.338

Pride, W. M., & Ferrell, O. C. (1993). *Marketing* (8th ed.). Boston, MA: Houghton Mifflin.

Prothero, A. (1998). Green Marketing: The Fad That Wont Slip Slide Away. *Journal of Marketing Management.*, *14*(6), 507–512. doi:10.1362/026725798784867680

Pujari, D., & Wright, G. (1999). Management of Environmental New Product Development. In M. Charter & M. J. Polonsky (Eds.), *Greener Marketing: a Global Perspective on Greening Marketing Practice* (pp. 388–412). Sheffield, UK: Greenleaf. doi:10.9774/GLEAF.978-1-907643-20-0_9

Rex, E., & Baumann, H. (2006). Beyond Ecolables: What Green Marketing Can Learn From Conventional Marketing. *Journal of Cleaner Production*, *15*(6), 567–576. doi:10.1016/j.jclepro.2006.05.013

Shearer, J. W. (1990). Business and the New Environmental Imperatives. *Business Quarterly*, *54*(3), 48–52.

Sheth, J. N., & Parvatiyar, A. (1995). Ecological Imperatives and the Role of Marketing. In M. J. Polonsky & A. T. Mintu-Wimsatt (Eds.), *Environmental Marketing: Strategies, Practice,Theory and Research* (pp. 3–20). New York: Haworth.

Sheth, J. N., & Parvatlyar, A. (1995). Relationship Marketing In Consumer Markets: Antecedents and Consequences. *Journal of the Academy of Marketing Science*, *23*(4), 255–271. doi:10.1177/009207039502300405

Shrivastava, P. (1995). The Role of Corporations in Achieving Ecological Sustainability. *Academy of Management Review*, *20*(4), 936–960.

Sinding, K. (2000). Environmental Management beyond the Boundaries of the Firm: Definitions and Constraints. *Business Strategy and the Environment*, *9*(2), 79–81. doi:10.1002/(SICI)1099-0836(200003/04)9:2<79::AID-BSE235>3.0.CO;2-#

Stafford, E., Polonsky, M., & Hartman, C. (2000). Environmental NGO–Business Collaboration and Strategic Bridging: A Case Analysis of the Greenpeace. *Foron Alliance Business Strategy and the Environment.*, *9*(2), 122–135. doi:10.1002/(SICI)1099-0836(200003/04)9:2<122::AID-BSE232>3.0.CO;2-C

Stanton, W. J., Etzel, M. J., & Walker, B. J. (1994). *Fundamentals of Marketing* (10th ed.). McGraw Hill.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Straughan, R. D., & Roberts, J. A. (1999). Environmental Segmentation Alternatives: A Look at Green Consumer Behavior in the New Millennium. *Journal of Consumer Marketing*, *16*(6), 558–575. doi:10.1108/07363769910297506

Tietenberg, T. H. (1985). *Emmissions Trading: An Exercise in Reforming Pollution Policy*. Washington, DC: Resources for The Future.

Uydacı, M. (2002). *Yeşil Pazarlama: İş Ahlakı ve Çevresellik Açısından Yaklaşımlar*. İstanbul: Türkmen Kitabevi.

Vale, G. (2005). What is Corporate Social Responsibility? The Case of Canada. *Managerial Law*, *47*(5), 20–46. doi:10.1108/03090550510771142

Van Dam, Y. K., & Apeldoorn, P. A. C. (1996). Sustainable Marketing. *Journal of Macromarketing*, *16*(2), 45–56. doi:10.1177/027614679601600204

Van Marrewijk, M., & Were, M. (2003). Multiple Levels of Corporate Sustainability. *Journal of Business Ethics*, *44*(2/3), 107–110. doi:10.1023/A:1023383229086

Varadarajan, P. R. (1992). Marketings Contribution to Strategy: The View Fram a Different Looking Glass. *Journal of the Academy of Marketing Science*, *20*(4), 335–343. doi:10.1007/BF02725210

Vorholz, F. (2009).. . *Global Climate Protection. Deutschland*, *5*, 8–13.

Wood, D. J., & Jones, R. E. (1995). Stakeholder Mismatching: A Theoretical Problem in Empirical Research on Corporate Social Performance. *The International Journal of Organizational Analysis*, *3*(3), 229–267. doi:10.1108/eb028831

Yurman, D. (1994). *Markets for Green Technologies; Working Paper, Current Literature Review and Bibliography.* EcoNet Western Lands Gopher.

Zinkhan, G. M., & Carlson, L. (1995). Green Advertising and the Reluctant Consumer. *Journal of Advertising*, *24*(2), 1–6. doi:10.1080/00913367.1995.10673471

This research was previously published in Green Marketing and Environmental Responsibility in Modern Corporations edited by Thangasamy Esakki, pages 105-135, copyright year 2017 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 40
Educated Young Consumer Purchase Behavior Towards Green Products:
An Empirical Study in India

Gyaneshwar Singh Kushwaha
Maulana Azad National Institute of Technology, India

Nagendra Kumar Sharma
Maulana Azad National Institute of Technology, India

ABSTRACT

Green marketing is one of the emerging fields in India. Educated young consumers are very advantageous segment for green marketing. This paper aims to evaluate the purchase behavior and reactions of educated young consumers towards 'green products' which is an essential element of the green marketing. Various variables have been found on the basis of the literature review. The survey questionnaire was designed with the help of literature and expert's inputs and got 343 actual respondents. An exploratory factor analysis and linear regression analysis has been used to bring the findings of the study. The result of the study shows that EYCs (Educated young consumers) purchase behavior towards green product is positive. Green product awareness, Eco-labels and satisfaction and all these found significantly associated with the purchase behavior or intention, but premium price and consumer (those who are highly concern towards environment) has insignificant relationship with the purchase behavior. The concept of green marketing in India is emerging and the study can be a meaningful guide.

1. INTRODUCTION

India will soon have the largest, youngest workforce ever, nearly half of the population is under 24 years of age while about 64% of Indians are of working age (Tulloch, 2014). Majority of the population in India are young and hence we can say India is a young country. Young consumer those who have attained the age of adult i.e. eighteen years in India, play important role in buying decision process in the family and they individually purchase a good amount of products annually (Ghodeswar). Seven hundred degree

DOI: 10.4018/978-1-5225-7915-1.ch040

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

granting institution and thirty five thousand and five hundred affiliated colleges and about enrolling more than twenty million students. Indian higher education system is very large (Choudaha, 2013). The higher education system is continuously involved in producing young graduates each year. It is also a matter of pride that our youth is educated. But still in our country there are lots of problems related to the social issues such as environment, even there is separate mandate syllabus for environmental education in higher education system (Chhokar, 2010). India ranks on 155 out of 178 countries in the Environmental Performance Index (EPI, 2014). This is very poor in the world. There are so many causes for environmental problems but the industries are the main cause (Lin Ru-Jen et.al.2011). India and China are rapidly developing their economy and in both the countries industrial development is recorded well (Siraj, 2011). In order to reduce the blames most of the industries started adopting green practices in production and marketing of goods and services but are not found sufficient to provide a better safe guard to the environment (Lin & Sheu, 2012). On the other hand, it is also seen that people give more priorities to their comfort and life style rather than environment and hence the essentials of environment are ignored many times (Christensen, 1997). Educated and young consumer (EYC) can change the scenario because they are much more aware about the environment, they can raise the green issues and also change their consumer buying decision in a greener way and it is also one of the fact that they have to live more on this planet in comparison to others (World youth report,2003). Consumption of green products and services by these consumers may give a positive impact on the environment which will lead to the sustainable development (Singh, 2011). Higher consumption pattern among youths can also motivate to the marketer and manufacturer in order to bring new and innovative green products which will not be harmful for the environment. Many studies also find that adoption of green practices will also give positive impact on competitive advantage of the firm, customer satisfaction and creation of public image (Ar. Ilker, 2012). There are various types of green practices such as green marketing which consists of number of activities as development & design of green products, green pricing strategies, green promotions, eco-labeling and Green Supply Chain Management (GSCM) (Polonsky & Rosenberger, 2001). This paper is one of its kinds of exploratory study in Indian context as there is rarely any study found so far in this regard. The primary objective is to analyze the green purchase behavior of EYCs in India. Recently most of the companies have started green marketing approach in various categories like FMCG, Automobile etc. Adoption of green practices by companies may be the demand of today's era which is full of environmental problems, but few of the companies are adopting as defensive strategy just because of government pressure and threat of carbon emission tax. (Chan, 2013). The purpose of this paper is to highlight the young and well educated consumer's responses or reaction towards the eco-logical or green products as this market segment is very large and can be very advantageous to the green marketer and obviously for the environment.

At the end of the introduction part the paper is followed by the literature review which focuses on the green marketing and green product in detail, further it helps in identifying variables of the study. Rest of the body consists of theoretical model and development of hypotheses, research methodology, results and discussion, managerial implications, conclusions and at the end limitations and suggestions for future research.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

2. LITERATURE REVIEW

In recent scenario it has been observed that consumers are more conscious about their purchase decisions, as they are giving preference to green products over non-green products (Lee, et al 2013). The significant cause for behavioral change towards green products is increasing consumer awareness about the environment (Saxena & Khandelwal, 2008). People are aware about the harmful impact of the product, especially young consumers those who are educated enough to understand the consequences of the environment (Straughan & Roberts, 1999). Knowledgeable consumer those who understand environment make greener purchase (Peattie, 2001). A study suggested that knowledge of consumer and his belief about the environment is a strong weapon for market segmentation (Awan & Raza). Consumers those who are young play very important role in buying decision in the family. (Kaur & Singh, 2006). It is also true that majority of the population in India are young, with more than seventy percent population below the age of forty and almost fifty percent below the age of twenty and these consumers are well aware about the brand and quality (Dutta et al, 2008). Young consumers have good spending capacity in any market (Moses, 2000). Therefore, young population is an important market segment (Yu & Zhou, 2009). Younger individuals are sensitive towards environment (Straughan & Roberts, 1999) and young consumers are much more inclined towards adopting environment friendly products (Getzner & Grabner-Krauter, 2004). Consumers who are young and also educated can give more attention towards green product. Studies shows that, income and environmental education both are positively related to the green behavior of the consumer and have very strong impact on green purchase behavior (Kreidler & Joseph, 2009). The consumers with higher ecological conscious consumer behavior have shown higher green purchase behavior (GPI) (Akehurst et al. 2012) Because education and environmental knowledge are associated parallel (Pac & Raposo, 2009). A study also shows that environmental knowledge and level of knowledge are positively correlated (Zimmer, et al, 1994). Some studies found that consumer attitude is not only affected by the education, but there are certain other demographic factors like age and income (Pickett, 2008). Consumption of green product can assure for long term sustainable development and competitive advantage. Companies can create competitive advantage if they use innovativeness which is related to environmental sustainability (Karna et al. 2003). There is a need of change in life style and adoptation of green products in the household consumption pattern for the long term sustainability (Christensen, 1997). Often green products are defined as the products which are safe for the environment or there is no or very less effect of it on the environment and also safe for the health. (Polonsky & Rosenberger, 2001). Many companies are involved in green marketing and focusing on green products and other green practices in the business operations. The consumption of green product is significant as it leads to triple bottom approach i.e. people, planet and profit (Cronin et al, 2011). But environmental performance of the product indicates the high price, as less polluting products are expensive to produce (Mahenc, 2008). But studies say that green products are often priced higher than traditional products but it doesn't mean they cost more specifically when we consider all the associated costs, often green products have higher front cost but lower term costs as they are more durables and save money at times for example traditional bulb and fluorescent lights (Polonsky & Rosenberger, 2001). Findings of the study show that young consumers are willing to pay for premium products and services (Dutta et al, 2008). The environmental consciousness drives consumer behavior towards the green products (Singh, 2011). Consumers who are conscious about the environment are willing to pay high price premium for green products even if the green product is less effective in its performance. (Lee et al 2013). It has also been observed that more

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

cost for green products generally create problem in willingness to pay by the consumers as they want to pay small premium while expecting equal performance of the product (Polonsky & Rosenberger, 2001). Indian consumers are more willing to engage in green practices than Americans, but majority of them are not willing to pay higher for green practices but they expect businesses to take full responsibility for green practices (Dutta et al., 2008). Green buying behavior attitude contains consumer willingness to pay more for green products and his concern for pollution and recycling (Gupta, et al, 2009). The demand for green products may also increase more as it is an innovative product segment and young consumer much more interested in seeking innovative and novelty products in the web market (Khare, et al., 2010). Consumers are interested to buy the product which is environment friendly but its purpose and knowledge must be clear and they must be aware about it (Pickett, 2008). Previous studies also show that many of the consumers do not trust on green product due to misleading information on the product. (Leire & Thidell, 2005). On the other hand, there are various eco-labels which insure that the product is eco-friendly in nature (D'Souza et al., 2006). Eco-labels or environmental labels help consumer in identifying the green product in the market (Rashid, 2009). Eco-labels have emerged as one of the main tools of green marketing and there are various government and non-government organisation for eco-labelling (Rex & Baumann, 2007). Eco-labels are the important ingredient of the green products and it influences the purchase of the green products. Consumer perceived that green products are not able to fulfill their claims, low in quality and are costly also (Ginsberg & Bloom, 2004). In such a scenario companies are facing problem of green washing, where the companies are promising for ecological benefits but are failed in actual performance (Chen, et al., 2013). There is need to focus on elimination of consumer skepticism, so that green product can build their value in the market place (Polonsky & Rosenberger, 2001). Green product is a basic element of the green marketing concept; green product satisfies consumer if it is actually green. Green marketing concept evolves in way back in 1980's in European countries. Many Asian developing countries are now involved in the green marketing such as China, India, Hong Kong, etc. Successful green marketing will lead to the sustainable development. Green marketing can be viewed as adherence to ethical and social responsibility requirements in marketing. (Dheeraj & Vishal, 2012). Young consumers those who are involved in consumption of green products in India are profitable for green marketers as well as also fruitful in achieving long term sustainability goal. (Leire, & Thidell, 2005).

After the depth study of literature we have summarized this in the form of Table 1 which is significant in understanding the important parameters of the study. The table contains the authors who have contributed their studies, parameters and its short description to understand the elements which are relevant to this research paper.

2.1. Theoretical Model and Hypotheses Development

The study reveals various important factors which are essential in understanding the green purchase behavior of EYCs towards the green products. There are various variables has been decided to take in the study which revolves around the educated young consumers (EYCs). These variables are EYCs who are highly concern towards environment, awareness about the green products, eco-labels, premium price which leads to the green purchase behavior of EYCs. Figure 1 shows all these variables in form of a model. This model is tested further in the study.

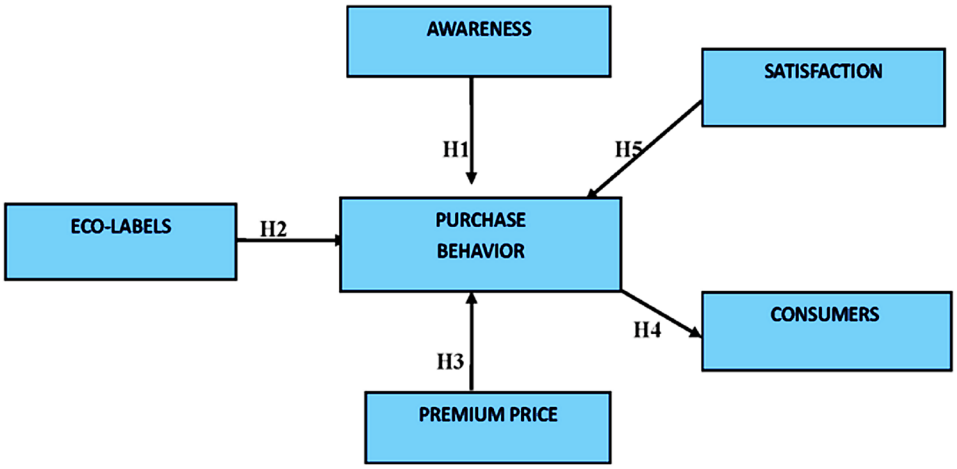
On the basis of the proposed model of the study various hypotheses has been formulated as:

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 1. Relevant parameters and their descriptions

S. No.	Parameters	Authors	Descriptions
1	**Young Indian**	Tulloch,2014; Ghodeswar; Dutta et al,2008	Majority of the population in India is young. They are profitable and major marketing segment.
2	**Young consumers and education**	Ghodeswar; Choudaha, 2013; Chhokar,2010; Straughn & Roberts,1999; Moses,2000; Nittala,2014);Getzner & Grabner-Krauter, 2004; Kreidler & Joseph, 2009;Akehurst et al. 2012; Pac & Raposo, 2009; Zimmer, et al, 1994; Pickett, 2008; Agyeman,2014	Young consumers are conscious in making their purchase decisions education and knowledge play significant role in this process.
3	**Green products**	Lin Ru-Jen et al.2011; Lin&Sheu,2012; Christensen, 1997; Singh,2011; Ar. Ilker,2012; Polonsky & Rosenberger, 2001; Chan,2013; Lee et al.2013; Saxena & Khandelwal,2008; Akehurst et al.2012; Karna et al.,2003; Cronin et al,2011; Khare et al.2010; Pickett,2008	People are becoming more aware about the green products due to harmful effect of non-green product on environment. Consumption of green products saves money and environment.
4	**Eco-labels**	Ar.Ilker, 2012; Polonsky & Rosenberger,2001; Chan,2013; Rashid;2009; Rex & Baumann,2007; Ginsberg & Bloom,2007	Eco-labels are the logo or mark which helps in identifying the green products.
5	**Green purchase behavior/ Intentions**	Chan,2013; Lee et al.2013; Saxena & Khandelwal,2008; Straughan & Roberts,1999; Peattie,2001; Kaur & Singh,2006; Getzner & Grabner-Krauter,2004; Karna et al.2003; Kreidler & Joseph, 2009; Akehurst et al.2012; Pickett,2008; Singh, 2011	Green purchase behavior/intentions are influenced with consumer education, knowledge and environmental awareness. Price also affects the green purchase behavior.
6	**Green Price**	Mahenc,2008; Polonsky & Rosenberger, 2001; Dutta et al.2008; Lee et al,2013; Gupta et al., 2009	Consumers are willing to pay green price or premium price only when the product pays attentions towards green ingredients.

Figure 1. Proposed research model for green purchase behavior



Above model consists of various variables which are associated with the educated and young consumers (EYCs). Such as green product awareness, Eco-labeling used on green product packaging, willingness to pay premium price, consumer, those who are highly concern towards environment and satisfaction through green products.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

H1: EYCs awareness has positive and significant relationship with the green purchase behavior;
H2: There is a positive and significant relationship between eco-labels and purchase behavior;
H3: There is a positive and significant relationship between premium price and purchase behavior;
H4: There is a positive and significant relationship between consumers who are highly concern for environment and purchase behavior;
H5: EYCs, who are satisfied with green products, have positive relationship with the purchase behavior towards green product.

3. RESEARCH METHODOLOGY

In order to test the relationship shown in the proposed model (Figure 1), we have developed a study based on quantitative arrangements. A set of questionnaire has been made and verified with the help of experts in the field of marketing management and consumer behavior. Later the questionnaire was rearranged with the help of valuable comments of these experts, so that meaningful results can be drawn. Total 23 numbers of items were taken in the study which defines each variable as ecological concern, awareness about green product, eco-labels, green product satisfaction, green purchase behavior, premium price and last 5 items taken for descriptive study. The respondents were selected from the various departments of Maulana Azad National Institute of Technology (MANIT), Bhopal, MP, India. The respondents were including undergraduate (UG) i.e. B. Tech students and post graduate (PG) i.e. M.Tech, MBA and MCA students. A questionnaire was designed by keeping in mind about the young consumer and green products. The convenient sampling technique has been used while data collection. The variables used in the questionnaire were measured on a five point Likert type scale (1= stongly disagree; 5= strongly agree). The questions were arranged as assertive sentences even they were negative in nature to fit in the Likert type scale. Total 500 questionnaires were printed on used papers (one sided) to save environment and were distributed and collected from the hostels and classrooms. While collecting questionnaire some of the respondents has been interviewed also regarding green product and environment which was informal in nature but we have discussed it in the paper. Total turned 343 actual respondents which is 68.6% of the total questionnaire distributed. In which male undergraduate (UG) students were 105, male postgraduate

Table 2. Demographic profiles of the respondents

Characteristics	*Number of respondents*	*Percentage (%)*
Gender (total)		
Male	249	72.60
Female	94	27.40
Education		
Undergraduate (UG)		
Male	105	30.61
Female	13	3.79
Postgraduate (PG)		
Male	144	41.98
Female	81	23.61

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

(PG) students 144, female (UG) 13 and female (PG) students were 81 which is 30.61%, 41.98, 3.79% and 23.61% of the total respondents respectively (see Table 2).

All the data were compiled in a systematic order and loaded in the SPSS 22. Simple percentage was used to analysis the demography of the respondent and Cronbach's Alpha reliability test was used to measure the reliability of the data on measured items. To bring the findings of the study exploratory factor analysis and linear regressions analysis has been done.

4. RESULTS AND DISCUSSION

4.1. Reliability and Validity

Total number of questions was 23 in the study to bring the meaningful results. The reliability measure, for 23 item had a validated reliability measure of 0.619 Cronbach's alpha which is more than 0.6 and hence it is satisfactory (Malhotra, 2010, p.279). The KMO (Kaiser-Meyer-Olkin measure of sampling adequacy) is 0.638 and Bartlett's test of sphericity is ($p<0.000$) which is significant at 0.05 level. Both indicated that the variable set was appropriate for factor analysis (Karna et al., 2001).

Table 3. Factors affecting purchase behavior of EYCs

Factor	Factor Labeling	% Variance Explained	Loadings	Variables Included in the Factor
F1	Consumer (Highly concern for environment)	16.951	0.502	You are highly concern towards your environment.
			0.679	When you get an opportunity for doing something for your environment, you do it with full energy.
F2	Green Product awareness	13.935	0.533	The product which emits less carbon can be called green product.
			0.621	A product which saves energy can be called green product.
F3	Eco-labels	11.755	0.688	Eco-labels helps you in identifying green products.
			0.605	You generally check eco-labels on the product packaging while purchasing green products.
			0.653	Eco-labels assure the product is safe for the environment.
F4	Satisfaction	8.996	0.526	The green product purchased by you is fulfilling its claims and is satisfactory.
F5	Purchase intention	6.436	0.567	You prefer to buy green product, because it helps in protecting environment.
			0.661	You buy green products because of its features.
			0.538	You help your family in making purchase decision related to green products.
F6	Premium price	5.991	0.501	Sometimes you do not purchase the green products just because of higher price.
			0.539	You will more prefer to buy eco-product, if it saves money.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

4.2. Factor Analysis

The results of principal component factor analysis using varimax rotation yielded 6 factors that explained 64.064% of the variance. The first three factors environmental concern, green product awareness and eco-labels altogether explain 42.64% of the variance. The fourth factor which is labeled as satisfaction (through green product) explained 8.996% of the variance. Then fifth factor which is labeled as purchase intentions explains 6.436% of the variance and finally the sixth factor explains 5.991% of the variance. Table 3 represents a brief summary of factor analysis.

4.3. Regression Analysis

To test the hypotheses, linear regression was used with the help of SPSS 22. In this method EYCs purchase behavior used as a dependent variables and other variables which affects purchase behavior as green product awareness, eco-labels, premium price, Consumer (highly concern towards environment) and satisfaction used as predictors. Here H1, which is EYCs awareness, has positive and significant relationship with the green purchase behavior. The result shows a significant statistic between the EYCs green product awareness and the purchase behavior, which shows that the green purchase behavior can be positively affected by the green product awareness among EYCs. The summary can be seen in the Table 4 which shows that the H1 is statistically significant and hence it is accepted.

The result of H1 shows that if the green product awareness can be increased among EYCs it will definitely raise the green purchase behavior among them. In the same manner to test the H2 which states

Table 4. EYCs awareness for green products and purchase behavior

Model	B	SE	T	Sig.	Collinearity Diagnostics (VIF)
Constant	2.946	0.121	24.332	0.000	
Awareness	0.145	0.033	2.703	0.007	1

Adjusted R^2 =0.018 for model; F value of ANOVA=7.308; p value of < 0.000

Table 5. Eco-labels on green products and purchase behavior

Model	B	SE	T	Sig.	Collinearity Diagnostics (VIF)
Constant	2.693	0.183	14.704	0.000	
Eco-labels	0.158	0.050	3.159	0.002	1

Adjusted R^2 =0.026 for model; F value of ANOVA=9.981; p value of < 0.000

Table 6. Premium price and purchase behavior

Model	B	SE	T	Sig.	Collinearity Diagnostics (VIF)
Constant	3.063	0.122	25.079	0.000	
Premium price	0.060	0.035	1.697	0.091	1

Adjusted R^2 =0.001 for model; F value of ANOVA=0.861; p value of > 0.000

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

that, there is a positive and significant relationship between eco-labels and purchase behavior, here we again applied the same method and purchase behavior remain the same as dependent variables and eco-labels as predictors and used linear regression method and found a significant relationship between these two and hence the H2 is also accepted. Table 5 shows the summary of results of regression analysis.

In the same way we further tested H3 which states that there is a positive and significant relationship between premium price and purchase behavior. The result of the linear regression shows the relationship between these two not reliable significant as the p value > 0.05. Table 6 shows the regression summary. The interpretation of this result is that, EYCs does not want to pay

Premium price for the green product or we can say that they are not that much interested in green product to pay more price. It simply means that the premium price discourages EYCs to purchase green product and also influences their green purchase behavior. Hence H3 is not accepted, whereas H4 which states that, there is a positive and significant relationship between consumers who are highly concern for environment and purchase behavior also not accepted. As the p value is > 0.05 and hence we can say that the H4 is not accepted in this case. The summary can be seen in Table 7 It supports previous studies that people who are merely concern towards the environment does not mean that they are also interested or highly inclined towards the purchase of green products (Straughan & Roberts, 1999; Nittala,2014). Whereas the results also contradict with some of the studies (Schuhwerk & Lefkokk-Hagius,1995; Vlosky et al,1999 ; Rios et al,2006;Akehurst et al,2012).

Table 7. Consumer those who are highly concern for environment and purchase behavior

Model	B	SE	T	Sig.	Collinearity Diagnostics (VIF)
Constant	3.093	0.188	16.468	0.000	
Highly concern consumer	0.043	0.046	0.928	0.354	1

Adjusted R^2 =0.005 for model; F value of ANOVA=2.881; p value of > 0.000

Table 8. Satisfaction and purchase behavior

Model	B	SE	T	Sig.	Collinearity Diagnostics (VIF)
Constant	3.132	0.155	27.239	0.000	
Satisfaction	0.039	0.032	1.199	0.003	1

Adjusted R^2 =0.002 for model; F value of ANOVA=1.437; p value of < 0.000

Table 9. Showing the results of all hypotheses

S. No.	Hypotheses	Results
1.	H1-EYCs awareness has positive and significant relationship with the green purchase behavior.	Accepted
2.	H2-There is a positive and significant relationship between eco-labels and purchase behavior.	Accepted
3.	H3-There is a positive and significant relationship between premium price and purchase behavior.	Not accepted
4.	H4-EYCs, who are highly concern for environment, have positive relationship with the purchase behavior	Not accepted
5	H5-EYCs, who are satisfied with green products, have positive relationship with the purchase behavior towards green product.	Accepted

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

There may be several reasons for this difference such as demographical differences among these studies. Like, here in this study we are focusing on EYCs in India.

In the succession of the testing of the next hypothesis which is H5 stating that EYCs, who are satisfied with green products, have positive relationship with the purchase behavior towards green product is accepted. EYCs who are satisfied with the green product performance are more inclined towards purchase of green product. Table 8 summaries the regression results for H5.

In all the results we can see that there is no collinearity found as the value of variance inflation factor (VIF) is less than 5 (Malhotra, 2010). Table 9 shows a glimpse of the results of the hypotheses.

4.4. Descriptive Analysis

The results of the descriptive analysis are on the basis of taking simple mean of the responses. When they (EYCs) have been asked that "you always try to avoid those activities which can harm our environment, majority of the respondent (69%) chose that they are agree that they avoid those activities such as excessive use of water or avoiding products which can cause problem to the environment. Many of the respondents are agree that they get the information about green product from advertisement. Somewhat these consumers are agreeing that the green product is better but still they are not strongly agreed on this issue. In a response to the question that, do they consider environment more than price and quality of the product, they gave moderate reply which can be interpreted that they consider price and quality more than environment. EYCs are also not interested to pay premium price for the green product though they are highly concern for environment. Reason behind these phenomena may be that they are mostly in their study phase and are unemployed so there is a lack of economic viability and they cannot pay more (see Table 10).

Generally they buy consumer durable products but it is very often, as there is nothing fixed buying pattern or criteria for it. According to EYCs opinion on automobile, it is the most harmful for the environment. EYCs are convinced that if people will start consuming green product it will definitely give a positive impact on the environment. It is a very good sign that our educated youth trust in green product and environment. Most of them are agree that transportation used in product delivery process is also one

Table 10. Descriptive statistics

Variable	Mean
You always try to avoid those activities which can harm our environment.	3.82
From advertisements you get the information about the green product.	3.56
Green products are better than non-green products in terms of performance.	3.33
When you go for purchase you mainly concern for environment over the price and quality.	3.12
You can pay extra for a green product even if the non-green product performance is better than it.	3.32
Generally, you buy consumer durables which saves energy.	2.94
Automobiles are considered most harmful for the environment.	3.88
When people will start consuming eco-products, it will definitely give a positive impact on our natural environment.	4.13
Transportation activities involve in product delivery is also one of the main sources of environmental degradation.	3.68
Company should adopt take back policy of used/waste/scrap products for recycling it, to save environment.	4.18

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

of the major sources of environmental problem in form of air and noise pollution. EYCs are very much support that there should be buy back or take back of used /waste/scrap policy which will enhance and encourage recycling and a safeguard can be provided to the environment.

4.5. Informal Interview Analysis

In order to understand more about the reaction of EYCs towards green product we have interviewed many respondents informally, like without showing them that we are asking something very formal. We asked questions before and after they fill their questionnaire. We asked them what you know about green product. Many of them are really not aware about terminology "green product" but they are smart enough to make the guesses as "the product which does not harm the environment." They told us that EYCs are day by day getting aware about the green product. We also try to buy it provided the price should not be very high. Majority of them told us that people buy consumer electronic product which is eco-labeled as 'Star ratings' (shows energy efficiency) because it saves electricity bills. Many of them are aware about the eco-labels but do not know about the technical description of it and they are also not sure about the authenticity of eco-labels. EYCs opinion about the green product is that the company should focus the green features of the product, highlighting eco-labels, give emphasis on advertisement, lowering price than ordinary product and Government should also make some more strict norms to be followed by the marketers.

5. MANAGERIAL IMPLICATIONS

The research indicates that EYCs are aware and supporting green or ecological products but when it comes to purchase of these products they are not highly motivated towards the green pricing so they take less interest in purchasing of such product. In recent scenario it can be seen that companies are taking much interest in greening business so that objective of sustainability and long term profitability can be maintained but the results which are shown here in the study is critical and the management have to work a lot in all the dimensions specially in the price reduction of green products, so that these consumers can participate in marketing process. There are few companies who are charging premium price for green products but here in case of EYCs in India, this practice is not advisable for the marketers. The study also motivates the investors or managers those who want to invest in the green market as the demand of the green product is favorable among these EYCs and on the other hand it will also give an opportunity to the organization in greening their operations which can be helpful in creating competitive advantage to the firm. Targeting EYCs would be profitable as it is a creamy marketing segment in India.

6. CONCLUSION

In order to make better policies and plan for the green marketing, concept it is very important to focus closely in each segment of the market especially EYS's, as we have already discussed that this segment is important. The analysis of the study shows that there is increasing consumer awareness towards the green market, which is a very good indicator for the success for the green market. There is a positive relationship found between green product awareness and green brand preference (Mourad & Ahmed,

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

2012). But due to various challenges or obstacles, such as premium price or green price, substitution of raw material and extra greening cost to the company etc. creates problem to the manufacturers and marketers. EYS's are very much aware about the green products and eco-labels which give a positive impact on purchase behavior. But it is also seen in the study those consumers who are highly concern for environment they are not willing to pay premium price. There may be several reasons such as they are student and their purchasing power does not allow for paying more for a green product or the marketer of the green products have not yet made a better promotional program for this segment. On the other hand, their green product satisfaction gives a significant impact on the purchase behavior. There are conservation donors those who want to save the environment are willing to pay the price premium over direct payment. (Ferraro, et al., 2005). There are environmental conscious people those who can give up to forty percent extra for the green product. (Laroche, et al., 2001). But all it depends upon the income level, consumption behavior pattern and lifestyle etc.

There is a very vast gap in the field of promotion of green products, which can be observed in Indian market scenario. Marketer must try to develop various sales promotions and premiums especially for the young consumers, but as the concept is getting old and may not be very workable in case of young consumers. Therefore, marketers must try to do it in more innovative and attractive style for these consumers in order to build purchase behavior towards green products. (Te'ni-Harari, 2009). There may be some educational programs for the consumers which can help them understanding about the importance of green products. Marketer's role is not just to throw the product in the market, but there is responsiveness towards better sales of that product, which is only possible, when they position the product in the green market. There are claims that marketing offers important ways of changing consumer behavior and influencing attitudes and beliefs. (Jones et al., 2008). The concept of green marketing is not only limited to the business only but it has the greater responsibility such as developing environmental sustainability. To achieve the ecosystem conservation objectives in low-income nations, international organizations and domestic governments have invested heavily in promotion of green product. (Ferraro, et al., 2005). In UK many of the prominent retailers are continuously involved in designing the product to reduce the water, energy and waste and they are also trying to reduce the price of the green product. (Jones, et al., 2008). These are the good indicators for the development and expansion of the green marketing. Finally, on the basis of this study it can be said merely education and being young is not the sufficient criteria for the purchase behavior towards green products. There may be some more reasons which leave a scope for further study in this area.

7. CONTRIBUTION OF THE STUDY

The study is significant in many ways as it gives an insight into the purchase behavior of young and educated consumers. This market segment is large and expanding day by day. Knowing their consumption pattern and reaction towards green products can be very fruitful for the sustainability and profitability. Few of the research papers are available relevant to this study such as Ghodeswar; Choudaha, 2013; Chhokar, 2010; Straughn & Roberts, 1999; Moses, 2000; Nittala, 2014; Getzner & Grabner-Krauter, 2004; Kreidler & Joseph, 2009; Akehurst et al.2012; Pac & Raposo, 2009;. Zimmer, et al, 1994; Pickett, 2008. The paper finds that there is a positive relationship between the consumer buying behavior and purchase of green products. (Agyeman, 2014). Young and educated consumers those who are in the universities and professionally they are teachers and results shows that the education have a negative

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

impact on the green purchase behavior. (Nittala, 2014). These few papers are based on the exploratory and empirical research work. These research papers are very good which gave base to bring this study. There are few research gaps found while studying these papers such as both the papers have not targeted the young segment who are students, although one paper have done its work in education arena (Nittala, 2014). Previous studies also, have not performed to test the relationship between eco-labels and consumer satisfaction in context to EYCs. This research paper has filled these research gaps with the help of empirical study on young and educated consumers who are willing to take good purchase decisions especially for featured products like green products.

8. LIMITATIONS OF THE STUDY

Like every study have some limitations and obstacles, in the same manner we have also face few challenges such as lack of relevant research studies in context to India, and while going for filling the questionnaire we found less number of students in the campus as final examinations were over and most of the students about to go to their homes. The study has one more limitations that the results of the study cannot be generalize in certain circumstances.

9. FUTURE RESEARCH SCOPE

This research can be extended more by taking few additional variables in the existing research paper such as green advertisement and green product promotions etc. The study can be done on broader parameters.

REFERENCES

Ageyman, C.M. (2014). Consumer's buying behavior towards green products: An exploratory study. *International journal of management research and business strategy*, 3(1), 188-197.

Awan, U., & Raza, M. A. (2012). Green consumer behavior: Empirical study of Swedish consumer behavior. In Recent researches in Economics (pp. 89-104).

Chan, E. S. W. (2013). Managing green marketing: Hong Kong hotel managers' perspective. *International Journal of Hospitality Management*, *34*, 442–461. doi:10.1016/j.ijhm.2012.12.007

Chan, R. Y. K. (2001). Determinants of Chinese consumers' green purchase behavior. *Psychology and Marketing*, *18*(4), 389–413. doi:10.1002/mar.1013

Chen, Y.-S., & Chang, C.-H. (2012). Enhance green purchase behavior, the role of green perceived value, green perceived risk, and green trust. *Management Decision*, *50*(3), 502–520. doi:10.1108/00251741211216250

Chen, Y.-S., Lin, C.-L., & Chang, C.-H. (2013). The influence of green wash on green word-of-mouth (green WOM): The mediation effects of green perceived quality and green satisfaction. *Quality & Quantity*, *48*(5), 2411–2425. doi:10.100711135-013-9898-1

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chhokar, K. B. (2010). Higher education and curriculum innovation for sustainable development in India. *International Journal of Sustainability in Higher Education*, *11*(2), 141–152. doi:10.1108/14676371011031865

Choudaha, R. (2013). Statistics on Indian higher education 2012-2013. Retrieved from http://www.dreducation.com/2013/08/data-statistics-india-student-college.html

Christensen, P. (1997). Different lifestyles and their impact on the environment. *Sustainable Development*, *5*(1), 30–35. doi:10.1002/(SICI)1099-1719(199703)5:1<30::AID-SD59>3.0.CO;2-5

Cronin, J. J. Jr, Smith, J. S., Gleim, M. R., Ramirez, E., & Martinez, J. D. (2011). Green marketing strategies: An examination of stakeholders and the opportunities they present. *Journal of the Academy of Marketing Science*, *39*(1), 158–174. doi:10.100711747-010-0227-0

D'Souza, C. (2004). Ecolabels programmes: A stakeholder (consumer) perspective. *Corporate Communication: An International Journal*, *9*(3), 179–188. doi:10.1108/13563280410551105

Dutta, K., Umashankar, V., Choi, G., & Parsa, H. G. (2008). A Comparative Study of Consumers' Green Practice Orientation in India and the United States: A Study from the Restaurant Industry. *Journal of Foodservice Business Research*, *11*(3), 269–285. doi:10.1080/15378020802316570

Environmental performance index: Environmental performance index of India. (2014). Retrieved from http://epi.yale.edu/epi/country-profile/india

Ferraro, P. J., Uchida, T., & Conrad, J. M. (2005). Price premiums for Eco-friendly Commodities: Are 'Green' Markets the Best Way to protect Endangered Ecosystem? *Environmental and Resource Economics*, *32*(3), 419–438. doi:10.100710640-005-7962-6

Getzner, M., & Grabner-Kräuter, S. (2004). Consumer preferences and marketing strategies for 'green shares' specifics of the Austrian market. *International Journal of Bank Marketing*, *22*(4), 260–278. doi:10.1108/02652320410542545

Ghodeswar, B. M. (2007). Consumer Decision-Making Styles among Indian Students. *Alliance Journal of Business Research*, *3*, 36–48.

Ginsberg, J. M., & Bloom, P. N. (2004). Choosing the right green marketing strategy. *MIT Sloan Management Review*, *46*(1), 79–84.

Granzin, K., & Olson, J. (1991). Characterizing participants in activities protecting the environment: A focus on donating, recycling and conservation behaviors. *Journal of Public Policy & Marketing*, *10*(2), 1–27.

Gupta, S., & Ogden, D. T. (2009). To buy or not to buy? A social dilemma perspective on green buying. *Journal of Consumer Marketing*, *26*(6), 376–391. doi:10.1108/07363760910988201

Ilker, M. (2012). The impact of green product innovation on firm performance and competitive capability: The moderating role of managerial environment concern. *Procedia: Social and Behavioral Sciences*, *62*, 854–864. doi:10.1016/j.sbspro.2012.09.144

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Jones, P., Colin, C.-H., Comfort, D., & Hillier, D. (2008). Marketing and sustainability. *Marketing Intelligence & Planning*, *26*(2), 123–130. doi:10.1108/02634500810860584

Karna, J., Hansen, E., & Juslin, H. (2003). Social responsibility in environmental marketing planning. *European Journal of Marketing*, *37*(5/6), 848–871. doi:10.1108/03090560310465170

Khare, A., Singh, S., & Khare, A. (2010). Innovativeness/Novelty- Seeking Behavior as Determinants of Online Shopping Behavior Among Indian Youth. *Journal of Internet Commerce*, *9*(3/4), 164–185. doi:10.1080/15332861.2010.529054

Kinnear, T., Taylor, J. R., & Ahmed, S. A. (1974). ecologically concerned consumers: Who are they? *Journal of Marketing*, *38*(2), 20–24. doi:10.2307/1250192

Kreidler, N. B., & Joseph, M. S. (2009). how green should you go? Understanding the role of green atmospherics in service environment evaluations. *International Journal of Culture, Tourism and Hospitality Research*, *3*(3), 228–245. doi:10.1108/17506180910995414

Laroche, M., Bergeron, J., & Barbaro-Forleo, G. (2001). Targeting consumers who are willing to pay more for environmentally friendly products. *Journal of Consumer Marketing*, *18*(6), 503–520. doi:10.1108/EUM0000000006155

Lee, E.-J., Kwon, G., Shin, H. J., Yang, S. L., Lee, S., & Suh, M. (2013). The spell of green: An frontal EEG activations identify green consumers? *Journal of Business Ethics*, *122*(3), 511–521. doi:10.100710551-013-1775-2

Leire, C., & Thidell, A. (2005). Product-related environmental information to guide consumer purchases a review and analysis of research on perceptions, understanding and use among Nordic consumers. *Journal of Cleaner Production*, *13*(10), 61–70.

Lin, R.-J., Chen, R.-H., & Nguyen, T.-H. (2011). Green supply chain management performance in automobile manufacturing industry under uncertainty. *Procedia: Social and Behavioral Sciences*, *25*, 233–245. doi:10.1016/j.sbspro.2011.10.544

Lin, R.-J., & Sheu, C. (2012). Why do Firms Adopt/Implement Green Practices? – An institutional Theory Perspective. *Procedia: Social and Behavioral Sciences*, *57*, 553–540. doi:10.1016/j.sbspro.2012.09.1221

Lyer, G. (1999). Business, customers and sustainable living in an interconnected world: A multilateral eco-centric approach. *Journal of Business Ethics*, *20*(4), 273–288. doi:10.1023/A:1006095304996

Macdonald, S., & ... . (2006). Sustainability: Consumer Perceptions and Marketing Strategies. *Business Strategy and the Environment*, *15*(3), 157–170. doi:10.1002/bse.524

Mahenc, P. (2008). Signalling the Environmental Performance of Polluting Products to Green Consumers. *International Journal of Industrial Organization*, *26*(1), 59–68. doi:10.1016/j.ijindorg.2006.10.005

Mainieri, T., Barnett, E. G., Valdero, T. R., Unipan, J. B., & Oskamp, S. (1997). Green buying: The influence of environmental concern on consumer behavior. *The Journal of Social Psychology*, *137*(2), 189–204. doi:10.1080/00224549709595430

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Malhotra, N. K., & Dash, S. (2010). *Marketing Research: An Applied Orientation* (6th ed.). United States: Pearson Education Inc. doi:10.1108/S1548-6435(2010)6

Montoro Rios, F. J., Luque Martínez, T., Fuentes Moreno, F., & Cañadas Soriano, P. (2006). Improving attitudes towards brands with environmental association: An experimental approach. *Journal of Consumer Marketing*, *23*(1), 26–34. doi:10.1108/07363760610641136

Mourad, M., & Ahmed, Y. S. E. (2012). Perception of green brand in an emerging innovative market. *European Journal of Innovation Management*, *15*(4), 514–537. doi:10.1108/14601061211272402

Murphy, P. E. (1978). Environmentally Concerned Consumer. *Proceedings of the 1978 Educator's Conference*, Chicago, USA (pp. 316-320).

Nik Abdul Rashid, N. R. (2009). Awareness of eco-label in Malaysia's green marketing initiative. *International Journal of Business and Management*, *4*(8), 132–141.

Nittala, R. (2014). Green consumer behavior of the educated segment in India. *Journal of international consumer marketing,* 26(2), 138-152.

Pac, O. A., & Raposo, M. (2009). Green segmentation: An application to the Portuguese consumer market. *Marketing Intelligence & Planning*, *27*(3), 364–379. doi:10.1108/02634500910955245

Peattie, K. (2001). Golden Goose or Wild Goose? The Hunt for the Green Consumer. *Business Strategy and the Environment*, *10*(4), 187–199. doi:10.1002/bse.292

Pickett, B. J. (2008). Pro-environmental products: Marketing influence on consumer purchase decision. *Journal of Consumer Marketing*, *25*(5), 281–293. doi:10.1108/07363760810890516

Polonsky, M. J., & Rosenberger, P. J. III. (2001). Reevaluating Green Marketing: A strategic approach. *Business Horizons*, *44*(5), 21–30. doi:10.1016/S0007-6813(01)80057-4

Raskovic, M., & Grahek, P. (2012). Testing the Cultural Universality of Young-Adult Consumer Purchase Decision-Making Styles: Empirical Results from Turkey, Malaysia, Kazakhstan and Egypt. *International Journal of Management Cases*, *14*(1), 87–99. doi:10.5848/APBJ.2012.00011

Rex, E., & Baumann, H. (2007). Beyond ecolabels: What green marketing can learn from conventional marketing. *Journal of Cleaner Production*, *15*(6), 567–576. doi:10.1016/j.jclepro.2006.05.013

Sammer, K., & Wu¨stenhagen, R. (2006). The influence of eco-labeling on consumer behavior – results of a discrete choice analysis for washing machines. *Business Strategy and the Environment*, *15*(3), 185–199. doi:10.1002/bse.522

San, Y.W. and Yazdanifard R. (2014). How consumer decision making process differ from youngster to older consumer generation. *Global journal of commerce and management perspective,* 2, 39-43.

Saxena, R. P., & Khandelwal, P. K. (2008). *Consumer attitudes towards green marketing on exploratory study* (pp. 1–31).

Schuhwerk, M., & Lefkokk-Hagius, R. (1995). Green or non-green Does type of appeal matter when advertising a green product? *Journal of Advertising*, *24*(2), 45–55. doi:10.1080/00913367.1995.10673475

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Siraj, M. (2011). China and India: A comparative analysis of their integration into the global economy. *Real -world economic review,* 57, 60-70.

Straughan, R., & Roberts, J. (1999). Environmental segmentation alternatives: A look at green consumer behavior in the new millennium. *Journal of Consumer Marketing*, *16*(6), 558–575. doi:10.1108/07363769910297506

Te'eni-Harari, T. (2008). Sales Promotion, Premiums, and Young People in the 21st Century. *Journal of Promotion Management*, *14*(1/2), 17–30. doi:10.1080/10496490802508534

Tulloch, J. (2014). Key facts and figures about India's population. *Open Knowledge*. Retrieved from http://knowledge.allianz.com/demography/population/?1656/key-facts-and-figures-about-%20Indias-population

Van Liere, K., & Dunlap, R. (1980). The social bases of environmental concern: A review of hypotheses, explanations and empirical evidence. *Public Opinion Quarterly*, *44*(2), 181–197. doi:10.1086/268583

Vlosky, R. L., Ozanne, L. K., & Fontenot, R. J. (1999). A conceptual model of US consumer willingness to pay for environmental certified wood products. *Journal of Consumer Marketing*, *16*(2), 122–140. doi:10.1108/07363769910260498

World youth report. (2003). In *Youth and the environment* (Ch. 5, pp.131-147).

Yu, J., & Zhou, J. X. (2009). Segmenting Young Chinese Consumers Based on Shopping- Decision Styles: A Regional Comparison. *Journal of International Consumer Marketing*, *22*(1), 59–71. doi:10.1080/08961530902844964

Zimmer, M., Stafford, T. F., & Stafford, M. R. (1994). Green issues: Dimensions of environmental concern. *Journal of Business Research*, *30*(1), 63–74. doi:10.1016/0148-2963(94)90069-8

This research was previously published in the International Journal of Green Computing (IJGC), 6(1); edited by Vicente Gonzalez-Prida, pages 48-63, copyright year 2015 by IGI Publishing (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 41
Tourists Becoming Increasingly Aware of Green Tourism:
Tourist Intention to Choose Green Hotels in Bangalore, India

Nichola A. Ramchurjee
University of Mysore, India

Esther P. Ramchurjee
Independent Researcher, India

ABSTRACT

The continual development of the hospitality industry has led to negative impacts on the environment. However, the development of green hotels could be a solution to this problem. As more tourists are becoming gradually concerned about environmentally friendly products and services, it is crucial for the hotel industry to take an interest and participate in the green initiative. A questionnaire method was used to collect data from 209 participants using the intercept approach in several main tourist sites in Bangalore, India. The analysis showed that tourists staying in hotels in Bangalore give substantial influence on their intention to choose green hotels and thus environmentally friendly services and products. Therefore, it is of primary importance for green hotel operators/managers to continuously educate their guests about the importance of being environmentally friendly and the environmental impacts of their behaviors.

INTRODUCTION

Tourism is considered vital to the world's economy. According to the World Travel and Tourism Council (WTTC, 2016) the direct contribution of travel and tourism to GDP was US$2.23 trillion (3.0% of total GDP) in 2015 and is forecasted to rise by 3.3% in 2016, and to rise by 4.2% pa, from 2016-2026, to USD3.3 bn (3.4% of total GDP) in 2026. In 2015 Travel and Tourism directly supported 107,833,000 jobs (3.6% of total employment). This is expected to rise by 1.9% in 2016 and rise by 2.1% pa to 135,884,000

DOI: 10.4018/978-1-5225-7915-1.ch041

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

jobs (4.0% of total employment) in 2026. Tourism is an activity that has grown by around 25 per cent in the past 10 years. It now accounts for around 10 per cent of the world's economic activity and is one of the main generators of employment. Tourism, being a main source of income and employment in many countries highly depends on environmental resources that include pristine beaches, warm climate, clean air, landscape formation and others (Kasimu, Zaiton, & Hassan, 2012). Within the tourism sector, economic development and environmental protection should not be seen as opposing forces—they should be pursued hand in hand as aspirations that can and should be mutually reinforcing. Policies and actions must aim to strengthen the benefits and reduce the costs of tourism.

Making tourism more sustainable is not just about controlling and managing the negative impacts of the industry. Tourism is in a very special position to benefit local communities, economically and socially, and to raise awareness and support for conservation of the environment. In the last 20 years, the concept of sustainable development has become widely accepted as the way to a better future, even though its roots go back to the 1980s. According to the World Commission on Environmental Development (1987), sustainable development is defined as "meeting the needs of the present without compromising the ability of the future generations to meet their own needs." Sustainable development also leads to the integration of economic, social and environmental dimensions in decision making without sacrificing the needs of future generations. Harmonizing the development of the business with the natural environment is the key, as well as improving human well-being by lessening the damage to the Earth and its organisms.

Among the various industries in tourism, the hotel industry plays a major part. Traditionally, the operational activities of hotels constituted a threat to the environment due to the high consumption of energy, water (Kasim, 2009) and waste generation. Although, the hotel industry may not be the only one that creates substantial environmental pollution and consumes large amounts of global environmental resources, its primary purposes are providing services (such as food, drinks, hot/cold water, linens, towels, lightning, air conditioning, water and swimming pools) and these activities clearly consume huge amounts of energy, water, non-recyclable goods and natural resources, thus directly or indirectly harming the environment (Han, Hsu, and Sheu, 2010).

In general, the daily operations of hotels create substantial amount of pollution. Public concerns for issues affecting the environment have significantly increased over the past decade, thus, pressuring the hotel industry to become more environmentally sustainable. This saw the emergence of the green tourism concept and it is being introduced in urban facilities and lodges. Green tourism, a form of ecotourism, is low-impact tourism with an eye toward protecting the environment and culture of an area (Lee, Honda, Ren, & Lo, 2016). Therefore, hotels are adopting green practices because they are more aware of their environmental impact and carbon footprint.

However, in developing countries this has not been the case as some hotels have not yet adopted the basic green practices and hence they have never enjoyed the benefits of going green. One of the important aspects that should be understood about green practices was that the range of the term "green" is broad and varying based on perspective. Green was defined from an economic point of view by Gupta (2006) who defines "greening" as corporate environmental performance in meeting stockholders' expectations. Shrivastava (2000) views environmental management as a tool to fit into a social and ecological system. Further, Gupta and Sharma (2002) defined green practices as environmentally friendly management principles in which executive levels convert natural resources into better outputs or products. During the last few decades it has become a common phenomenon to focus on the environmental impact of the hotel

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

industry with each hotel striving to achieve environmental sensitivity even though there is no universally agreed upon definition of a green hotel (Harris & Crane, 2002). Academics, governmental agencies and nonprofit environmental organizations have introduced their own definitions of a green facility.

Some scholars defined green hotel as an environmentally sensitive hotel that operates its business in a manner that minimizes degradation of the environment (Iwanowski, 2003). The specific areas of focus are energy efficiency, recycling, water conversation, and clean air practices (Bohdanowicz, 2005). Similarly, Manaktola and Jauhari (2007) define a green hotel as a lodging facility committed to ecological practices such as saving of water, energy and waste. In the hotel industry, practices associated with green concerns are diverse; they may encompass a variety of activities from pollution prevention to stakeholders' awareness campaigns regarding these activities. However, for the purpose of the study this research views green practices as internal efforts or activities of a hotel to implement environmentally friendly practices towards the goal of reducing its operating costs. The term "green facility or hotel" can be used interchangeably or synonymously with "an environment friendly hotel," "an eco-friendly hotel," or "a sustainable hotel."

Hotel managers/operators recognized the 'green shift' in consumers' behaviors/desires to purchase and promote environmentally friendly services and products, proactive management and so they have taken the steps to implement environmentally conscious practices to improve their competitiveness (Lee and Moscardo, 2005) and image. These consumers' behaviors are composed of consumer commitments, responsibility, attitudes and willingness to pay more for green products (Farj and Martinez, 2007a).

The term 'green' refers to the actions that reduce the impacts on the environment (Han, Hsu, and Sheu, 2010), such as recycling (Ramchurjee and Suresha 2014), saving energy and water, purchasing eco-friendly products, and using transportation with lower CO_2 emissions such as using public transportation (ITP, 2013). The concept of 'green hotels' are environmentally friendly properties whose managers are eager to institute programs that save water/energy (Green Hotels Association, 2008) and reduces waste/emission by reducing operational costs, while saving money in order to protect "OUR EARTH."

From responsible business perspectives, green hotels must incorporate green strategies into their decision making. Hotels whether they have adopted green initiative program or not, must operate in a responsible manner towards the local community, local culture, and the surrounding ecology and to their employees (Kang, Stein, Heo and Lee, 2012).

But, some hotel managers/operators are resistant to adopting 'green initiatives' such as investing in environmental protection programs and introducing environmentally friendly activities. These businesses/companies believe that these initiative programs require considerably large capital investment, and they do not realize any significant financial benefits to the hotels (Oliver, Naar and Harris, 2015).

However, for those hotels that have introduce green initiative programs, they have found that this image reflects the set of beliefs, ideas (Manaktola, and Jauhari, 2007) and brands that promotes the public's environmental concerns and awareness to move away from more conventional processes that destroy the environment to more sustainable practices. Therefore, there's a growing number of consumers nowadays who are demanding green hotels, and so green management has become directly associated with customers demand and satisfaction (Enz and Siguaw, 1999), increased employees' morals (Laroche, Bergeron and Barbaro-Forleo, 2001), willingness to pay more for green products (Mensah, 2008) and corporate image (Butler, 2008). Nowadays, green management has consequently become an important part of both strategic and operational planning and it has now become standard, rather than being just a temporary side interest (Manaktola, and Jauhari, 2007).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Green hotel establishments actively follow eco-friendly guidelines and practice environmental management; they commit themselves to carrying out environmental improvements, demonstrating such efforts through eco-labels or the green globe logo and acquiring techniques related to the best practices in environmental management with experts' help (Han, Hsu, & Sheu, 2010). It is generally agreed that turning a lodging property green not only fulfills environmentally cautious customers' green needs and assumes the responsibility of performing environmental duties, but also results in substantial cost saving through various environmental benefits (Manaktola, and Jauhari, 2007).

Environmental Attitudes

Environmental attitude is a complex mental state involving beliefs and values of individuals to behave environmentally. In other words, it taps the consumer's cognitive and affective judgment with respect to environmental protection and green living (Lee, 2008). Attitudes are evaluative judgments towards an object with respect to some degree of favor or disfavor (Eagly and Chaiken, 1993). It is the enduring, individually defined moral obligations to protect the environment. Supporting the view that these judgments play a major role in determining human social behaviour (e.g. Ajzen and Gilbert Cote, 2008; Fishbein and Ajzen, 2010), there is a plethora of empirical evidence linking attitudes to pro-environmental behaviour (for two recent meta-analyses, see Bamberg and Mo¨ser, 2007; Klo¨ckner, 2013). Both the supply and demand sides of the tourism industry of purchasing and consumption have been shown to be affected by environmental values (Holden, 2005). Zografos and Allcroft (2007) used environmental values in their study as a base to segment potential ecotourists in Scotland. Hedlund (2011) found positive relationships between environmental values and the willingness to accept economic sacrifices to protect the environment and the intentions to buy ecologically sustainable tourism alternatives.

With the increasing profile of environmental issues, more research is being conducted on consumer's environmental attitudes and behaviors. Most of this research is questionnaire-based, especially given Dunlap and Van Liere's introduction of growth limits, natural balance and anti-anthropocentrism in 1978 – a new environmental paradigm scale that is widely used by scholars (Stern, Dietz, & Guagnano, 1995). The complex environmental issues that characterized the 1990s – including the deterioration of the ozone layer, waste, biodiversity and global environmental changes – led Dunlap, Van Liere, Mertig, and Jones (2000) to develop a new ecological paradigm (NEP) scale based on the environmental paradigm scale, ecological crisis and other related issues. The new ecological paradigm scale consists of the following five dimensions: limited growth, anti-anthropocentrism, fragile natural balance, anti-exceptionalism and the possibility of ecological crisis. The scale was used to measure the cognitive and emotional tendencies of the respondents on environmental issues in this study.

Laroche, Bergeron, Barbaro-Forleo (2001) investigated the relationships between attitudes towards environmental issues and consumers' willingness to pay more for green products. Nine hundred and seven individuals from a large North American city participated in the study. The results indicated a strong relationship between attitudes towards environmental issues and consumers' willingness to pay more for green products. Mair's (2011) study on tourists participating in carbon-offset programs found travelers that purchased offsets had positive environmental values. Barber et al. identified the market of "the Millennial male with strong environmental attitudes" as a "substantial market for ecological products" (Barber, Taylor, & Strick, 2010, p. 64). Dolnicar (2010) found environmental values, or a moral obligation to protect the environment, was a strong predictor of environmentally-friendly tourist

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

behavior and environmental behavior at home. Ham and Han (2012) show that purchase-related loyalty, measured as intentions to visit, acceptance of price premiums, and providing recommendations, were amplified by consumers with positive environmental values.

Environmentally Friendly Activities (EFA)

People have become aware of the fragility of our environment and the need for preservation of natural resources. Thus, in recent years, increasing numbers of individuals with environmental concerns, identify themselves as an environmentalist engaging in environmentally friendly activities (EFA) (Han, Hsu, and Sheu, 2010 and Manaktola, and Jauhari, 2007). Individuals who perceive the importance of EFA concerning ecological issues actively engage in those types of behaviors (Kalafatis, Pollard, East, and Tsogas, 1999) and (Laroche, Bergeron, and Barbaro, 2001). These categories of consumers are willing to change their buying behavior in a more ecologically favorable way (avoidance of disposable products) and behave in an environmentally friendly fashion in their everyday lives (e.g. recycling activity), thus sacrificing friendly products and even paying extra for the products (Manaktola, and Jauhari, 2007). On the other hand, consumers who do not engage in EFA tend to feel environmental problems will resolve themselves, those who are engaged as eco-friendly customers frequently believe our ecological situation faces serious problems that need corrective action and strongly feel that they should do something for the protection of the environment (Han, Hsu, and Sheu, 2010). Given their perceptions about rigorousness of the environmental problem, such individuals' EFA affects their purchasing behavior (Laroche, Bergeron, and Barbaro, 2001).

Therefore, in the context of the tourism industry, we could expect that the formation of intentions to stay at green hotel can differ between tourists often engaging in EFA and tourists infrequently engaging in EFA. In particular, to gain a better understanding of the linkages, we posit that the higher the EFA of the tourists, the higher the intention to visit green hotel.

Eco-friendly attitudes refer to the individual value judgement of environmental protection (Lee, 2011). In other words, eco-friendly attitude taps the individuals' cognitive assessment of the value of environmental protection. In 2010, Han, Hsu and Sheu defined attitudes of environmental concern as rooted in a person's concept of self and it is the degree to which an individual perceives him or herself to be an integral part of the natural environment. Attitude represents what consumers like and dislike and consumer product purchasing decisions are often based on their environmental attitudes (Lyer, 1999). Eco-friendly attitude is commonly understood as a cognitive judgement towards the value of environmental protection (Lee, 2011). In his study, Balderjahn concluded that individuals who had a positive attitude towards the environment participated more in the buying and consumption of green products (Balderjahn, 1988).

Examining consumer eco-friendly attitudes toward hotel s' green practices and behaviour, researchers (Manaktola, and Jauhari, 2007) concluded that customers who are aware of a hotel's eco-friendly practices show preference to patronize a green lodging property. Further, Roberts indicated that consumer attitudes are significantly predictors of ecologically conscious consumer behavior (Robert, 1996). His findings revealed that environmentally conscious people are likely to engage in eco-friendly consumer behavior and individuals who believe their specific ecological activities can cause positive change are more likely to display green consumer behavior. Similarly, a recent study by Han and other researcher revealed that hotel customer's eco-friendly attitudes positively affect their expressed intention (Han, Hsu, and Sheu, 2010).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Therefore, tourists with positive environmental attitudes tend to choose green hotels. Therefore, it is of primary importance for green hotel operators to continuously educate the guests about the importance of being environmentally friendly and the environmental impacts of their behaviour.

Maximizing hotel guests' involvement in executing green practices can be the key strategy to improve the green image of the hotel, which in the long–run improves the guests' behavioral intention to the hotel. Thus, managers should establish green attributes to offer direct experience opportunities to the guests.

How a Hotel's Green Image Can Influence Tourists' Behavioral Intent

When green management was first introduced, the major reasons for a hotel to "go green" center on complying with government regulations and saving money by reducing waste and energy usage. However, since a growing number of customers are now demanding green hotels, green management has become directly associated with product quality, employee morale (Enz and Siguaw, 1999), customer satisfaction and demand (Manaktola and Jauhari, 2007), the willingness to pay a premium for green products (Laroche, Bergeron & Barbaro- Forleo, 2001) and corporate image (Mensah, 2004; Penny, 2007). According to a study by the International Hotels Environment Initiative and Accor, 90% of hotel guests would prefer to stay in a hotel that cares about the environment (Mensah, 2004). Penny (2007) also conducted a survey that examined the attitude of hotel managers in Macau towards green management. He found that 65% of respondents believe that good green management can contribute to a hotel's image and competitiveness. Green management has consequently become an important part of both strategic and operational planning. It has now become standard, rather than being just a temporary side interest, as it was in the 1970s (Butler, 2008).

Despite the significant effect of image on product/service value (MacInnis and Price, 1987), customer satisfaction and loyalty (Andreassen and Lindestad, 1998), to date, no research efforts have focused on examining the image of a green hotel from the perspective of hotel guests. But despite the increasing concern for the environment, green products were found to struggle with a low market share (Wong, Turner, & Stoneman, 1996). According to UK surveys, the number of green consumers has grown only slightly, and their willingness to purchase green products has also declined (Mintel, 1991, 1995).

Hotel Guests' Preferences and Awareness for Green Attributes and Environmentally Friendly Initiatives in Hotels

Watkins, 1994, indicated in a study conducted by Virginia Polytechnic Institute and State University (Virginia Tech) and Lodging Hospitality that frequent travelers would stay in hotels with environmental strategies, but they would not be willing to pay a premium for those rooms. The study reported that some environmentally friendly hotel attributes that travelers may consider when selecting a green hotel included, but were not limited to: recycling bins, energy-efficient lighting, using recycled paper for promotional materials, changing sheets only when requested, and turning of lights in unoccupied guest rooms. Despite the fact that travelers in the survey said they were likely to stay in hotels that provided such attributes, and despite the fact that a large portion of the travelers considered themselves environmentally conscious consumers, they did not necessarily consider themselves environmentally conscious travelers (Watkins, 1994). In other words, their beliefs were not necessarily followed up by their actions when traveling.

Kasim (2004) studied tourists to Penang Island, Malaysia and found that tourists were knowledgeable and cared about the environment but they did not consider a hotel's environmental strategy as a

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

foundation for their hotel choice. That is not to say that they would not approve of room attributes that were environmentally friendly. Tourists were willing to accept rooms with water saving features, recycling bins, fire-safety features, energy saving features, and information on local ecotourism attractions.

Green hotels follow strict green guidelines to ensure that the guests are staying in a safe, non-toxic and energy efficient accommodations. Here are some basic characteristics of a green hotel:

- Housekeeping uses non-toxic cleaning agents and laundry detergents
- 100% organic cotton sheets, towels and mattresses
- Non-smoking environment
- Renewable energy sources like solar or wind energy
- Bulk organic soap and amenities instead of individual packages to reduce waste
- Guest room and hotel lobby recycling bins
- Towel and sheet reuse
- Energy efficient lighting
- Serve Organic and local grown food
- Non-disposable dishes
- Offers a fresh air exchange system
- Newspaper Recycling
- Gray water recycling

Selecting the right decisions in developing a green hotel is very crucial. Selecting a location, the technology and other green equipment in plan of developing a green hotel are all interrelated. Getting a certification such as LEED or GRIHA has become very important nowadays, as the current generation of people trust in these certifications. Whereas building a green hotel used to cost a premium, current studies show that the cost of building to LEED standards is not greater than conventional approaches, while those buildings are healthier for occupants and less expensive to operate (Butler, 2008).

The hospitality industry in general has been feeling the pressure from society as well as governmental regulations related to the implementation of more environmentally friendly policies (Bohdanoqicz, 2006; Zurburg, Ruff & Ninemeier, 1995).

In order to monitor and improve energy savings, a hotel needs an energy management program that includes temperature controls, motion-sensitive lighting systems, and Energy Star rated devices and Appliances (Iwanowski & Rushmore, 1994). An energy program coordinator of the United Nations Environment Program suggested that consuming less energy and adopting energy-efficient technologies reduce the need for investment in energy infrastructures and increase the competitiveness of businesses (Accor, 2006). A solid waste management program is intended to reduce the volume and toxicity of the garbage being sent to the landfill (Iwanowski & Rushmore, 1994). Kirk (1995) suggested that waste can be recycled either by reusing products, or by recycling the materials, by minimizing waste in operations. For the efforts, hotels have installed soap and shampoo dispensers in guest bathrooms instead of individually packed toiletries (Bohdanowicz, 2006). With such waste management programs, the Willard InterContinental Hotel in D.C. reduced waste by 22%, from 1029 tons in 2005 to 807 tons in 2006 (Envirelation, 2007). Environmental management has been targeted at reducing wastage of water and improving water quality. Excessive water use can deplete or destroy local water resources, and threaten the availability of water for local needs (The Center for Environmental Leadership, 2003). Nearly all

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

hotels pay for the water they consume twice: first to obtain fresh water and then to dispose it (Dodds, 2005). Water consumption depends on the services and facilities offered, and on existing water conservation practices (Bohdanowicz, 2006).

Demographic Characteristics and Environmental Friendly Behavior

Generally, findings concerning demographic characteristics and environmentally friendly variables are controversial, with some researchers arriving at significant differences concerning demographic characteristics and environmentally friendly behavior (Han, Hsu, & Lee, 2009) and (Gronhoj & Olander, 2007), and others supporting the opposite (Straughan and Roberts, 1999). Previous research has yet to agree on the role of demographics in green purchasing (do Paço et al., 2009; Roberts, 1996). Zografos and Allcroft (2007) found significant differences in hotel choice based on gender, age, and education levels. Zografos and Allcroft, 2007 segmented audiences and found skeptical audiences were slightly younger and more likely to be female than male. People who were categorized as concerned were more educated and were older.

Previous studies highlighted differences between males and females regarding their environmental attitudes and actions. According to Gronhoj & Olander, 2007, women are more concerned with environmental issues and more likely to participate in environmental activities than men. (Han, Hsu, & Lee, 2009 aimed to investigate sex differences in environmentally conscious behaviors in a green hotel. The study sample was composed of 371 hotel customers from the USA (men – 46.6%, women – 53.4). The findings indicated that women are more willing than men to pay extra money for "green" hotels. Studies on differences in environmentally friendly behaviors among different age groups have not always produced similar findings.

Finisterra do Paco, Raposo, Leal Filho, 2009 investigated the demographic profile of the green consumer in a sample of 887 Spanish individuals, 18-year-old and above, and found

significant differences regarding different age groups and environmentally friendly behaviors. Different findings were revealed by (Laroche, Bergeron and Barbaro-Forleo, 2001), who found no statistically significant differences between consumers at different ages in their willingness to pay more for green products. (Han, Hsu, & Lee, 2009 supported that older individuals were more willing to pay more for 'green' hotels than younger ones. In contrast, (Lee, 2008) investigated green purchasing behaviour in a sample of 6.010 Hong Kong adolescents and argued that younger individuals were more likely to buy 'green products'.

The findings regarding different educational levels and environmentally friendly behaviors have been equivocal. Musa, Seng, Thirumoorthi (2011) explored the influence of the demographic profile of divers on underwater behavior. Data were collected using a sample of 302 divers from Malaysia. The results showed that divers were generally responsible underwater, with the ones with a higher education being more concerned about the environment, and behaving in a more environmentally friendly manner. However, (Laroche, Bergeron and Barbaro-Forleo, 2001), who investigated the demographic profile of consumers willing to pay more for environmentally friendly products found no significant differences in their willingness to pay more among individuals with different levels of education. Although, many studies have examined the impact of demographic characteristics on environmentally friendly behaviour, no definitive and conclusive findings have been established regarding the relationship between the two variables.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chia-Jung and Pei-Chun (2014) provide evidence that sex, income and age have significant influences on tourists' choice behaviors. In other studies, demographic variables like age and household income were not significant (Tierney et al., 2011; Berezan et al., 2014). Singh (2011) found that within a sample of 60-85-year-old, 85% believe in green marketing and 52% purchase green products. Additionally, Singh found older adults report the quality of green products (35%) and the convenience in buying (31%) were the most important reasons for purchasing green products; however, two-thirds of the sample of seniors (66%) noted the lack of information as a reason that would prohibit them from purchasing a green product. One-fifth (20%) of the respondents purchase green travel products.

MATERIALS AND METHODS

A study research questionnaire was best adopted to obtain personal and social facts, attitudes and behavior, values and beliefs data from tourists visiting the tourist sites in Bangalore, and so it was utilized for this study.

Data Collection

The present study adopted a questionnaire methodology, where a quantitative approach research was used to collect data from tourists. Two hundred and twenty (220) questionnaires were distributed and 209 questionnaires were returned, achieving a 95% response rate. The potential participants were contacted at tourist sites such as hotel lobbies and recreational areas (famous sites and scenic nature sites). Each participant (220) was approached and information about the study (i.e. topic, objectives, purpose, confidentiality and project leader contact information) were given and asked if the tourist was willing to participate in the study. Those tourists who were willing to participate were provided with a questionnaire (with both English Language and the native spoken language Kannada). The project assistant helped in translating the language so that the questions were easily understood by the participants. Questionnaires were collected and the participants and the project team discussed more about the questions and what they would like to see happen in the near future for India's "Silicon Valley".

Questionnaire Development

The instrument used for the study was designed independently. One area of inquiry explored the likelihood of what the participants would choose if sustainable/green conservational features were available at the hotels in which the participants stayed at and if these programs can influence consumer choices. Participants were asked to rate ten (10) specific features that hotels adopting the green initiative would have benefit from; of course, many hotels are now in the phrase of implementing their green initiative programs. Participants were asked if implementing these programs would decrease, increase or not change the likelihood of booking a reservation at green hotels. The ten (10) features were adopted from previous literature (Butler, 2008) and also by reviewing current industry policies and practices, these features include:

- Eco-certification
- Energy saving lights

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- Renewable energy
- Recycling general wastes (plastic/paper)
- Recycling kitchen wastes
- Reusing items
- Reuse linen
- Environmentally friendly (EF) paper products
- Rain/grey water reuse
- Bio-chemicals

RESULTS

Profile of Participants

The profile of the participants is based on age, gender, education and occupation can be seen in Table 1.

DESCRIPTIVE STATISTICS OF THE HYPOTHESES

Nowadays, hotels that are becoming environmentally conscious in their functions fulfill their environmental responsibility and achieve substantial cost-saving through various environmental benefits (Han, Hsu, and Lee, 2009). This action increases and promotes environmentally friendly products and services to hotel guests who would prefer to stay in a hotel that implements green management.

H1: Investigating the attitude and behavior of tourists towards green practices in hotels.

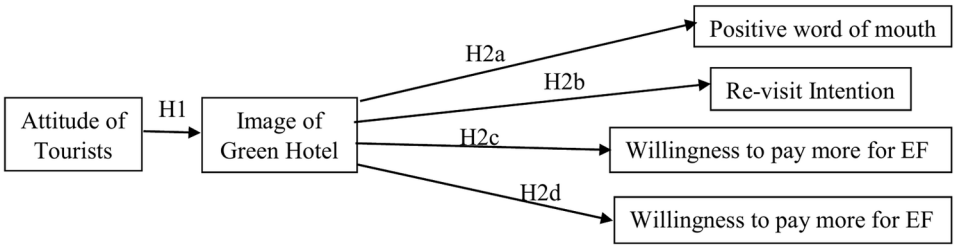
Apart from the cost-efficiency of green practices in hotels, green management has now played a critical role in marketing, operational building (Ramchurjee and Suresha 2014) and the image of the hotel.

Table 1. Profile of Participants

Characteristics	Description	Values	Characteristics	Description	Values
Gender	Male	69%	Education	Pre-University	17%
	Female	31%		University	30%
Age	18-25	16%		Post-Graduate Degree	2%
	26-33	30%		Other	22%
	34-41	15%	Occupation	Student	0
	42-49	7.0%		Professional	46%
	50-57	21%		Self-Employed	3%
	58-65	7%		Homemaker	40%
	65-74	4%		Unemployed	11%
Education	Primary	11%			
	High School	18%			

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 1. Displays the relationship among the variables of attitude of tourists towards green practices, image of green hotel, positive word of mouth; re-visit intention, willingness to pay more for EF services and willingness to pay more for EF products



Many studies have been conducted to show the connection between environmental responsible attitude and behavior, image, positive word of mouth, re-visit intentions and willingness to pay for environmentally friendly services and products (Han, Hsu, and Sheu, 2010).

H2: Investigating the extent to which the image of hotels will influence.
H2a: Positive word of mouth
H2b: Re-visit intention
H2c: Willingness to pay for environmentally friendly services
H2d: Willingness to pay for environmentally friendly products

In terms of descriptive statistics, the tourists reported relatively high scores for the 'attitude and behavior of tourists towards green practices in hotels' variable (M=3.76, SD=0.06). A large number of studies indicated that tourists are becoming more aware of the importance of protecting the environment and they are more involved in practicing environmentally friendly behavior on holidays (Kalafatis, Pollard, East, and Tsogas, 1999). In other words, people have become increasingly aware of the fragility of our environment and the need to perverse our natural resources (Enz and Siguaw, 1999) and (Laroche, Bergeron, and Barbaro, 2001). Thus, individuals who are environmentally responsible perceive the importance of engaging in such types of behaviors (Laroche, Bergeron, and Barbaro, 2001) and (Lita, Surya, Ma'ruf, and Syahrul, 2014) concerning ecological issues. These groups of consumers are willing to change their buying behavior towards more environmentally friendly activities (recycling, green purchasing) and behave in environmentally friendly ways in their everyday lives (Enz and Siguaw, 1999).

In terms of the extent to which the image of the hotels will influence 'positive word of mouth' variable (M=3.66, SD=0.07), 're-visit intention' variable (M=3.46, SD=0.07), 'willingness to pay more for environmentally friendly services' (M=4.00, SD=0.07) and 'willingness to pay more environmentally friendly products (M=4.06, SD=0.06). It was discovered that attitude toward green behavior of hotels had positive impact on the overall image, and the overall image had positive impact on the intention to visit, word-of-mouth, and willingness to pay more (Choi, G. et al., 2009). Many studies from North America and Europe have found that consumers demonstrate a strong willingness to pay for hotels committed to environmentally friendly practices, but cultural and social structures determine consumers' green orientation and willingness to pay (Han, H. et al., 2011). One study (Ramchurjee and Suresha 2014), examined the broader connection between hotel customers' eco-friendly decision-making and overall hotel image, re-visit intention, word-of-mouth and willingness to pay more in a green hotel context.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The results showed that the overall image is a positive function of attitude towards green behavior and that the overall image significantly affects visit intention, word-of-mouth intention and willingness to pay more. Figure 1 displays the relationship among the variables of attitude of tourists towards green practices, image of green hotel, positive word of mouth; re-visit intention, willingness to pay more for EF services and willingness to pay more for EF products. This study shows how the following variables are hypothesize.

Demographic Differences: Gender

An independent sample t-test was calculated aiming to seek the differences between males and females' participants. Statistically significant differences were found between 'gender' and 'willingness to pay more for EF products' (t_{208}=-5.341, p<0.05) and gender and positive word of mouth (t_{208}=-5.521, p<0.05). No statistical significant differences were found between the other three groups in 'green practices' (t_{208}=-3.605, p<0.05), 're-visit intention' (t_{208}=-2.558, p<0.05), and 'willingness to pay more for EF services' (t_{208}=-1.294, p<0.05). Studies have shown that gender differences were found with the intention to visit again which was affected by their previous experiences with green hotels (Han, Hsu, and Sheu, 2010). The male participants scored significantly higher than their female counterparts as seen in Table 2.

Demographic Differences: Age

An analysis of variance was conducted to test the differences between 'age' and the five subgroups. The analysis revealed that there are strong significant effects for 'green practices' ($F_{5,208}$=5.830, p<0.05), 'word of mouth' ($F_{5,208}$=2.912, p<0.005), 're-visit intention' ($F_{5,208}$=4.365, p<0.001), 'willingness to pay more for environmentally friendly services' ($F_{5,208}$=4.309, p<0.005) and 'willingness to pay more for environmentally friendly products ($F_{5,208}$=5.268, p<0.005).

Demographic Differences: Levels of Education

An analysis of variance was conducted to test the differences between levels of education and the five subgroups. The analysis showed there are significant effects for 're-visit intention' ($F_{3,208}$=0.319, p<0.005),'willingness to pay more for environmental friendly services' ($F_{3,208}$=0.314, p<0.005) and 'willingness to pay more for environmentally friendly products' ($F_{3,208}$=0.384, p<0.005). No significant effects were reported for 'green practices' ($F_{3,208}$=0.279, n. s) and 'positive word of mouth' ($F_{3,208}$=0.213, n. s).

Table 2. Results of t-Test for the study variables by Gender

	Green Practices	Word of Mouth	Re-visit Intention	Willingness to pay more for services	Willingness to pay more for products
	M (±SD)	M (±SD)	M (±SD)	M (±SD)	M (±SD)
Male	3.36(±0.31)	3.26(±0.33)	3.85(±0.35)	3.64(±0.37)	3.18(±0.29)
Female	3.77(±0.82)	3.65(±0.94)	4.05(±0.62)	4.00(±0.93)	3.46(±0.13)
t	-3.605	-5.521	-2.558	-1.294	-5.341
p	p<0.05	p<0.05	P<0.05	P<0.05	p<0.05

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Correlation Among the Five Subgroups

Correlation analysis was computed for the five subgroups and the 209 participants in this study. The results suggest that 9 out of 10 correlations were statistically significant and were greater or equal to (r_{209}= +0.60, p<0.01), two-tailed test. The 'attitude of tourists towards green practices' showed the highest correlation with 'willingness to pay more for EF products' (r_{209}=0.972, p<0.01). The second highest correlation is between 're-visit intention' and 'willingness to pay more for environmental friendly services' (r_{209}=0.916, p<0.01). The remaining variables indicated moderate correlation, with no significant effect reported for 'word of mouth' with 'willingness to pay more for EF products (r209=0.091, p<0.01). In general, the results suggest that the tourists who adopt green practices are willing to re-visit the same destinations and are willing to pay more for environmentally friendly services and products offered by hotels that are implementing and that are already following the green initiative. According to many studies, it has been shown that customers' green attitudes are significantly associated with their expressed intentions to visit green hotels when on vacation, spreading positive word-of-mouth when they are satisfied with the environmentally friendly products and services being offered by the green hotels, leading to visiting that destination/hotel again and again and they are of course willing to pay for it (Han, Hsu, and Sheu, 2010). Table 3 shows the correlation analysis between the five subgroups.

Current Practices at Hotels Which Affect the Environment

In order to measure the current practices in the daily operations of hotels the following characteristics were used (1) Eco-certification, (2) Energy saving lightings, (3) Renewable energy, (4) Recycling general products (plastics/paper), (5) Recycling kitchen products (cooking oils, unused vegetables/foods), (6) Reusing items, (7) Reuse linen, (8) Environmental friendly (EF) paper products, (9) Rain/grey water reuse, and (10) Bio-chemicals.

The results (beta weights for each variable and their significance, based on the t-values, as well as variance explained by each regression) are described in Table 4.

Mean Responses for Sustainable Practices

Table 5 shows relatively high ratings for increased tendency to choose a hotel based on sustainable practices. Particularly, consumers provided the lowest ratings for practices that might lessen from their

Table 3. Correlation analysis between the five subgroups

	Green Practices	Word of Mouth	Re-visit Intention	Willingness to pay more for services	Willingness to pay more for products
Green Practices					
Word of Mouth	0.648	1			
Re-visit Intention	0.631	0.618	1		
Willingness to pay more for EF services	0.669	0.626	0.916	1	
Willingness to pay more for EF products	0.972	0.091	0.682	0.661	1

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 4. Sustainable Practices implemented by green hotels

β	Eco-certification	Energy Saving Lighting	Renewable Energy	Recycling general wastes	Recycling Kitchen Wastes
Age	-4.226	0.241	1.521	0.418	-3.985
Gender	0.978	0.901	0.195	0.615	0.329
Education	1.646	1.057	1.030	5.156	0.578
Income	0238	0.530	0.303	0.120	0.392
Environmental Values	0.176	0.571	2.214	1.964	4.812
Environmental Belief	0.383	1.793	5.473	4.562	0.915
R^2	0.718 (p=0.05)	0.337 (p=0.07)	0.698 (p=0.06)	0.679 (p=0.06)	0.555 (p=0.05)

β	Reusing items	Reuse Linen	EF paper products	Rain/grey water reuse	Bio-cleaning chemicals
Age	1.719	1.814	0.713	-5.870	0.754
Gender	0.964	0.711	0.007	0.735	0.737
Education	5.440	0.422	1.399	5.033	0.059
Income	0.631	0.275	0.139	0.086	0.077
Environmental Values	0.803	2.934	1.576	0.568	4.585
Environmental Belief	2.137	1.602	4.405	3.611	1.434
R^2	0.641 (p=0.05)	0.699 (p=0.04)	0.616 (p=0.05)	0.798 (p=0.03)	0.549 (p=0.05)

Table 5. Mean Responses for Sustainable Practices

Sustainable Practices	Mean	S.D.
Eco-certification	3.77	0.55
Energy Saving Lighting	3.54	0.50
Renewable Energy	3.64	0.50
Recycling General Wastes	3.50	0.50
Recycling Kitchen Wastes	3.63	0.50
Reusing Items	3.43	0.48
Reuse Linen	3.30	0.46
EF paper products	3.54	0.50
Rain/grey water reuse	3.65	0.48
Bio- cleaning chemicals	3.53	0.50

experiences, like reusing items and reuse of linen. The ratings are not significantly different from each other, but present a different view of customer perceptions, since previous researches suggested consumers are most likely to perceive value associated with the practices they directly observe (e.g. Millar & Baloglu, 2011). Earlier researches suggested consumers require a discount to give up amenities, like toiletries (Chia-Jung & Pei-Chun, 2014). The current samples placed higher value on eco-certification, rain/grey water reuse and renewable energy.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

DISCUSSION

The average age of the participants was 29 years old and males dominated with 69%. 30% of the participants had a university degree and 46% were professional employed. Overall, the data showed that 44% of the male participants were in the age groups 26-33 having a university degree and being professionally employed.

The results of the hypotheses for the current study is supported by (Ramchurjee and Suresha 2014), study showing that attitude towards green behavior positively affects overall image, and that overall image positively affects positive word of mouth, re-visit intention and the willingness to pay more for environmentally friendly services and products. Many studies have shown that there are significant impacts on the overall image of hotels and the willingness of consumers to pay more for these activities. This can be corroborated by (Ramchurjee and Suresha 2014) that tourists are becoming more aware of the importance of protecting the environment and being more involved in practicing environmentally friendly behavior on holidays. This may start by tourists choosing green hotels to stay at, while engaging in nature-based activities (Ramchurjee, 2013).

As the concerns for the natural environment increases, individuals are adopting environmentally friendly attitudes and behavior. In the Demographic Differences – Gender, statistical significant differences were found for willingness to pay more for environmentally friendly products and female participants, scoring significantly higher than their male counterparts. This result corresponds with many other studies in that women are more willing to pay more to be sustainably friendly towards the environment. On the other hand, significant differences were found between positive word of mouth and male participants. Satisfied tourists, in this case, the male participants are more likely to become promoter via positive word of mouth (Ramchurjee, 2013).

The Demographic Differences – Age has shown significant statistically differences with all the subgroups. This may suggest that age plays a major role in the concerns of the tourists for the environment, where older-aged groups will show more appreciation for the smaller things in life (Hopkins, and Roche, 2009), thus saving the environment for younger generations, and the realization of the younger-aged groups that they have to save the environment for their future as well as for other generations.

Guests do not actually see what happens with the recycling systems adopted by any hotel, and so they are not overly concerned about the waste management system, only that their rooms are daily cleaned. In India, waste is a massive concern and is somewhat controlled to a certain extent by the private enterprises. Some hotels, take waste management to another level, where they recycle their excessive food and vegetable wastes to other useful products such as compost

Conservation of water is a relatively new concept in India. Traditionally, hotels felt that if water was available, guests would be happy; however, with environmental concerns on the rise, conservation is now needed as a measure to help to combat India's growing population.

This study found that age had a negative relationship with three (3) features such as eco-certification, recycling (food waste) and rain/grey water reuse. Few hotels in Bangalore are eco-certified and are willing to implement green initiative programs into their daily operations. Some hotels managers/operators think that by implementing these programs cost money, and that they will not receive any return on their investment.

This study did not find any significant relationship with gender and income and considers that it reflects the same results as previous studies concerning hotel guests regarding sustainability (Tierney,

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Hunt, and Latkova, 2011) and (Berezan, Millar, and Raab, 2014). When people are motivated to adopt green practices, gender – male or female does not show any differences as to as individual gender.

However, levels of education did record high relationships with recycling general wastes (such as plastic, paper and aluminum), reusing items and rain/grey water reuse (conservation of water). These three features would be expected to have high association because of their impacts on the environment. Thus, hotel guests with high level of education will take into consideration recycling, reuse and conservation of items to show their environmentally friendly attitudes and behaviors.

This study did find socio-demographic factors having moderate significance with selecting a hotel that had employed environmentally sustainable practices, and so we expected environmental values to have positive connection with selecting hotels that participated in green practices. Our results have shown positive relationship between environmental values and the selected green features. This can be related to other studies that show hotel guests have positive associations between environmental values with green hotels while there are on holiday (Cometa, 2012). This further shows that the value of green hotels may increase beyond the group of green consumers.

Our findings indicate positive relationship with environmental belief and all the selected practices that are being offered by green hotels in Bangalore. Belief, in relation to environmentally friendly practices is a value, customers perceived to be offered by green hotels and the willingness of consumers to participate in these activities and their willingness to pay more for these environmentally friendly services and products [36] offered by the hotels.

The overall results proposed that the participants in the survey were more likely to choose green practices (11%-16%) than the general population (5%) influenced by sustainable practices.

These results could provide guidance and opportunities to hotel managers/operators as a source to increase their green practices (Oliver, Naar, and Harris, 2015) and share these operations with their guests, who can enjoy the experience of being included in the decision of hotels to become 'sustainable.'

Consumer concerns about environmental practices, and sustainability issues on a broader scale, are not likely to dissipate. Therefore, each nuanced level of understanding about consumer preferences and decision-making can direct sustainability managers, product developers and marketers in a more enduring, responsible solution to tourism's sustainability challenges.

CONCLUSION

Today, the society we live in judge industries on their ethics, social accountability, socio-environ-economic awareness and their financial inputs and outputs. As the public understanding of global warming and environmental degradation growths, it is expected that businesses/firms that contribute to these harmful behaviors must now move in a 'green' direction.

As this study submitted, a green hotel image becomes a powerful operational tool in attracting and retaining more guests. From the analysis, environmentally friendly activities of tourists give significant influence to their intention to choose green hotels, being promoter via positive word of mouth. In practice, the findings of this study should contribute to encouraging green hotel operators/managers to consider their green initiative programs as part of the guest experience and recognize the investment towards 'becoming' green will be realized significantly.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

REFERENCES

Accor. (2006). *Accor hotels environment charter*. Retrieved from http://www.accor.com/gb/espace_pro/reunions/posteraccor_GB.pdf

Ajzen, I., & Gilbert, C. N. (2008). Attitudes and the prediction of behavior. In *Attitudes and Attitude Change* (pp. 289–311). New York, NY: Psychology Press.

Balderjahn, I. (1988). Personality Variables and Environmental Attitudes as Predictors of Ecologically Responsible Consumption Patterns. *Journal of Business Research*, *17*(1), 51–56. doi:10.1016/0148-2963(88)90022-7

Bamberg, S., & Mo¨ser, G. (2007). Twenty years after Hines, Hungerford, and Tomera: A new meta-analysis of psychosocial determinants of pro-environmental behaviour. *Journal of Environmental Psychology*, *27*(1), 14–25. doi:10.1016/j.jenvp.2006.12.002

Barber, N., Taylor, D. C., & Strick, S. (2010). Selective marketing to environmentally concerned wine consumers: A case for location, gender and age. *Journal of Consumer Marketing*, *27*(1), 64–75. doi:10.1108/07363761011012967

Berezan, O., Millar, M., & Raab, C. (2014). Sustainable hotel practices and guest satisfaction levels. *International Journal of Hospitality & Tourism Administration*, *15*(1), 1–18. doi:10.1080/15256480.2014.872884

Bohdanowicz, P. (2006). Environmental awareness and initiative in the Swedish and Polish hotel industries—survey results. *International Journal of Hospitality Management*, *25*(4), 662–682. doi:10.1016/j.ijhm.2005.06.006

Butler, J. (2008). *Hospitality lawyer on green hotel development*. Retrieved from http.//hotellaw.jmbm.com/2008/05/hospitality_lawyer_on_green_ho.html

Butler, J. (2008). The compelling "hard case" for "green" hotel development. *Cornell Hospitality Quarterly*, *49*(3), 234–244. doi:10.1177/1938965508322174

Chia-Jung, C., & Pei-Chun, C. (2014). Preferences and willingness to pay for green hotel attributes in tourist choice behavior: The case of Taiwan. *Journal of Travel & Tourism Marketing*, *31*(8), 937–957. doi:10.1080/10548408.2014.895479

Choi, G., Parsa, H. G., Sigala, M., & Putrevu, S. (2009). Consumers' environmental concerns and behaviors in the lodging industry. A comparison between Greece and the United States. *Journal of Quality Assurance in Hospitality & Tourism*, *10*(2), 93–112. doi:10.1080/15280080902946335

Cometa, L. (2012). Consumer Beliefs About Green Hotels. In *College and Graduate School of Education, Health and Human Services* (p. 109). Kent, OH: Kent State University.

do Paço, A. M. F., Raposo, M. L. B., & Leal Filho, W. (2009). Identifying the green consumer: A segmentation study. *Journal of Targeting Measurement and Analysis for Marketing*, *17*(1), 17–25. doi:10.1057/jt.2008.28

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Dodds, R. (2005). *Why environmental benchmarking will help your hotel.* The Prince of Wales International Business Leaders Forum, London, UK.

Dolnicar, S. (2010). Identifying tourists with smaller environmental footprints. *Journal of Sustainable Tourism*, *18*(6), 717–734. doi:10.1080/09669581003668516

Dunlap, R. E., & Van Liere, K. D. (1978). The new environmental paradigm: A proposed measuring instrument and preliminary results. *The Journal of Environmental Education*, *9*(4), 10–19. doi:10.1080/00958964.1978.10801875

Dunlap, R. E., Van Liere, K. D., Mertig, A. G., & Jones, R. E. (2000). Measuring endorsement of the new ecological paradigm: A revised NEP scale. *The Journal of Social Issues*, *56*(3), 425–442. doi:10.1111/0022-4537.00176

Eagly, A. H., & Chaiken, S. (1993). *The Psychology of Attitudes*. Fort Worth, TX: Harcourt Brace Jovanovich.

Envirelation. (2007). *Willard InterContinental Washington D.C. 2007 Sustainability Report*. Washington, DC: Intercontinental Hotels Group.

Enz, C. A., & Siguaw, J. A. (1999). Best hotel environmental practices. *Cornell Hospitality Quarterly*, *40*(5), 72–77. doi:10.1177/001088049904000511

Farj, E., & Martinez, E. (2007a). Impact of environmental knowledge on ecological consumer behavior. *Journal of International Consumer Marketing*, *19*(3), 73–102. doi:10.1300/J046v19n03_05

Finisterra do Paco, A. M., Raposo, M. L., & Leal Filho, W. (2009). Identifying the green consumer: A segmentation study. *J Target Meas Anal Mark*, *17*(1), 17–25. doi:10.1057/jt.2008.28

Fishbein, M., & Ajzen, I. (2010). *Predicting and Changing Behavior: The Reasoned Action Approach*. New York, NY: Psychology Press.

Green Hotels Association. (n.d.). *What are green hotels?* Retrieved October 10, 2008, from http.//www.greenhotels.com/whatare.htm

Gronhoj, A., & Olander, F. A. (2007). Gender perspective on environmentally related family consumption. *Journal of Consumer Behaviour*, *6*(4), 218–235. doi:10.1002/cb.216

Ham, S., & Han, H. (2012). Role of perceived fit with hotels' green practices in the formation of customer loyalty: Impact of environmental concerns. *Asia Pacific Journal of Tourism Research*, *18*(7), 731–748. doi:10.1080/10941665.2012.695291

Han, H., Hsu, L. T. J., & Lee, J. S. (2009). Empirical investigation of the roles of attitudes toward green behaviors, overall image, gender, and age in hotel customers eco-friendly decision-making process. *International Journal of Hospitality Management*, *28*(4), 519–528. doi:10.1016/j.ijhm.2009.02.004

Han, H., Hsu, L.-T. J., Lee, J.-S., & Sheu, C. (2011). Are lodging customers ready to go green? An examination of attitudes, demographics, and eco-friendly intentions. *International Journal of Hospitality Management*, *30*(2), 345–355. doi:10.1016/j.ijhm.2010.07.008

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Han, H., Hsu, L. T. J., & Sheu, C. (2010). Application of the Theory of Planned Behaviour to green hotel choice. Testing the effect of environmental friendly activities. *Tourism Management*, *31*(3), 325–334. doi:10.1016/j.tourman.2009.03.013

Hedlund, T. (2011). The impact of values, environmental concern, and willingness to accept economic sacrifices to protect the environment on tourists' intentions to buy ecologically sustainable tourism alternatives. *Tourism and Hospitality Research*, *11*(4), 278–288. doi:10.1177/1467358411423330

Holden, A. (2005). Achieving a sustainable relationship between common pool resources and tourism: The role of environmental ethics. *Journal of Sustainable Tourism*, *13*(4), 339–352. doi:10.1080/09669580508668561

Hopkins, M. S., & Roche, C. (2009). What the 'green' consumer wants. *MIT Sloan Management Review*, *50*(4), 87.

ITP. (2013). *Going Green, Minimum standards towards a sustainable hotel*. Retrieved from http.//www.tourismpartnership.org/images/content/downloads/pdf/going_green_english_final.pdf?phpMyAdmin=Zd1KntrIWrp5naH36prpqkf%2Cai0&phpMyAdmin= cpubnqEvF6EtPsurLpUs99ncVv3

Iwanowski, K., & Rushmore, C. (1994). Introducing the eco-friendly hotel. *The Cornell Hotel and Restaurant Administration Quarterly*, *35*(1), 34–37.

Kalafatis, S. P., Pollard, M., East, R., & Tsogas, M. H. (1999). Green marketing and Ajzen's theory of planned behavior. Cross market examination. *Journal of Consumer Marketing*, *16*(5), 441–460. doi:10.1108/07363769910289550

Kang, K. H., Stein, L., Heo, C. Y., & Lee, S. (2012). Consumers' willingness to pay for green initiatives of the hotel industry. *International Journal of Hospitality Management*, *31*(2), 564–572. doi:10.1016/j.ijhm.2011.08.001

Kasim, A. (2004). Socio-environmentally responsible hotel business: Do tourists to Penang Island, Malaysia care? *Journal of Hospitality & Leisure Marketing*, *11*(4), 5–28. doi:10.1300/J150v11n04_02

Kasim, A. (2009). Managerial attitudes towards environmental management among small and medium hotels in Kuala Lumpur. *Journal of Sustainable Tourism*, *1*, 1–17.

Kasimu, A. B., Zaiton, S., & Hassan, H. (2012). Hotels involvement in sustainable tourism practices in Klang Valley, Malaysia. *International Journal of Economics and Management*, *6*(1), 21–34.

Kirk, D. (1995). Environmental management in hotels. *International Journal of Contemporary Hospitality*, *7*(6), 3–6. doi:10.1108/09596119510095325

Klo¨ckner, C. A. (2013). A comprehensive model of the psychology of environmental behaviour – A meta-analysis. *Global Environmental Change*, *23*(5), 1028–1038. doi:10.1016/j.gloenvcha.2013.05.014

Laroche, M., Bergeron, J., & Barbaro-Forleo, G. (2001). Targeting consumers who are willing to pay more for environmentally friendly products. *Journal of Consumer Marketing*, *18*(6), 503–520. doi:10.1108/EUM0000000006155

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Laroche, M., Bergeron, J., & Barbaro-Forleo, G. (2001). Targeting consumers who are willing to pay more for environmentally friendly products. *Journal of Consumer Marketing*, *18*(6), 503–520. doi:10.1108/EUM0000000006155

Lee, K. (2008). Opportunities for green marketing: Young consumers. *Marketing Intelligence & Planning*, *26*(6), 573–586. doi:10.1108/02634500810902839

Lee, S. M., Honda, H. C., Ren, G., & Lo, Y. C. (2016). The Implementation of Green Tourism and Hospitality. *Journal of Tourism & Hospitality (Los Angeles, Calif.)*, *5*, 233. doi:10.4172/2167- 0269.1000233

Lee, T. H. (2011). How recreation involvement, place attachment and conservation commitment affect environmentally responsible behavior. *Journal of Sustainable Tourism*, *19*(7), 895–915. doi:10.1080/09669582.2011.570345

Lee, W. L., & Moscardo, G. (2005). Understanding the impact of ecotourism resort experiences on tourists' environmental attitudes and behavioural intentions. *Journal of Sustainable Tourism*, *13*(6), 546–565. doi:10.1080/09669580508668581

Lita, R. P., Surya, S., Ma'ruf, M., & Syahrul, L. (2014). Green Attitude and Behavior of Local Tourists towards Hotels and Restaurants in West Sumatra, Indonesia. *Procedia Environmental Sciences*, *20*, 261–270. doi:10.1016/j.proenv.2014.03.033

Lyer, G. (1999). Business, customers and sustainable living in an interconnected world: A multilateral ecocentric approach. *Journal of Business Ethics*, *20*(4), 273–288. doi:10.1023/A:1006095304996

Mair, J. (2011). Exploring air travelers' voluntary carbon-offsetting behavior. *Journal of Sustainable Tourism*, *19*(2), 215–230. doi:10.1080/09669582.2010.517317

Manaktola, K., & Jauhari, V. (2007). Exploring consumer attitude and behaviour towards green practices in the lodging industry in India. *International Journal of Contemporary Hospitality Management*, *19*(5), 364–377. doi:10.1108/09596110710757534

Mensah, I. (2008). *Environmental management practices in US hotels*. Retrieved from http.//www.hotel-online.com/News/PR2004 2nd/May04 EnvironmentalPractices.html

Musa, G., Seng, W. T., Thirumoorthi, T., & Abessi, M. (2011). The influence of scuba divers' personality, experience, and demographic profile on their underwater behavior. *Tourism in Marine Environments*, *7*(1), 1–14. doi:10.3727/154427310X12826772784757

Oliver, J. D., Naar, A., & Harris, E. (2015). Festival attendees' perceptions of green hotel practices. *Journal of Tourism Insights*, *6*(1), 1–26. doi:10.9707/2328-0824.1051

Ramchurjee, N. A. (2013). Understanding the relationship between tourists' motivations and their experience and satisfaction. *International Journal of Development and Sustainability*, *2*(3), 1758–1769.

Ramchurjee, N. A., & Suresha, S. (2014). Contribution of Tourists' Environmental Behaviors towards Green Tourism in Mysore, India, *Midas Touch International Journal of Commerce. Management and Technology*, *2*(1), 239–249.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Robert, J. A. (1996). Green consumers in the 1990s: Profile and implications for advertising. *Journal of Business Research*, *36*(3), 217–232. doi:10.1016/0148-2963(95)00150-6

Singh, S. D. (2011). A study of consumer behavior of elderly consumers with special reference to green products. *International Journal of Management & Information Systems*, *15*(4), 101–104.

Stern, P. C., Dietz, T., & Guagnano, G. A. (1995). The new ecological paradigm in social-psychological context. *Environment and Behavior*, *27*(6), 723–743. doi:10.1177/0013916595276001

Straughan, R., & Roberts, J. (1999). Environmental segmentation alternatives: A look at green consumer behaviour in the new millennium. *Journal of Consumer Marketing*, *16*(6), 558–575. doi:10.1108/07363769910297506

The Center for Environmental Leadership. (2003). Retrieved from http://www.conservation.org/projects/Pages/Center-for-Environmental-Leadership-in-Business.aspx

Tierney, P., Hunt, M., & Latkova, P. (2011). Do travelers support green practices and sustainable development. *Journal of Tourism Insights*, *2*(2), 5. doi:10.9707/2328-0824.1014

Watkins, E. (1994). Do guests want green hotels? *Lodging Hospitality*, 70-72.

World Commission on Environment and Development. (1987). *Our Common Future*. Report of the World Commission on Environment and Development, Published as Annex to General Assembly Document A/42/427, Development and International Co-operation. Environment.

WTTC (World Travel and Tourism Council). (2016). *Travel & Tourism. Economic Impact 2016 World.* Retrieved from https.//www.wttc.org/-/media/files/reports/economic impact research/regions 2016/world2016.pdf

Zografos, C., & Allcroft, D. (2007). The environmental values of potential ecotourists: A segmentation study. *Journal of Sustainable Tourism*, *15*(1), 44–66. doi:10.2167/jost572.0

Zurburg, R., Ruff, D., & Ninemeier, J. (1995). Environmental action in the United States lodging industry. *Hospitality and Tourism Educator*, *7*(2), 45–49.

This research was previously published in Managing Sustainable Tourism Resources edited by Debasish Batabyal, pages 219-245, copyright year 2018 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 42
Improving the Supply Chain (SC) Stream With Green Product Design (GPD) Strategy:
Green Supply Chain Management (GSCM)

Rodrigo Villanueva
Universidad Autonoma de Ciudad Juarez, Mexico

Emilio Jimenez-Macias
Universidad de la Rioja, Spain

Julio Blanco-Fernandez
Universidad de la Rioja, Spain

ABSTRACT

The current Supply Chain (SC) is under change. The traditional way to generate a product contained the following stages: product design, raw material selection, material transportation, manufacturability, distribution and disposition at end of life. Product design for instance, is considered an extremely important stage of a product, being that, it directs the way the product can potentially be managed along the SC. It defines the raw material to be used, the possible supplier to select, the industrial processes involved in its fabrication, the packaging for its transportation and the newest stage where the product reaches its end of life and needs to be disposed. The Product design then becomes Green Product Design (GPD), where energy, time, resources become critical for a company. GPD takes into account the whole product life cycle. This chapter presents the importance of having a GPD process into the SC, the way to incorporate it, and the benefits of implementing it into the SC.

INTRODUCTION

With the development of economic and the progress the industry of products conflicts arise between these two main drivers. The company´s economic gain faces the challenge to reduce energy consumption and environmental resource care. Today consumers have become more aware of environmental care and seek for products that are manufactured following green practices. Therefore, companies are motivated

DOI: 10.4018/978-1-5225-7915-1.ch042

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

to invest in strategies that will help address these highly changing needs and establish a competitive advantage among competitors.

Supply chain (SC) is a methodology that aims to achieve organizational goals, some authors are considering it as the new strategy for proficiency in this globalized world (Elgazzar, Tipi, & Hubbard, 2012; Ngai, Chau, & Chan, 2011) and supply chain management (SCM) is the group of activities that aims to plan, integrate and control those activities as a strategy. Nevertheless, with the increasing worldwide awareness of environmental care, a green production has become an important metric for almost every manufacturer, so the SCM is turning into green supply chain management (Lee, 2009; Mark & Anton, 2014).

A more sustainable supply chain performance is indicated by a company's capacity to reduce the use of materials, energy or water and to find solutions that are more eco-efficient by improving the management of their supply chains (Ortas, Moneva &, Alvarez, 2014).

The general idea is that the use of green operational practices reduces energy consumption and waste, consequently producing higher revenues. Among these practices, Green product design (GPD) is one of the main themes in the literature on environmental management (Albino, Balice & Dangelico, 2009).

The introduction of GPD is undoubtedly one of the new trends in industry as significantly influences the cost of manufacturing a product throughout the SC. The main goal of GPD is the reduction of environmental impacts in each stage of any product's life cycle and in parallel will bring benefits for the company like: reduction of energy consumption, less waste disposal, less resources consumption, improved social and corporate image and therefore more revenue. Therefore, the purpose of chapter is to provide an input regarding the importance that GSCM via GPD brings to any company's SC.

The chapter is organized as follows: Section 1 Introduction, 2 incorporates a description of Supply Chain, Supply Chain Management and examples of application and success, Section 3 presents the description of Green Supply Chain Management and overview of the components, examples of applicability and success and the potential competencies, Section 4 describes Green Product Design, its practices, benefits, and process and a way to implement into a SC, closing with Section 5 Conclusions and remarks.

Supply Chain (SC)

The SC is the sequence of events that cover the entire lifecycle of a product or service from beginning (raw material distribution) to end (final customer use) according to Blanchard (2010). Therefore, SC includes all of the tasks involved directly or indirectly in fulfilling a customer´s need.

The SC can be extremely complex as it integrates independent organizations that work together to develop, control and manage a product (Wu, Chen & Hsieh, 2012). The integration of independent companies lead for SC to become an important element in current global economy, SC is the new strategy for competence (Ngai et al., 2011).

The supply chain is integrated by three main components (Villanueva-Ponce, Romero-González & Alor-Hernández, 2014)

- Supplier (raw material)
- Manufacturer (product)
- Distributor (to end user)

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

As seen in Figure 1, the point of start of a SC begins with the supplier of a determined raw material followed by the manufacturer and the distributor.

Supplier Selection

Suppliers have a direct influence on final product quality, final cost and delivery time. Therefore, represent a very important link in any GSCM system, and the selection of the right supplier is crucial for a successful SC. The supplier selection process (SSP) involves evaluation and selection task where the performance of a group of suppliers is measured. The evaluation will be defined by the product requirements, and generally a group of experts assess the set of attributes.

The criteria to be considered when selecting a supplier will be defined by the SC's needs and product requirements. Due to the multiple attributes, the common techniques used for supplier evaluation are classified as multi-attribute decision making because they permit to evaluate simultaneously those attributes (Shaw, Shankar & Yadar, 2012). However, during the last decades, traditional approaches for selecting suppliers have only considered the quality, cost and lead time, but nowadays, those attributes are no longer enough to choose the right supplier and companies need to incorporate more and newer attributes such as environmental characteristics into the common supplier selection criteria.

Table 1 illustrates a list of attributes used when evaluating a supplier with a multicriteria technique in a literature review from 2009 to 2015 including non-disclosed environmental attributes.

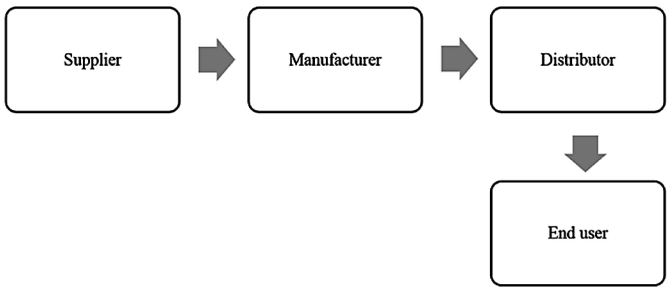
For a deeper discussion about the supplier selection process, the multicriteria techniques & tendencies, readers can review the reports from (Chai, Liu & Ngai, 2013) and for green supplier selection, the newest tendencies appear in (Govindan, Rajendran, Sarkis & Murugesan, 2013).

Manufacturing

One of the strategies used during this important step in the design flow is Design for Manufacturing (DFM) and Design for Assembly (DFA) which integrated form Design for Manufacturing and Assembly (DFMA) as one common activity. The objective is to design a product that is easily and economically manufactured. The importance of designing for manufacturing is given due to the fact that a great part of manufacturing costs of a product are caused by the design step.

For each assembly component, there is opportunity for an assembly challenge to reduce complexity. The importance of this is to eliminate waste, variation, complexity, and avoid using different sizes, shapes or colors so the operators and automated processes can easily complete the fabrication step.

Figure 1. Supply chain



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 1. Main attributes evaluated in traditional supplier selection process

Attributes	Year							Total
	2009	2010	2011	2012	2013	2014	2015	
Price	15	13	22	16	22	5	18	**111**
Quality	12	14	19	15	17	4	19	**100**
Delivery	9	10	19	16	17	2	15	**88**
Aftermarket Service	3	5	10	5	8	2	3	**36**
Management	1	1	6	10	0	0	4	**22**
Relationship with supplier	5	2	7	3	0	0	7	**24**
Flexibility	1	4	2	7	0	0	4	**18**
Capacity	1	0	1	3	6	3	3	**17**
Risk	2	0	3	3	4	1	4	**17**
Environmental impact	0	1	1	2	3	3	13	**23**
Security	1	0	0	4	0	0	0	**5**
Performance	0	0	0	2	2	1	0	**5**
Finances	0	0	0	4	0	0	2	**6**
Warranty	0	0	0	0	2	0	0	**2**
Rate	0	0	0	0	2	0	0	**2**
Government facilities	1	0	0	0	0	0	0	**1**
Transport facilities	0	0	0	1	0	0	0	**1**
Experience	0	0	0	0	1	0	0	**1**
Technology	0	0	0	0	1	0	7	**8**
Geographical position	0	0	0	0	0	0	4	**4**

The following guidelines should be followed when designing for manufacturing:

1. Understand the product. The need to have a vast understanding of the product will lead to a better result on the design and in consequence to the steps to fabricate the product.
2. Minimize total number of components. The reduction of the number of parts in a product is potentially the best opportunity for reducing manufacturing costs. A final assembly formed out of less parts represents a reduction of materials, purchased components, processes to assemble, handling, process time, quality inspection, testing among others.
3. Develop a modular design. The use of modules in product design simplifies manufacturing activities like assembly, maintenance, inspection, service or rework. Modules add flexibility to product update in the redesign process.
4. Use of standard components. Standard components help reduce the cost as these can be reused instead of generating new custom-made items for every new assembly to launch reducing product lead time.
5. Design parts for multiple use. Focus on design a part that can be used in different applications, it is necessary to identify the parts that are suitable for multiple use. This step is aimed to define a set of standard part families from which multiple use parts are created.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

6. Minimize handling. When assembling a part it drives additional process time to position, orient, fixate or joint components. Therefore, the use of indexing features, guiding posts are needed to help on the orientation of a part.
7. Minimize the variations. The utilization of standard components whenever possible is a must. In a final assembly that needs certain types of fasteners, it should be avoided the similarity of components and keep a standard one for all the activities.
8. Minimize assembly directions. All parts should be assembled from one direction if possible. The desired way to add additional components if a top down operation, in this way, the effects of gravity help the assembly process, instead of having to compensate the other way around.
9. Packaging of product compliance. When designing the product, try to minimize the flow of material waste, parts, and so on, in the manufacturing operation; also, take packaging into account, select appropriate and safe packaging for the product.

Distribution

The distribution flow ensures that the level of quality determined by the manufacturer is maintained throughout the distribution network in the SC. As a result, all the products are distributed to retail stores, automotive industry, and others selling the product to the general public without any alteration of their properties. The distribution should be defined according to the properties of the product being transported. These requirements and properties should be kept intact from shipment to delivery to its final customer. The distribution should be implemented through a quality system operated by the distributor or wholesaler to ensure that:

- Products are in good care.
- Storage conditions are observed at all times.
- Contamination from or of other products is avoided.
- Products are stored in appropriately safe and secure areas.
- Packaging will withstand the transportation.
- Packaging can be designed in a way to eliminate waste.

In addition, the distribution quality system should ensure that the products are delivered to the final destination within a satisfactory time period.

Supply Chain Application

Due to the recent rapid growth of consumers demanding newer, improved, flexible, modern, and custom made products, industry must switch into a more innovative, faster and more flexible way of being that could offer a wide variety of products to satisfy modern demands. The way to achieve these demands requires a boost in technology and a division of manual labor.

The globalization is a tactic that most companies have implemented in their operational activities to strengthen inner capabilities and be competitive. Driving the companies to outsourcing the activities that are not handled internally to improve their competitive advantage, any part of the SC could be integrated by different independent organizations located far from each other and still bring the most effective way to acquire raw material, manufacture and distribute a product.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

A company must focus in its sustainability by utilizing resources to meet the needs without compromising the future. Business sustainability signifies the resiliency of organizations over time where they are closely connected to healthy environmental, economic and social systems so they are better positioned to respond to internal or external shocks (Ahi & Searcy, 2013).

Increasingly, researchers in different fields are taking into account the influence and implications of business sustainability on traditional assumptions and practices in their fields, (Gimenez & Tachizawa, 2012). Sustainability is important for businesses and supply chains, as stakeholders are increasingly concerned about society, the environment and economic development (Golicic & Smith, 2013).

Supply Chain Management is one of these research fields and an introduction is provided in the next subsection.

Supply Chain Management (SCM)

SCM is described as the management of a network of relationships within a firm and between interdependent organizations and business units consisting of material suppliers, purchasing, production facilities, logistics, marketing, and related systems that facilitate the forward and reverse flow of materials, services, finances and information from the original producer to final customer with the benefits of adding value, maximizing profitability through efficiencies, and achieving customer satisfaction (Stock & Boyer, 2009).

SCM is described as the management of the inputs of goods or services including arrange of activities not only within a single department in an organization but also from different departments and outside the organization, for final users from procurement of raw materials through to the end of the products' useful life (Eng, 2005). The systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole. (Mentzer, et al., 2001)

SCM encompasses the planning and management of all activities involved in sourcing and procurement, conversion, demand creation and fulfillment, and all logistic management activities (Gibson, Mentzer & Cook, 2005). Nonetheless, one of the most complete definitions of SCM is found in (Lummus, Krumwiede & Vokurka, 2001), they defined it as "all the activities involved in delivering a product from raw material through to the customer, including sourcing raw materials and parts, manufacturing and assembly, warehousing and inventory tracking, order entry and order management, distribution across all channels, delivery to the customer, and the information systems necessary to monitor all of these activities".

Based on all the previous authors described above, SCM in summary, is the management of an interconnected industry system involved in the provision of product and/or services required by an end consumer and comprehends all movement and storage of raw material, work-in-process inventory, and finished goods from point of origin to point of consumption.

As stated then SCM involves a wide number of activities and independent companies with the shared goal, and there is the need to minimize or eliminate the negative effects of the SC processes to the environment. The extension of the SC that includes activities that aim to reduce and eliminate the environmental impact of a product along its entire life cycle is defined as the Green Supply Chain Management and it is described in the next section.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Green Supply Chain Management (GSCM)

The current condition of the planet, the uncontrolled increment of population and the deterioration of the natural resources is diminishing the quality of life for all inhabitants to a dead end. One way of reducing the harm impact of this condition is by incorporating environmental care into supply chains. Green supply chain management (GSCM) practices are geared toward improving environmental performance (Mirhedayatian, Azadi & Farzipoor, 2014).

GSCM is a scheme by leading industrial companies, extending pressure on their suppliers to achieve certain levels of environmental performance, stimulating operational cooperation by all SC members. Nonetheless, all along the SC, the environmental impact must be evaluated, because only a collaborative work among SC partners leads to reduce environmental influence to a minimum and, at the same time, provide financial profits (Golicic et al., 2013). GSCM is a way for firms to achieve profit and market share objectives by lowering environmental impacts and increasing ecological efficiency (Buyukozkan & Cidci, 2012). GSCM tends to minimizing and preferably eliminating the negative effects of the SC on the environment (Andic, Yurt & Baltacioglu, 2012).

Thus, the general idea intended in GSCM is to reduce through the whole SC cycle: pollution, waste, energy consumption, and use of hazardous materials. In essence, GSCM is an important approach for organizations to manage their environmental and social responsibilities at the same time of fulfilling government regulations and public awareness of environmental protection.

Common procedures in GSCM begin applying a set of internal environmental policies conceived to obtain green purchasing practices with suppliers, good-practices in eco-design, cooperation and communication with customers, and investment recovery during production process and post-sale (Zhu, Sarkis, & Lai, 2008b), closing so the GSCM loop.

A lot of global enterprises have already adopted GSCM or are considering its adoption for such various factors as response to diverse environmental legislation and regulation, improvement of the image of their enterprise brand, work innovation, and cost reduction (Chun, Hwang & Byun, 2015).

GSCM Practices

There is a wide variety of application for GSCM in the industry. A lot of reports appear in literature informing about benefits obtained by a good GSCM philosophy with supplier participation, informing that green practices can result in immediate statistically significant gains in stock prices (Bose & Pal 2012).

A comprehensive approach to understand how the adoption of GSCM practices, including green sources, influences environmental and operational performance indicators is found in Lopes de Sousa, Cortegoso de Oliveira Frascareli, and Chiappetta Jabbour, (2015). They consider pertinent to study the relationship between the adoption of GSCM practices and the performance of companies, establishing that this relationship requires a more individualized perspective between each GSCM practice and performance indicators being studied.

Chinese car companies have experienced increasing environmental pressure while simultaneously recognizing various benefits and incentives to turn green SC (Zhu & Sarkis 2004, 2006).

UK organizations, that have a progressive attitude towards green SC, are also the most active operationally that is traduced in financial benefits (Yusuf, Gunasekaran, Musa, El-Berishy, Abubakar, & Ambursa, 2013).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Similarly when European Union's restriction on hazardous substances directive took effect in 2006, Hewlett-Packard anticipated this and invested money in finding alternatives, providing a competitive product and increasing profitability (Nidumolu, Prahalad, & Rangaswami, 2009).

A study reflecting the current developing country's automobile GSCM status is presented in Diabat and Khodaverdi, (2013). They show, the automobile industry has attempted to improve their economic, environmental, and sustainability performances simultaneously.

Yang, Lu, Haider and Marlow, (2013) present a study that provides an empirical assessment of internal green practices and external green collaboration in the container shipping. The study's main findings are that internal and external GSCM practices have a positive effect on all the environmental practices. On the other hand external practices have a greater influence on environmental practices than internal practices

Zhu, Sarkis and Lai, (2013), present a study of 396 Chinese manufacturers and the main drivers why these have adopted GSCM and they indirect way that these green practices improve the economic performance. The results also provide policy insights for professional organizations, regulators, and legislators to further promote GSCM.

Laosirihongthong, Adebanjo and Tan, (2013), examine the deployment of practices in the implementation of GSCM and analyze their impact on environmental, economic, and intangible performance by considering business strategy as organizational focus, they found that legislation was a consideration that resulted in companies enhancing their environmental, economic and intangible performance.

These are some of the main studies discussing the relationship between GSCM practices and performance to show the main indicators of this relationship. The next subsection presents a general overview of the GSCM elements.

GSCM Overview

There is a variety of practices that can be performed within GSCM. The scope of GSCM ranges with the supplier selection process through to manufacturer, end customer closing the loop with the reverse logistics that will feed the green product design (Villanueva-Ponce et al., 2015).

In this particular illustration it can be seen the way the GSCM manages the broad activities of the typical SC strategy involved in a product generation that may comprehend activities that involve selection of materials or disposition of a former product component in order to recover, recycle or reuse it to feed the cycle back to raw material supplier selection.

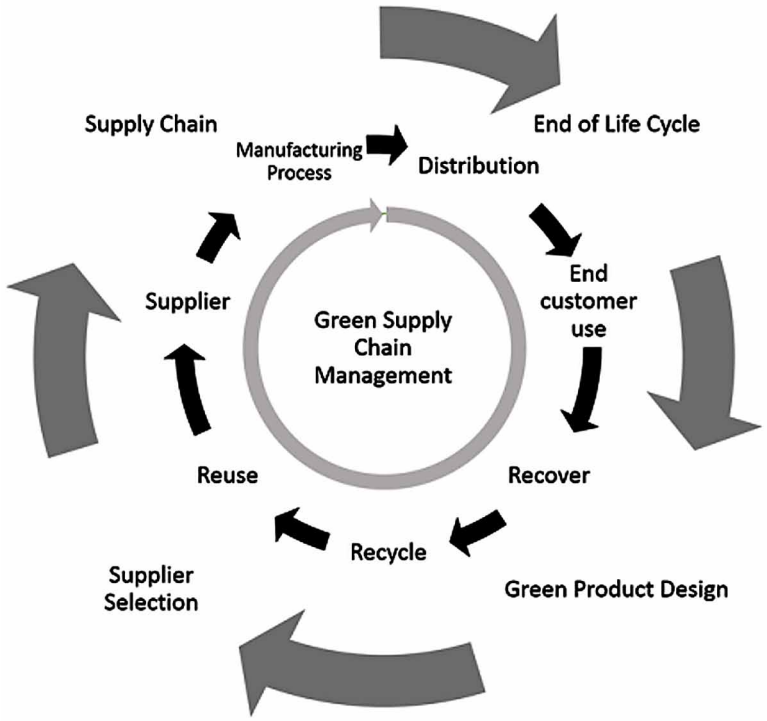
A brief description of the GSCM cycle is presented in the next subsections.

1. Supplier Selection

As described in the SC section, setting the correct supplier will impact along the entire SC. The supplier in the GSCM manages the same responsibility and has the same importance. The collaboration now in the activities extends to improve environmental performance for developing green products and innovations. The supplier such address activities such as recyclability, reusability, waste reduction, environmental material exchange, and hazardous material reduction. Companies have pushed suppliers to boost their environmental performance to assure that the materials being purchased are environmentally friendly and meet the needs.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 2. Green supply chain management



2. Supply Chain

A green SC can be defined as the extension of the traditional SC but including activities to reduce environmental impacts of a product all over its entire life cycle, such as green design, waste management, reuse, recycle, harmful material reduction among others. Green SC as the reduction of energy and virgin raw material usage and waste generation, and increasing product recovery options (El Saadany, Jaber &Bonney, 2011)

Therefore, green SC usually refers to the SC functions such as production, purchasing, materials management, warehousing and inventory control, distribution, shipping, and transport logistics now considering the impact to the environment.

3. End of Life Cycle

Refers to the operations like recycling, remanufacturing, and reuse adding complexity to the product design. Also the reverse logistics recovery process where products are collected from the end users and returned to the factory for a proper disposition, thus reducing manufacturing costs.

4. Green Product Design

Refers to activities whose intention is to decrease the negative environmental impacts of products during their entire life cycle. Green design is closely related to environmental risk management, product safety,

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

pollution prevention, resource conservation, and waste management. It emphases mainly on the returned products and materials from the point of use to back to the beginning of the SC.

GSCM Competencies

The percentage of companies that have established a GSCM in order to incorporate the ecological care is increasing. These firms do acknowledge the huge impact to the environment that needs to be reduce and have implemented a plan to respond to legislation, regulations and social concern. In some cases the bigger the company, the greater the interest in integrating a GSCM. The GSCM Competencies represent a broad set of activities.

Table 2 illustrates a list of competencies that main authors are enforcing when applying GSCM into their SC systems. It is observed that there are two competencies that are leading the list; the first is related to Green Product Design with 25 quotes, followed by Environmental Management with 20 quotes.

Table 2. GSCM competencies and main actions implemented review

Competency	Quotes	Authors
Green product design	25	(Amindoust, Ahmed, & Saghafinia, 2012); (Awasthi Cauhan, & Goyal, 2010); (Chia-Wei & Hu 2007); (Ge 2009); (Haiying 2011); (Hsu & Hu 2009); (Jabbour & Jabbour 2009a); (Kannan, Govindan, & Rajendran, 2015); (Kuo, Wang, & Tien, 2010); (Lee 2009); (Lee, Kang, Hsu, & Hung, 2009); (Li-yun & Yu-zhong 2008); (Lin 2013); (Mafakheri, Breton, & Ghoniem, 2011); (Sun, Wong, & Lee, 2013); (Tseng & Chiu 2013); (Weiwei & Lei 2012); (Wen & Chi 2010); (Xiangguo & Tongjuan 2011); (Xiaopeng & Changxin, 2009); (Xu, Kumar, Shankar, Kannan, & Chen 2013); (Yang & Wu 2007); (Yeh & Chuang 2011); (Yu-zhong & Li-yun 2008)
Green SCM, Environmental Management	20	(Amindoust et al. 2012); (Awasthi et al. 2010); (Bai & Sarkis 2010); (Chiou, Chan, Lettice, & Chung, 2011); (Haiying 2011); (Hsu et al. 2009); (Jabbour et al. 2009a); (Kannan et al. 2015); (Kumar & Jain 2010); (Kuo et al. 2010); (Lee et al. 2009); (Mafakheri et al. 2011); (Shaw et al. 2012); (Tseng & Chiu 2013); (Weiwei, et al. 2012); (Wen & Chi 2010); (Xiangguo & Tongjuan 2011); (Xiaopeng, et al. 2009); (Yeh, et al. 2011)
Environmental regulations certification	10	(Amindoust et al. 2012); (Chiou et al. 2011); (Haiying 2011); (Jabbour & Jabbour 2009a); (Li-yun & Yu-zhong 2008); (Thongchattu & Siripokapirom 2010); (Wang et al. 2009); (Wen & Chi 2010); (Wu et al. 2013); (Yang & Wu 2007)
Pollution control and production	9	(Amindoust et al. 2012);(Awasthi et al., 2010); (Bai & Sarkis 2010); (Kannan et al., 2013); (Lee et al., 2009); (Xiangguo & Tongjuan 2011); (Yuan, ZhiGeng, Sifeng, & Baohua, 2009); (Zhu & Sarkis 2006)
Recycling rate	8	(Amindoust et al., 2012); (Chiou et al., 2011); (Haiying 2011); (Lin 2013); (Wang et al., 2009); (Weiwei & Lei 2012); (Xiangguo & Tongjuan 2011); (Yeh & Chuang 2011)
Carbon emissions	8	(Choi 2013; Haiying 2011); (Hashemi, Karimi, Aghakhani, & Kalantar, 2013); (Hsu et al., 2013); (Hsu, Kuo, Chen, & Hu, 2011); (Kumar, et al., 2010); (Sazvar, Mirzapour, Al-e-hashem, Baboli, & Akbari, 2014); (Shaw et al. 2012)
Waste management	7	(Amindoust et al., 2012); (Chiou et al., 2011); (Ge, 2009); (Haiying, 2011); (Hsu & Hu 2009); (Kuo et al., 2010); (Weiwei & Lei 2012)
Inventory of hazardous substances	6	(Chiou et al., 2011); (Haiying, 2011); (Hsu & Hu 2009); (Hsu et al., 201)1; (Sun et al., 2013); (Weiwei & Lei 2012)
Energy consumption	5	(Amindoust et al., 2012); (Kannan et al., 2015); (Wang et al., 2009; Xiangguo & Tongjuan 2011)
Green Research and development	5	(Amindoust et al, 2012); (Awasthi et al., 2010); (Haiying 2011); (Hsu & Hu 2009); Tseng & Chiu 2013)
Green material coding	4	(Chiou et al., 2011); (Hsu & Hu 2009); (Shu-Jen et al., 2009); (Thongchattu & Siripokapirom 2010)
Green purchasing	3	(Lin 2013); (Shu-Jen et al., 2009); (Sun et al., 2013)

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Therefore, Green Product Design is acting as a one of the key competencies that needs to be explored in GSCM and will be described in the following sections of this chapter.

Green Product Design (GPD)

GPD can also be called design for the environment or eco design, refers to measures taken during product development resolve at minimizing a product's environmental effect during its whole life cycle. It is considered one of the GSCM activities as it integrates environmental aspects into the process of designing a part due to the fact that most of the environmental influences caused during manufacturing and disposal are direct effects of decisions taken at this early phase.

A green product is defined by the use of green design, green materials, green manufacturing processes, green packaging for distribution (Chan, 2011; Chu, Luh & Chen, 2009). Then GPD, is generally defined as the useful method to decrease the environmental impact of a product generation and it has become one of the most important practices for achieving sustainability (Johansson & Sundin, 2014; Khor & Udin, 2013; Luh, Chu, & Pan, 2010).

GPD is easy to say, but there are a number of restrictions because all the SC activities must be integrated (Baud-Lavigne, Agard, & Penz, 2014). There are many traditional ways to do things considering different scenarios or alternatives for the same product (Russo & Rizzi, 2014) and companies must be able to evaluate simultaneously many attributes in all these scenarios, focusing the efforts in saving energy through their SC, (Moon, Youn, Chang, & Yeung, 2013).

GPD takes into account the whole product life cycle considering the product's environment impact in the production, use, disposal and recycling process in addition to consideration of product features, performance, longevity, cost and other technical and economic attribute.

Companies that have adopted a green design process may have products that are easier to recover, recycle and reuse. For that reason unlike TPD flow only contains four steps as seen in the previous section, GPD contains three additional steps: recover, recycle, reuse. These are fed back into the concept design step directing the ongoing development of a new product based on the lessons learned of the last.

Green Product Design Practices

Wu and Ho, (2015), performed a study on green mobile phone design considering the environment, quality, cost and customer demand. Using fuzzy theory and quality planning. The case study found that customers' concerns focused on the toxicity of the phone material, the power consumption and the environmental impact of the battery.

Wang, Chan, and Li, (2015), performed a case study concerning a consumer electronic product performing a design evaluation. The approach presented in this research help companies decrease development lead time by screening out poor design options.

Zhu et al. (2013), present a study of 396 Chinese manufacturers and the main drivers why these have adopted GSCM and they indirect way that these green practices improve the economic performance. The study results show that designers and product developers are playing an important role in GSCM, where internal cross-functional cooperation and supply chain relationships should also be encouraged.

To reduce energy consumption, local governments have organized energy audits for those manufacturers consuming excessive energy, and forced these manufacturers to re-design their technologies and products (Zhu & Geng, 2013).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Diabat *et al.* (2013), applied a study to the automotive industry as they consider it has the strongest drivers and pressure to implement GSCM. It expresses that the developing country's automobile SC members have attempted to improve their economic, environmental, and sustainability performances simultaneously. Their study indicates that GPD, cooperation with customers, and reverse logistics are the top three main GSCM practices that can bring better GSCM performances.

Eltayeb, Zailani and Ramayahc, (2011), present a study of the relationship between GSCM practices and economic, intangible aspects, environmental and operational performance, they found that only GPD affects positively the correct environmental performance. GPD and reverse logistics positively affect cost reduction.

Yang *et al.* 2013, present a study that provides an empirical assessment of internal green practices and external green collaboration in the container shipping industry and how these variables influence their green performance and firm competitiveness. The study's main findings are that internal and external GSCM practices have a positive effect on all the environmental practices applied in this type of industry.

Green Product Design Benefits

Recently, many companies have acknowledged the concepts of green supply chain management and green product design, nevertheless, moderately little research attention has been devoted to the consideration of relations between greening the supply chain, environmental performance and competitive advantage. Due to this fact, this section provides information about companies improving their environmental performance enhancing their competitive advantage in the global market.

Villanueva-Ponce *et al.* (2015), present a structural equation model analysis of GSCM in the maquiladora sector based on the incorporation green attributes to the supplier selection. The study's main findings are that GPD has a direct and positive impact on corporate image and financial profit. This means that any product with a stronger internal GPD processes are more likely to have a greater extent of green performance and economic benefits. In addition GPD represents a key element in the increase GSCM activities within the organization.

Wu & Ho, (2015), performed a study on green mobile phone design considering the environment, quality, cost and customer demand, and determined the importance of product design in technical attributes. It is expected that limited corporate resources can be applied in the key technical factor, thus developing a product research and design model to balance economic development and environmental protection. Although the consideration of environmental factors in the product design stage may increase the development cost, the green products may be favored by customers, thus increasing market share and profits.

Chiapetta Jabbour, Jugend, Lopes de Sousa Jabbour, Gunasekaran, and Latan, (2015), developed a study to present and test a conceptual framework that describes the technical, human and organizational aspects of the adoption of GPD practices and the effect of these on firms' environmental, operational and market performance. It shows that the adoption of GPD impacts the environmental performance and is not exclusive to large companies, but for any company.

According to Montabon, Sroufe and Narasimhan, (2007), green strategy can be an incentive for companies to make continuous efforts on environmental improvements to their green performance beyond green regulations. Thereby, economic performance relates to the manufacturing plant's ability to reduce costs associated with purchased materials, energy consumption, waste treatment, waste discharge, and fines for environmental accidents (Wagner, 2008; Zhu et al., 2004; Zhu, Sarkis, & Lai, 2008a).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

According to Seman, Zakuan, Jusoh and Arif, (2012), greening is a new approach, idea, product, process or service that contributes to differentiation from competitors and reduces adverse environmental impacts. For a company to present growth in the future, green innovation is needed to create new markets because market forecasts indicate that these fields will experience above average growth in the next 10 years, thus providing potential and opportunities (Walz & Eichhammer, 2012).

Organizations need to adopt green practices to comply with the laws and regulations. However, these activities may take organizations above and beyond compliance, and help them develop competitive advantages and bring tremendous profit (Bose et al., 2012). For example, Clorox introduced the Green works line to address significant environmental concerns associated with the household cleaning products and by the end of the year, the line had grown the US natural cleaners market by 100% (Nidumolu, et al., 2009).

In addition social concern about environmental issues and global warming is causing consumers to demand the green products and companies need to improve their environmental performance improving its green image and thus, in higher sales and profits in the long term (De Giovanni & EspositoVinzi, 2012). Green operational activities in SC bring benefit for the members, and one of the most important is the corporate image (Hsu, Kuo, Chen, & Hu, 2013).

Green Product Design Implementation Process

Many buying firms are demanding that their suppliers implement GSCM practices and fulfill even additional environmental requirements. Supplier firms that have already implemented GPD are in a better position to win more business from large customer firms.

Green design can point the direction that each SC component will follow. Companies need to invest in the design core group and help develop an understanding of how design decisions impact the products' entire life cycle.

The GDP process is formed by four key items:

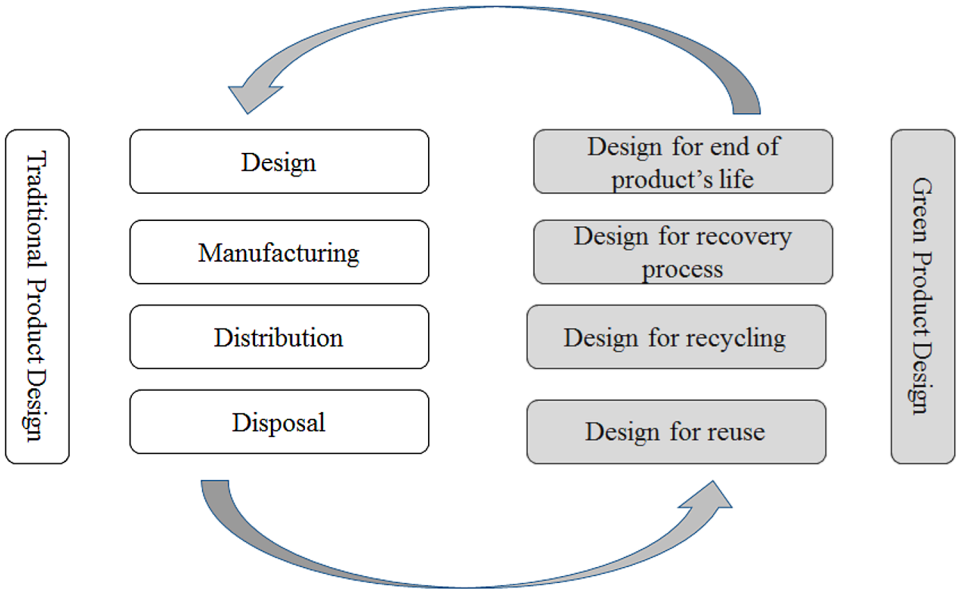
1. Design for end of product's life cycle.
    a. Aimed to reduce the environmentally hazardous materials at the end of life.
2. Design for recovery process.
    a. Intended to facilitate the return of the waste part back to the manufacturer for proper disposition.
3. Design for recycling.
    a. Pointed to facilitate the disassembly of the waste product and reprocessing of the material.
4. Design for reuse.
    a. Focused in the reuse of a product or component of it.

The GPD process and the Traditional Product Design (TPD) process are identical in their role of fulfilling basic needs. The goal is to conceptualize a design, manufacture it and deliver it to a final customer. There are notable differences between these two in terms of design process flow.

As seen in Figure 3, GPD process flow goes on each SC phase reducing the environmental impact of the product throughout all the entire life cycle.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 3. Green product design flow



1. Design for End of Product's Life Cycle

Defines the product longevity to assure the economic indicators, such as the value and environmental requirements in the product life cycle. At the same time, seeking the necessary reliability, security, and the service that the product will provide, all this in order to reduce resource consumption. The end of life cycle reflects the essence and core of green product design.

There are some initiatives that can be incorporated when disposal is reached:

- **The Extended Manufacturer Responsibility:** This is an approach designed to encourage the integration of environmental costs associated with goods throughout their life cycles into the market price of the products.
- **Recycling Program:** Basically an initiative set an easy way to establish the reduction of waste discharges to the environment by recycling a product.
- **Reuse Program:** This is the program that provides extra utilization to a product or components to an assembly.
- **E-Waste Recycling:** Nothing more than the approach to dispose of all the electronic devices in proper ways to avoid contamination to the land field or water.

2. Design for Recovery Process

Also called, reverse logistic process ensures that products are returned from the end customer to the manufacturer for its proper disposition. This process involves a big range of activities; collection, sorting, processing and reconditioning.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Companies use reverse logistic in order to collect the product at end of the life cycle. This strategy requires an extra effort for companies including the capacity to adapt this process to different social conditions (Khor et al., 2013). However, this strategy lets to companies to recycle parts and components in the product, because finally, companies are focused in obtain financial benefits and this concern never is forgotten in a GPD (Chu et al., 2009).

The models of reverse SC in the developed countries include three types:

1. **Manufacturer Take-Back (MT):** Requires the manufacturer building the enormous recycle network with an excessive cost trying to find ways to enhance the sustainability for future operational success.
2. **Retailer Take-Back (RT):** Retailer Take-Back (RT). Can effectively utilize the stronger marketing network of retailer, but the manufacturer has to face some coordinating problems with retailer.
3. **Third Party Take-Back (TPT):** In the case of enterprises are unable to invest building themselves reverse logistic systems, the trend is to outsource this activity to the third party.

3. Design for Recycling

Recycling is strongly connected to GPD. A proper green design of the product will result in an easy way to establish the recycling phase of it, and the reduction of waste discharges to the environment.

The recycle stage indicates the volume of used products that will be collected after the end of life cycle, and is continuously shorter.

4. Design for Reuse

Companies can achieve and be benefited by waste management, taking as an advantage the reuse of the initial product, reducing ecological risks, and improving process efficiency with the final result of creating products and processes that are environmental friendly throughout its life.

Incorporation of GPD into a SC

Converting the TPD process into a GPD process takes efforts. Going green is a term not well understood, and has many economic and technical implications from the materials being used to the type of energy, and the quantity being consumed.

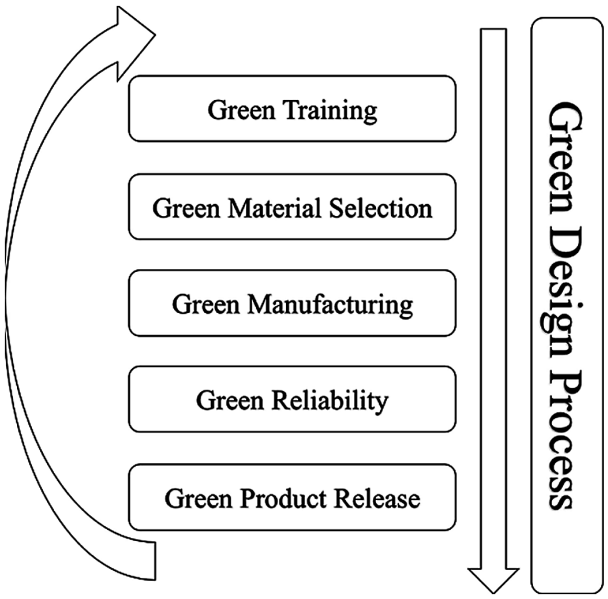
A product can be regenerated into a green one for its coming generations and the cycle that is followed to create a GPD process is shown in Figure 4.

1. Green Training (GT)

The first step into transforming TPD development is the GT. The personnel involved into the development of the product from its conception to release and final distribution needs to be educated into the green way of doing things. The approach is to find the right recipe to develop a product that will meet the quality of a regular product, the expected life cycle, the lower use of energy, the easy disassemble and the potential recycle and reuse at the end of its life.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 4. Green product design incorporation process



The technology, the method and tool research relating to a green product is important therefore there is imperative to conduct an environmental research. In the case of developing green material a publication needs to be issued in order to expand knowledge and establish investigation networks among the globe. GT should be strongly implemented in engineering and purchasing groups as these are in direct contact with suppliers.

a. Green Engineering Group

The Engineering group is formed by three areas that develop and manage the conception, process and finally control the manufacturing of any product.

- **Product Engineering Group:** The initiator of the concept, it has a close relationship with the rest of the departments within the company such as process, manufacturing and purchasing. This group needs to be trained to learn how its decisions impact the rest of the SC organisms. It is key to know what green materials can be used, reduce the number of components in one assembly to minimize the energy consumption and number or processes involved when manufacturing a product.
- **Process Engineering Group:** The importance of having a GT applied to this group relies on the need to teach the members of this group how to communize production processes or steps in order to eliminate redundant operations saving energy consumption and perhaps material waste.
- **Manufacturing Engineering Group:** This group is in charge of all the manufacturing of the product therefore the importance as to what materials can be reused with the existing manufacturing tools, what considerations need to be taken to avoid risks for the product being built, what disposal needs to be performed to the waste of the material and the recycling rate that some materials can offer.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

b. Green Purchasing

The purchasing department is extremely important due to the nowadays industrial globalization, where economic networks need to arise and manage the demanding market. Buyers are in the perfect position to identify an ecological hazard and generate requirements for suppliers to meet. Green standards in purchasing provide a basis for constructive negotiation with suppliers and should encourage the impulse of the activities with their own SC providers.

2. Green Material Selection (GMS)

The ISO 11496 specifies a system to uniform marking of products that have been fabricated from plastics materials; intended to help identify plastics products for subsequent decisions concerning handling, waste, recovery or disposal.

Material coding is also important when disposing the products that reached its end of life providing an immediate identification of hazardous from non-hazardous materials. For example, when applying a revision on material such as the automotive regulation of removing lead from all components and boards, a new part number should be assigned to distinguish them from lead-based ones.

Ever since the restriction on hazardous substances in regulations took effect, companies have put into a great number of resources and costs in respond to the management of hazardous substance after realizing that numerous certainties still exist in current management methods, the International Electro technical Commission (IEC) setup the Hazardous Substance Process Management (HSPM) standard, namely IECQ QC 080000 HSPM. Obtaining this certification can help companies mitigate risks associated with hazardous substances (Hsu & Hu 2009).

When switching to sustainable practices and greater use of organic natural materials, companies produce non-hazardous products, controls processes that can harm the environment diminishing the environmental impact. Therefore, GDP is a health concern and companies must no evade that responsibility (Smith & Yen, 2010).

3. Green Manufacturing (GM)

GM is a concept that is implementing the current industrial processes, its emphasis is on the use of green design of products reflected by reducing parts, rationalizing materials, using green raw materials, reusing components, using eco-friendly packaging among others. The main characteristic of GM is that minimizes waste and pollution throughout the complete manufacturing process.

It is vital for a company to enhance its ability of improving energy utilization efficiency through inner energy audit and energy management. All the current Lean Manufacturing methods which primary objective is to eliminate waste in a production process are associated with energy and resource consumption. In current GSC when selecting a supplier not only the well-known attributes are evaluated, also the green criteria is incorporated into the evaluation. In order to eliminate waste, there has to be a better use of the current industry resources when manufacturing the product.

GM is the only way of building products with sustainable development strategies using the modern technology and the lessons learned of previous processes and products.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

4. Green Reliability (GR)

Each aspect of going green has reliability implications due to the intrinsic reliability risks that arise when material properties, material substitutions or components replacement are incorporated. Companies have yet to understand the reliability aspects when going green. If a product fails prematurely, the guidelines call out how to dispose of the product, nevertheless reliability engineering offers solutions for preventing it from failing. Reliability engineering is going to play an important role in all the enterprises because they are trying to replace a current material used in a product that must be as good or better. Some of the emerging requirements are; higher reliability, warranty requirements, new materials properties.

To fulfilling the last requirements in GPD, some authors are focusing their research in determining the main tasks and activities for a successful GPD (Gmelin & Seuring, 2014). There is a consensus about the important role that human resources play, including the technician's knowledge and abilities the management commitment with resources supply (Wong, Lai, Shang, Lu, & Leung, 2012) and the supplier capacities, attributes and relationship (Khor et al. 2013).

CONCLUSION

The presented chapter brings initiatives and describes the current situation and potential growth of the GSCM and GPD in the industry. The GPD application studies presented in this work do present to have direct impact on firm's internal and external performance outcomes. Various studies found significant positive relationship between GPD and environmental outcomes. Designing green products, packaging and greening manufacturing processes, business organizations can generate benefits to the environment, in the form of reduced waste and better resource utilization, in parallel to economic benefits and cost reductions to the organizations. Inside the company, GPD practices have a significant effect in reducing consumption of hazardous materials and wastes that potentially may have negative effects internally. Outside the company, GPD practices have positive effect on the natural environment through reducing the use the amount of materials and energy that would be translated into emissions and wastes throughout product life cycle. This indicates that GPD practices can be of value to the organizations as well as to the external environment.

Therefore, GPD practices do play significant role in achieving economic, social and environmental requirements.

REFERENCES

Ahi, P., & Searcy, C. (2013). A comparative literature analysis of definitions for green and sustainable supply chain management. *Journal of Cleaner Production*, *52*, 329–341. doi:10.1016/j.jclepro.2013.02.018

Albino, V., Balice, A., & Dangelico, R. M. (2009). Environmental strategies and green product development: An overview on sustainability-driven companies. *Business Strategy and the Environment*, *18*(2), 83–96. doi:10.1002/bse.638

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Amindoust, A., Ahmed, S., Saghafinia, A., & Bahreininejad, A. (2012). Sustainable supplier selection: A ranking model based on fuzzy inference system. *Applied Soft Computing*, *12*(6), 1668–1677. doi:10.1016/j.asoc.2012.01.023

Andic, E., Yurt, O., & Baltacıoglu, T. (2012). Green supply chains: Efforts and potential applications for the Turkish market. *Resources, Conservation and Recycling*, *58*, 50–68. doi:10.1016/j.resconrec.2011.10.008

Awasthi, A., Chauhan, S. S., & Goyal, S. K. (2010). A fuzzy multicriteria approach for evaluating environmental performance of suppliers. *International Journal of Production Economics*, *126*(2), 370–378. doi:10.1016/j.ijpe.2010.04.029

Bai, C., & Sarkis, J. (2010). Integrating sustainability into supplier selection with grey system and rough set methodologies. *International Journal of Production Economics*, *124*(1), 252–264. doi:10.1016/j.ijpe.2009.11.023

Baud-Lavigne, B., Agard, B., & Penz, B. (2014). Environmental constraints in joint product and supply chain design optimization. *Computers & Industrial Engineering*, *76*, 16–22. doi:10.1016/j.cie.2014.07.014

Blanchard, D. (2010). *Supply Chain Management Best Practices* (2nd ed.). John Wiley and Sons.

Bose, I., & Pal, R. (2012). Do green supply chain management initiatives impact stock prices of firms? *Decision Support Systems*, *52*(3), 624–634. doi:10.1016/j.dss.2011.10.020

Buyukozkan, G., & Cidci, G. (2012). A novel hybrid MCDM approach based on fuzzy DEMATEL, fuzzy ANP and fuzzy TOPSIS to evaluate green suppliers. *Expert Systems with Applications*, *39*(3), 3000–3011.

Chai, J., Liu, J. N. K., & Ngai, E. W. T. (2013). Application of decision-making techniques in supplier selection: A systematic review of literature. *Expert Systems with Applications*, *40*(10), 3872–3885. doi:10.1016/j.eswa.2012.12.040

Chan, H. K. (2011). Green process and product design in practice. *Procedia: Social and Behavioral Sciences*, *25*, 398–402. doi:10.1016/j.sbspro.2012.02.050

Chia-Wei, H., & Hu, A. H. (2007). Application of analytic network process on supplier selection to hazardous substance management in green supply chain management. Industrial Engineering and Engineering Management, 2007 IEEE International Conference on. doi:10.1109/IEEM.2007.4419415

Chiapetta Jabbour, C. J., Jugend, D., Lopes de Sousa Jabbour, A. B., Gunasekaran, A., & Latan, H. (2015). Green product development and performance of Brazilian firms: Measuring the role of human and technical aspects. *Journal of Cleaner Production*, *87*, 442–451. doi:10.1016/j.jclepro.2014.09.036

Chiou, T.-Y., Chan, H. K., Lettice, F., & Chung, S. H. (2011). The influence of greening the suppliers and green innovation on environmental performance and competitive advantage in Taiwan. *Transportation Research Part E, Logistics and Transportation Review*, *47*(6), 822–836. doi:10.1016/j.tre.2011.05.016

Choi, T.-M. (2013). Optimal apparel supplier selection with forecast updates under carbon emission taxation scheme. *Computers & Operations Research*, *40*(11), 2646–2655. doi:10.1016/j.cor.2013.04.017

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chu, C.-H., Luh, Y.-P., Li, T.-C., & Chen, H. (2009). Economical green product design based on simplified computer-aided product structure variation. *Computers in Industry*, *60*(7), 485–500. doi:10.1016/j.compind.2009.02.003

Chun, S. H., Hwang, H. J., & Byun, Y. H. (2015). Green Supply Chain Management in the Construction Industry: Case of Korean Construction Companies. *Social and Behavioral Sciences*, *186*, 507–512.

De Giovanni, P., & Esposito Vinzi, V. (2012). Covariance versus component-based estimations of performance in green supply chain management. *International Journal of Production Economics*, *135*(2), 907–916. doi:10.1016/j.ijpe.2011.11.001

Diabat, A., Khodaverdi, R., & Olfat, L. (2013). An exploration of green supply chain practices and performances in an automotive industry. *International Journal of Advanced Manufacturing Technology*, *68*(1-4), 949–961. doi:10.100700170-013-4955-4

El Saadany, A. M. A., Jaber, M. Y., & Bonney, M. (2011). Environmental performance measures for supply chains. *Management Research Review*, *34*(11), 1202–1221. doi:10.1108/01409171111178756

Elgazzar, S. H., Tipi, N. S., Hubbard, N. J., & Leach, D. Z. (2012). Linking supply chain processes' performance to a company's financial strategic objectives. *European Journal of Operational Research*, *223*(1), 276–289. doi:10.1016/j.ejor.2012.05.043

Eltayeba, T. K., Zailani, S., & Ramayahc, T. (2011). Green supply chain initiatives among certified companies in Malaysia and environmental sustainability: Investigating the outcomes. *Resources, Conservation and Recycling*, *55*(5), 495–506. doi:10.1016/j.resconrec.2010.09.003

Eng, T.-Y. (2005). The influence of a firm's cross-functional orientation on supply chain performance. *Journal of Supply Chain Management*, *41*(4), 4–16. doi:10.1111/j.1745-493X.2005.04104002.x

Ge, Y. (2009). Research on Green Suppliers' Evaluation Based on AHP and#x00026; *Genetic Algorithm. International Conference on Signal Processing Systems*. doi:10.1109/ICSPS.2009.92

Gibson, B. J., Mentzer, J. T., & Cook, R. L. (2005). Supply chain management: The pursuit of a consensus definition. *Journal of Business Logistics.*, *26*(2), 17–25. doi:10.1002/j.2158-1592.2005.tb00203.x

Gimenez, C., & Tachizawa, E. M. (2012). Extending sustainability to suppliers: A systematic literature review. *Supply Chain Management: An International Journal*, *17*(5), 531–543. doi:10.1108/13598541211258591

Gmelin, H., & Seuring, S. (2014). Determinants of a sustainable new product development. Journal of Cleaner Production, 69, 1–9http://dx.doi. doi:10.1016/j.jclepro.2014.01.053

Golicic, S. L., & Smith, C. D. (2013). A meta-analysis of environmentally sustainable supply chain management practices and firm performance. *Journal Supply Chain Manage.*, *49*(2), 78–95. doi:10.1111/jscm.12006

Govindan, K., Rajendran, S., Sarkis, J., & Murugesan, P. (2013). Multi criteria decision making approaches for green supplier evaluation and selection: A literature review. *Journal of Cleaner Production*. doi:10.1016/j.jclepro.2013.06.046

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Haiying, C. (2011). The study of the suppliers evaluating and choosing strategies based on the green supply chain management. In Business Management and Electronic Information (BMEI), 2011 International Conference on, 13-15 May 2011 2011. doi:10.1109/ICBMEI.2011.5920377

Hashemi, S. H., Karimi, A., Aghakhani, N., & Kalantar, P. (2013). A grey-based carbon management model for green supplier selection. In Grey Systems and Intelligent Services, 2013 IEEE International Conference on, 15-17 Nov. 2013. doi:10.1109/GSIS.2013.6714815

Hsu, C.-W., & Hu, A. H. (2009). Applying hazardous substance management to supplier selection using analytic network process. *Journal of Cleaner Production*, *17*(2), 255–264. doi:10.1016/j.jclepro.2008.05.004

Hsu, C. W., Chen, S. H., & Chiou, C. Y. (2011). A model for carbon management of supplier selection in green supply chain management. In Industrial Engineering and Engineering Management (IEEM), 2011 IEEE International Conference on. doi:10.1109/IEEM.2011.6118115

Hsu, C.-W., Kuo, T.-C., Chen, S.-H., & Hu, A. H. (2013). Using DEMATEL to develop a carbon management model of supplier selection in green supply chain management. *Journal of Cleaner Production*, *56*, 164–172. doi:10.1016/j.jclepro.2011.09.012

Jabbour, A. B. L., & Jabbour, C. J. C. (2009a). Are supplier selection going green? Case of studies companies in Brazil. *Industrial Management & Data Systems*, *109*(4), 477–495. doi:10.1108/02635570910948623

Johansson, G., & Sundin, E. (2014). Lean and green product development: Two sides of the same coin? *Journal of Cleaner Production*, *85*, 104–121. doi:10.1016/j.jclepro.2014.04.005

Kannan, D., Govindan, K., & Rajendran, S. (2015). Fuzzy Axiomatic Design approach based green supplier selection: A case study from Singapore. *Journal of Cleaner Production*, *96*, 194–208. doi:10.1016/j.jclepro.2013.12.076

Khor, K. S., & Udin, Z. M. (2013). Reverse logistics in Malaysia: Investigating the effect of green product design and resource commitment. *Resources, Conservation and Recycling*, *81*, 71–80. doi:10.1016/j.resconrec.2013.08.005

Kumar, A., & Jain, V. (2010). Supplier selection: A green approach with carbon footprint monitoring. Supply Chain Management and Information Systems (SCMIS), 2010 8th International Conference on.

Kuo, R. J., Wang, Y. C., & Tien, F. C. (2010). Integration of artificial neural network and MADA methods for green supplier selection. *Journal of Cleaner Production*, *18*(12), 1161–1170. doi:10.1016/j.jclepro.2010.03.020

Laosirihongthong, T., Adebanjo, D., & Tan, K. C. (2013). Green supply chain management practices and performance. *Industrial Management & Data Systems*, *113*(8), 1088–1109. doi:10.1108/IMDS-04-2013-0164

Lee, A. H. I. (2009). A fuzzy supplier selection model with the consideration of benefits, opportunities, costs and risks. *Expert Systems with Applications*, *36*(2), 2879–2893. doi:10.1016/j.eswa.2008.01.045

Lee, A. H. I., Kang, H.-Y., Hsu, C.-F., & Hung, H.-C. (2009). A green supplier selection model for high-tech industry. *Expert Systems with Applications*, *36*(4), 7917–7927. doi:10.1016/j.eswa.2008.11.052

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Li-yun, W., & Yu-zhong, Y. (2008). TOPSIS method for green vendor selection in coal industry group. Machine Learning and Cybernetics, 2008 International Conference on. doi:10.1109/ICMLC.2008.4620683

Lin, R.-J. (2013). Using fuzzy DEMATEL to evaluate the green supply chain management practices. *Journal of Cleaner Production*, *40*, 32–39. doi:10.1016/j.jclepro.2011.06.010

Lopes de Sousa, A. B., Cortegoso de Oliveira Frascareli, F., & Chiappetta Jabbour, C. J. (2015). Green supply chain management and firms' performance: Understanding potential relationships and the role of green sourcingand some other green practices. *Resources, Conservation and Recycling*.

Luh, Y.-P., Chu, C.-H., & Pan, C.-C. (2010). Data management of green product development with generic modularized product architecture. *Computers in Industry*, *61*(3), 223–234. doi:10.1016/j.compind.2009.09.002

Lummus, R., Krumwiede, D., & Vokurka, R. (2001). The relationship of logistics to supply chain management: Developing a common industry definition. *Industrial Management & Data Systems*, *101*(8), 426–432. doi:10.1108/02635570110406730

Mafakheri, F., Breton, M., & Ghoniem, A. (2011). Supplier selection-order allocation: A two-stage multiple criteria dynamic programming approach. *International Journal of Production Economics*, *132*(1), 52–57. doi:10.1016/j.ijpe.2011.03.005

Mark, P., & Anton, S. (2014). Why Research In Sustainable Supply Chain Management Should Have No Future. *Jounal of Supply Chain Management*, *1*, 12.

Mentzer, J. T., DeWitt, W., Keebler, J. S., Min, S., Nix, N. W., Smith, C. D., & Zacharia, Z. G. (2001). Defining supply chain management. *Journal of Business Logistics*, *22*(2), 1–25. doi:10.1002/j.2158-1592.2001.tb00001.x

Mirhedayatian, S. M., Azadi, M., & Farzipoor, S. R. (2014). A novel network dataenvelopment analysis model for evaluating green supply chain management. *International Journal of Production Economics*, *147*, 544–554. doi:10.1016/j.ijpe.2013.02.009

Montabon, F., Sroufe, R., & Narasimhan, R. (2007). An examination of corporate reporting, environmental management practices and firm performance. *Journal of Operations Management*, *25*(5), 998–1014. doi:10.1016/j.jom.2006.10.003

Moon, K. K.-L., Youn, C., Chang, J. M. T., & Yeung, A. W.-H. (2013). Product design scenarios for energy saving: A case study of fashion apparel. *International Journal of Production Economics*, *146*(2), 392–401. doi:10.1016/j.ijpe.2013.02.024

Ngai, E. W. T., Chau, D. C. K., & Chan, T. L. A. (2011). Information technology, operational, and management competencies for supply chain agility: Findings from case studies. *The Journal of Strategic Information Systems*, *20*(3), 232–249. doi:10.1016/j.jsis.2010.11.002

Nidumolu, R., Prahalad, C. K., & Rangaswami, M. R. (2009). Why sustainability is now the key driver of innovation. *Harvard Business Review*, *87*, 56–64.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Ortas, E., & Moneva, J.M., & lvarez, I. (2014). Sustainable supply chain and companyperformance: A global examination. *Supply Chain Manage: An International Journal*, *19*, 332–350. doi:10.1108/SCM-12-2013-0444

Russo, D., & Rizzi, C. (2014). Structural optimization strategies to design green products. *Computers in Industry*, *65*(3), 470–479. doi:10.1016/j.compind.2013.12.009

Sazvar, Z., Mirzapour Al-e-hashem, S. M. J., Baboli, A., & Akbari Jokar, M. R. (2014). A bi-objective stochastic programming model for a centralized green supply chain with deteriorating products. *International Journal of Production Economics*, *150*, 140–154. doi:10.1016/j.ijpe.2013.12.023

Seman, N. A. A., Zakuan, N., Jusoh, A., Arif, M. S. M., & Saman, M. Z. M. (2012). The Relationship of Green Supply Chain Management and Green Innovation Concept. *Procedia: Social and Behavioral Sciences*, *57*, 453–457. doi:10.1016/j.sbspro.2012.09.1211

Shaw, K., Shankar, R., Yadav, S. S., & Thakur, L. S. (2012). Supplier selection using fuzzy AHP and fuzzy multi-objective linear programming for developing low carbon supply chain. *Expert Systems with Applications*, *39*(9), 8182–8192. doi:10.1016/j.eswa.2012.01.149

Shu-Jen, H., Sin-Ying, J., & Yu-Hua, L. (2009). Structural Equation Model for Brand Image Measurement of Jeans. Hybrid Intelligent Systems, 2009. HIS '09. Ninth International Conference on. doi:10.1109/HIS.2009.25

Smith, S., & Yen, C.-C. (2010). Green product design through product modularization using atomic theory. *Robotics and Computer-integrated Manufacturing*, *26*(6), 790–798. doi:10.1016/j.rcim.2010.05.006

Stock, J. R., & Boyer, S. L. (2009). Developing a consensus definition of supply chain management: A qualitative study. *International Journal of Physical Distribution & Logistics Management*, *39*(8), 690–711. doi:10.1108/09600030910996323

Sun, Z., Wong, T. N., & Lee, L. H. (2013). Using data envelopment analysis for supplier evaluation with environmental considerations. Systems Conference (SysCon), 2013 IEEE International. doi:10.1109/SysCon.2013.6549852

Tseng, M.-L., & Chiu, A. S. F. (2013). Evaluating firm's green supply chain management in linguistic preferences. *Journal of Cleaner Production*, *40*, 22–31. doi:10.1016/j.jclepro.2010.08.007

Villanueva-Ponce, R., Romero-González, J., & Alor-Hernández, A. (2014). Supplier Selection in a Manufacturing Environment. In *Lean Manufacturing in the Developing World* (pp. 122–138). Springer International Publishing Switzerland; doi:10.1016/j.jclepro.2015.09.013

Villanueva-Ponce, R., García-Alcaráz, J. L., Cortés-Robles, G., Romero-González, J., Jiménez-Macías, E., & Blanco-Fernández, J. (2015). Impact of suppliers' green attributes in corporate image and financial profit: Case maquiladora industry. *International Journal of Advanced Manufacturing Technology*, *80*(5-8), 1277–1296. doi:10.100700170-015-7082-6

Wagner, M. (2008). Empirical influence of environmental management on innovation: Evidence. *Europe Ecological Economics.*, *66*(2-3), 392–402. doi:10.1016/j.ecolecon.2007.10.001

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Walz, R., & Eichhammer, W. (2012). Benchmarking green innovation. *Miner Econ.*, *24*, 79–101. doi:10.100713563-012-0016-y

Weiwei, Z., & Lei, Z. (2012). Research on the selection of strategic supplier based on grey relation and multi level fuzzy evaluation in the electronics industry. Systems, Man, and Cybernetics. (SMC), 2012 IEEE International Conference on. doi:10.1109/ICSMC.2012.6377669

Wen, U. P., & Chi, J. M. (2010). Developing green supplier selection procedure: A DEA approach. In Industrial Engineering and Engineering Management (IEandEM), 2010 IEEE 17th International Conference on. doi:10.1109/ICIEEM.2010.5646615

Wong, C. W. Y., Lai, K.-H., Shang, K.-C., Lu, C.-S., & Leung, T. K. P. (2012). Green operations and the moderating role of environmental management capability of suppliers on manufacturing firm performance. *International Journal of Production Economics*, *140*(1), 283–294. doi:10.1016/j.ijpe.2011.08.031

Wu, Y.-H., & Ho, C. C. (2015). Integration of green quality function deployment and fuzzy theory: A case study on green mobile phone design. *Journal of Cleaner Production*, 1–10.

Wu, C. H., Chen, C. W., & Hsieh, C. C. (2012). Competitive pricing decisions in a two-echelon supply chain with horizontal and vertical competition. *International Journal of Production Economics*, *135*(1), 265–274. doi:10.1016/j.ijpe.2011.07.020

Wu, C.-M., Hsieh, C.-L., & Chang, K.-L. (2013). A Hybrid Multiple Criteria Decision Making Model for Supplier Selection. *Mathematical Problems in Engineering*, 8.

Xiangguo, M., & Tongjuan, L. (2011). Supplier selection analysis under the green supply chain. In Automation and Logistics (ICAL), 2011 IEEE International Conference on. doi:10.1109/ICAL.2011.6024713

Xiaopeng, L., & Changxin, Z. (2009). *Selection of suppliers of vehicle components based on green supply chain*. Industrial Engineering and Engineering Management; doi:10.1109/ICIEEM.2009.5344345

Xu, L., Kumar, D. T., Shankar, K. M., Kannan, D., & Chen, G. (2013). Analyzing criteria and sub- criteria for the corporate social responsibility-based supplier selection process using AHP. *International Journal of Advanced Manufacturing Technology*, *68*(1-4), 907–916. doi:10.100700170-013-4952-7

Yang, C.-S., Lu, C.-S., Haider, J. J., & Marlow, P. B. (2013). The effect of green supply chain management on green performance and firm competitiveness in the context of container shipping in Taiwan. *Transportation Research Part E, Logistics and Transportation Review*, *55*, 55–73. doi:10.1016/j.tre.2013.03.005

Yang, Y., & Wu, L. (2007). Grey Entropy Method for Green Supplier Selection. Wireless Communications, Networking and Mobile Computing. doi:10.1109/WICOM.2007.1150

Yeh, W.-C., & Chuang, M.-C. (2011). Using multi-objective genetic algorithm for partner selection in green supply chain problems. *Expert Systems with Applications*, *38*(4), 4244–4253. doi:10.1016/j.eswa.2010.09.091

Yu-Zhong, Y., & Li-Yun. (2008). Extension Method for Green Supplier Selection. Wireless Communications, Networking and Mobile Computing. doi:. doi:10.1109/WiCom.2008.1564

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Yuan, L. ZhiGeng, F., Sifeng, L., & Baohua, Y. (2009). The optimization of supply chain components' quality characteristics based on structural equation model. Grey Systems and Intelligent Services, 2009. GSIS 2009. IEEE International Conference on. doi:10.1109/GSIS.2009.5409992

Yusuf, Y. Y., Gunasekaran, A., Musa, A., El-Berishy, N. M., Abubakar, T., & Ambursa, H. M. (2013). The UK oil and gas supply chains: An empirical analysis of adoption of sustainable measures and performance outcomes. *International Journal of Production Economics*, *146*(2), 501–514. doi:10.1016/j.ijpe.2012.09.021

Zhu, Q., & Sarkis, J. (2004). Relationships between operational practices and performance among early adopters of green supply chain management practices in Chinese manufacturing enterprises. *Journal of Operations Management*, *22*(3), 265–289. doi:10.1016/j.jom.2004.01.005

Zhu, Q., & Sarkis, J. (2006). An inter-sectoral comparison of green supply chain management in China: Drivers and practices. *Journal of Cleaner Production*, *14*(5), 472–486. doi:10.1016/j.jclepro.2005.01.003

Zhu, Q., Sarkis, J., & Lai, K. (2008a). Confirmation of a measurement model for green supply chain management practices implementation. *International Journal of Production Economics*, *111*(2), 261–273. doi:10.1016/j.ijpe.2006.11.029

Zhu, Q., Sarkis, J., & Lai, K. (2008b). Green supply chain management implications for "closing the loop". *Transportation Research Part E, Logistics and Transportation Review*, *44*(1), 1–18. doi:10.1016/j.tre.2006.06.003

Zhu, Q., Sarkis, J., & Lai, K. H. (2013). Institutional-based antecedents and performanceoutcomes of internal and external green supply chain management practices. *Journal of Purchasing and Supply Management*, *19*(2), 106–117. doi:10.1016/j.pursup.2012.12.001

This research was previously published in the Handbook of Research on Managerial Strategies for Achieving Optimal Performance in Industrial Processes edited by Giner Alor-Hernández, Cuauhtémoc Sánchez-Ramírez, and Jorge Luis García-Alcaraz, pages 36-60, copyright year 2016 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 43
Ethical Practices, Buyer-Supplier Relationship, and Innovative Green Procurement Performance:
Some Exploratory Results

Surajit Bag
Tega Industries South Africa Pty Ltd., South Africa

V. G. Venkatesh
University of Waikato, New Zealand

Sunil Luthra
Government Engineering College, India

Neeraj Anand
University of Petroleum and Energy Studies, India

ABSTRACT

This study aims to examine how ethics and buyer-supplier relationship can contribute to enhanced innovative green procurement performance in the South African context. The hypotheses of this study were tested based on the data collected from manufacturing companies. Data collection involved convenience sampling and survey methodology in a research setting using procurement managers as subjects. The construct measures were based on existing measures and previous research studies. The reliability and validity of items were tested using exploratory factor analysis. Further the output of exploratory factor analysis was used as an input in the regression analysis using SPSS 20.0 version. The findings suggest that that supplier subtle practices; buyer-supplier bonding; continuous education and training and creativity and innovation are found to be strong determinants of innovative green procurement performance. The present study is unique in terms of scope and its contribution to both buyer-supplier relationship theory and practice.

DOI: 10.4018/978-1-5225-7915-1.ch043

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

INTRODUCTION

Procurement management is the management of external resources that are necessary for managing the primary and support processes of the organization (Van Weele, 2006). In today's dynamic business environment organizations mostly outsource business activities and therefore, procurement management has transformed into a functional domain of strategic relevance (Rajagopal and Bernard, 1993; Fernández and Kekale, 2007; Weele and Raaij, 2014). Gradually the concept of green procurement has evolved to meet the modern organizational requirements. Today, almost all world class organizations practice new and innovative eco-friendly methods of production (Bag, 2012). green procurement promotes sustainable production and consumption (Liu et al., 2012; Tanner and Kast, 2003). Recently, there has been increasing number of studies on Green procurement (Ehrgott et al., 2013; Kumar Sahu et al., 2014; Chekima et al., 2016; de Medeiros et al., 2016; Akhavan and Beckmann, 2017; Ateş et al., 2017; Bag and Gupta, 2017; Brewer and Arnette, 2017; Li and Huang, 2017; Yan et al., 2017).

Bag, (2016b) argued that collaboration, cooperation and coordination both with internal and external stakeholders enhance green procurement performance. It has been established that trust plays a critical role in the relationship between buyer-supplier relationship and innovative green procurement performance (Bag, in press). Also it is interesting to note that bringing the suppliers into confidence before taking any major decisions or initiating any new project strengthens the tie between buyers and suppliers by building a sense of confidence, pride and belongingness in the minds of the suppliers (Gupta and Narain, 2012). Therefore, it is evident that strong buyer-supplier relationships are necessary for improved innovative green procurement performance. However, every purchase decision has ethical, resource, waste and community impact implications (Young et al., 2010). So it is obvious that green procurement will also involve more ethical decision making at every stage of the procurement process.

Jonnes (1991) defined ethical decision as a decision that is both legal and morally acceptable to a bigger community. Interestingly, environmental or 'green' purchasing, and activities dealing with human rights such as purchasing from suppliers that use child labour and supplier deceitful and subtle practices are rarely mentioned in the ethics literature and is considered as a gap in the existing literature which further motivated the researchers to pursue the current study.

The purpose of the current study is to examine how ethics and buyer-supplier relationships can contribute to enhanced innovative green procurement performance in the South African steel and engineering industry.

This research has the following objectives, as follows:

- To identify various variables to Ethics from South African steel and engineering industry viewpoints;
- To identify various variables to Buyer-Supplier relationship from South African steel and engineering industry viewpoints;
- To understand relationships among identified variables to Innovative green procurement performance;
- To suggest a model for innovative green procurement performance from South African steel and engineering industry.

The chapter is organised as follows:

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Variables have been identified through reviewing procedure of relevant literature which has been presented in the *Literature Review*. Research methodology used in the present research has been explained in *Research Methods*. The results and discussions of this research are presented in *Data Analysis and Findings*. Conclusions drawn from the study, social implications and future research directions are provided in the *Conclusion*.

LITERATURE REVIEW

In this section, the review of literature is conducted considering selected papers from reputed journals such as *IJLRA, IJPE, IJPR, IJLSM, IJPM and SCM.* Authors have made an effort to discuss Ethics, Buyer-Supplier relationship and Innovative green procurement performance in the sub-sections.

Ethics

Jonnes (1991) defined ethical decision as a decision that is both legal and morally acceptable to a bigger community. Environmental factors (work, personal, professional, governmental, legal, and social) join individual attributes to affect the ethical decision process.

Rest (1986) presented a theory of individual ethical decision making that can easily be generalized to organizational settings.

Ethics is an important dimension of purchasing and supply management and forms a part of course curriculum in purchasing and supply management (PSM) courses. Birou et al. (2016) has conducted an interseting survey on purchasing and supply management courses and their teaching approaches. It was found that basic understanding of ethical and professional standards among PSM professionals is part of the learning objectives for undergraduate purchasing courses and normally instructors utilise average 3.25% of class time covering the topic on ethics.

It is worth to understand what basically influences purchasing ethical decisions. We know that values are one of the important dimensions of culture. Certain values particularly professional responsibility and beneficence are driving actions of purchasing professionals. Other values such as truth and justice are also important. Landeros and Plank, (1996) has shown the linkage of values to behaviours and the potential to better understand ethical versus unethical behaviours in terms of values and value tradeoffs.

Now, let us look into the ethics literature for selecting relevant studies and further developing the building blocks of the study.

Several researchers used innovative tools to capture the data more accurately. Wood, (1995) instead of using traditional open ended questionnaire, used an interesting methodology to capture richer insights of the organizational factors which influence ethical practices. Respondents were asked to mention one or multiple situations they have experienced where ethics were a major concern. Further they were also asked to explain how they resolved that situation effectively.

Cooper et al. (1997) conducted a study to firstly identify the key ethical issues faced by procurement professionals and secondly to identify various organizational factors which are helpful or presenting challenges to their working environment for acting ethically.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Carter (2000a) found that unethical practices in buyer supplier relationships are related to two broad categories of antecedents i.e. internal organizational characteristics and external, inter-organizational characteristics.

Carter (2000b) argued that a buyer's deceitful practices produce a significant, negative effect on supplier satisfaction, while there is no relationship between subtle practices and supplier satisfaction.

Another study by Ellis and Higgins (2006) offers a critique of the strategic consequences of Codes of Practice, specifically codes that have apparently been developed to guide ethical practices in supply chain management.

Karjalainen et al. (2009) explored the area of non-compliant purchasing behaviour, also known as "maverick buying": employees, both purchasing and non-purchasing, who buy goods and services outside of established contracts or procedures.

Eltantawy et al. (2009) concluded that strategic supply management skills and perceived reputation have a positive direct impact on performance. Supply management ethical responsibility is not directly affected by skills and has an indirect impact on performance through its positive relationship with perceived reputation.

From the above studies a conclusion can be drawn that ethical decisions lead to promote greater transparency and can be of great importance from green procurement perspective.

Buyer-Supplier Relationship

In the early nineties buyer-supplier relationship management started gaining more attention from supply chain researchers. Buyers gradually started reducing the supplier base and focused specifically on developing a handful number of strategic suppliers. In that process buyers treated key suppliers as close partners and started sharing confidential information, discussed long term growth and developmental plans with them. This lead to enhanced mutual dependency and ultimately more satisfaction is derived from the relationship (Moeller et al., 2006; Yazici, 2013; Hooshangi et al., 2016).

Burki and Buvik (2010) found that relationship duration is a significant antecedent in overcoming firm's difficulties in business relationships and also enhancing relationship quality. Rutherford et al., (2008) argued that buyer's perception of both the salesman and selling firm's commitment have a significant positive relationship with buyer's propensity to stay. Steward et al., (2010) found that buyer intraprenuerial ability and skills positively influences the quality of internal and external supplier relationships. Bag, (2016c) found that soft skills of green procurement workforce are essential for managing the green practices effectively.

Buyer-supplier relationship management can influence firm's performance with regard to innovation and operational efficiency (Revilla et al., 2013). Therefore supplier selection and evaluation criteria's must be carefully considered before finalizing a supplier. Perez-Arostegui et al. (2012) recommended to use reliability and quality as key criteria's' while selecting suppliers.

Previous researchers have used Institutional theory (Hemmert et al., 2016); Relational exchange (Srivastava and Singh, 2013); Principal-agent theory (Steinle et al., 2014; Wandfluh et al., 2016); Resource-based theories (Gualandris & Kalchschmidt, 2016); Transaction cost theory (Cox, 2007; Abd. Rahman et al., 2009); Agency theory (Norrman, 2008) and Social network theory (Bag, 2016a) as theoretical lens to study links in buyer-supplier relationship management.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Innovative Green Procurement Performance

Venkatesh and Luthra (2016) suggested manufacturing firms must consider procurement function as a strategic enabler for business sustainability.

Green procurement promotes business sustainability in terms of better inventory management, sustainability in production (producing first time right product and less wastage), and sustainability in distribution (Bag, 2016d).

Thus green procurement practices is all about considering social, environmental and financial aspects in making procurement decisions (Walker et al., 2012). From the recent research work in the area of green procurement it was found that green procurement practices cannot achieve success without integrating the component of innovation. Innovation must be intertwined in the fabric of green procurement for firms to become creative and go green effectively (Bag, 2016b). Now, readers may wonder why firms focus on innovative green procurement practices. It is certain that there are some pressures in the surrounding business environment which drives green procurement in organisations. From the literature it is evident that both regulatory pressures and market pressures are the critical green procurement drivers which ultimately enhance customer satisfaction (Dubey et al., 2013 and Luthra et al., 2014).

However, the success stories are few and most firms fail because they do not measure the innovative green procurement performance. Firms must focus both on green purchasing effectiveness and green purchasing efficiency which will ultimately lead to the final outcome i.e. enhanced innovative green purchasing performance.

Every firm has certain business objectives which further funnels down to operations and purchasing sub-objectives. Therefore, every firm need to measure performance to evaluate how far it is from the set goals. Also they must identify the strengths and weakness to further initiate performance improvements programs (Van Weele, 2006).

Firms must note that other than financial measures, non-financial measures also add significantly in the procurement performance (Kakwezi and Nyeko, 2010).

Green procurement and efficient order processing report (2015) shows that organizations with green procurement policies have more efficient order processing and higher numbers of purchase order line items processed. Therefore efficiency of green procurement process may be considered the first parameter for performance measurement.

Bag (in press) argued that there is more openness and transparency in the green procurement process which ultimately helps in improving trust in the buyer-supplier relationship. It includes discussing green procurement policy; publication of the results of the green procurement tendering process and discussing the long term strategies with key suppliers. So we may consider openness and transparency in the green procurement process as the second parameter for performance measurement.

Green procurement contract management is very essential to further avoid any conflict at a later stage. Developing green supplier scorecard system and periodical measurement of performance will help to derive the potential environmental and ethical benefits. Green procurement contract management and green supplier performance may be considered as the third parameter for performance measurement and indicators will include on time delivery, environmental quality management, ethics, relationship management and green contract management.

The professionalism of the procurement workforce may be considered as the fourth parameter for performance measurement. In case the procurement personnel are not competent to handle the complex

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

procurement activities, they will not be able to add value. The indicators include capacities and training of green procurement workforce.

Green procurement cost is the fifth parameter for performance measurement. UN Procurement Practitioner's Handbook shows that firms' can save directly or indirectly by implementing green procurement. However, it involves long-term efficiency savings and more efficient and effective use of natural resources.

Creativity and innovation is the sixth parameter for performance measurement. Unlike traditional procurement all modern procurement process includes sourcing ideas. Today creativity and innovation is considered the core of procurement competencies.

Theoretical Perspectives on Ethical Decision, Buyer-Supplier Relationship, and Innovative Green Procurement Performance

Supply management ethical responsibility antecedents include personal demographics of the buyer, top management support, presence of a company policy on ethics, periodic policy reviews, the amount of training that a buyer receives, sanctions against unethical behaviour, the length of time that the buying firm has had a relationship with a supplier, and the level of coordination that the buying firm has with a supplier (Eltantawy et al., 2009). Therefore, from the past studies it is established that ethical decision in procurement management is linked with buyer-supplier relationship management (i.e. length of relationship and level of coordination between buyer and supplier). Now, our next effort will be towards establishing a link with innovative green procurement performance. Organizations normally analyse carefully all possibilities associated with implementing a green procurement policy, such as potential environmental and ethical benefits.

Dubey et al. (2014) found that waste reduction through collaboration is a positive determinant of environmental performance. Innovative green procurement is used as a tool to enhance the economic, social and environmental development of recipient countries. Innovative green procurement seeks to follow a number of safeguards and checks in the procurement process to positively assist in the areas such as human rights, labour rights, environmental impacts, local entrepreneurship, empowerment women, poverty eradication and governance. In every step of innovative green procurement process ethical decision making is involved.

Dubey and Bag (2013) found that buyer-supplier relationship management is the positive determinant of environmental performance.

Therefore, on the basis of existing literature review it can be argued that ethical decision and buyer-supplier relationship influence innovative green procurement performance, here author propose the conceptual framework for the current study and further presented in Figure 1.

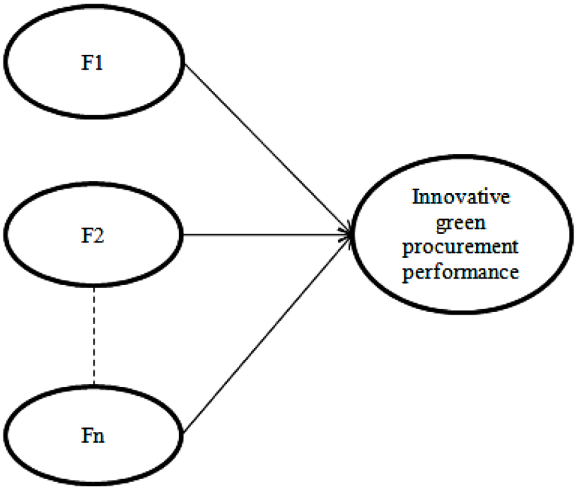
Research Hypotheses

The following hypothesis has been proposed based on the review of existing literature and further discussion with supply chain experts.

H1: Satisfaction with supplier relationship positively influences Innovative green procurement performance.
H2: Supplier subtle practices positively influence Innovative green procurement performance.
H3: Safety, health and environment positively influence Innovative green procurement performance.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 1. Research framework



H4: Buyer-supplier bonding positively influences Innovative green procurement performance.
H5: Supplier deceitful practices positively influence Innovative green procurement performance.
H6: Customer focus positively influences Innovative green procurement performance.
H7: Continuous education and training positively influences Innovative green procurement performance.
H8: Creativity and innovation positively influences Innovative green procurement performance.

RESEARCH METHODS

This section comprises the strategy adopted for data collection, identifying measures and conducting non-response bias testing for the study.

Data Collection

The survey instrument included dimensions of Ethics, Buyer-supplier relationship as well as Innovative green procurement specific constructs. The procurement managers of steel and engineering sector were selected to seek responses. The target sample frame consisted of South African firms who have successfully implemented innovative green procurement practices. The samples were derived on the basis of convenience sampling technique. In this case email survey method was employed. The initial email consisted of cover letter and the questionnaire. Email list has been compiled from Steel and Engineering Industries Federation of Southern Africa (SEIFSA) database.

Before questionnaire was finalized for final survey, it was pretested with ten experts from the industry who are having work experience for over fifteen years and professional members of Mining Industry association of South Africa (MIASA) and CILT SA. Based on the pretesting the questionnaire was slightly modified for more clarity of few items. The final instrument for the final survey was measured basically using a five point likert scale. The first section of the questionnaire includes questions on dimensions of Ethics in terms of thirteen items. The second section includes questions on dimensions of buyer-supplier

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

relationship in terms of twelve items. The third section includes questions on dimensions of Innovative green procurement practices in terms of seven items.

Initially, the questionnaire was sent to a sample size of 150 companies. Two weeks after sending the initial email, a gentle reminder email was sent to all potential respondents. Those respondents who did not reply within another 4 weeks were further telephoned and second friendly reminder was sent. In response, researcher received total 100 usable questionnaires, an effective response rate of 66.6%. The overview of responses is presented in Table 1.

Measures

Extensive literature review was conducted to identify the theoretical constructs for current study. Therefore, the constructs has been adopted from previously tested scales. Ethics captures the success of relationship between buyer-supplier relationship and innovative green procurement performance using seven key indicators as outlined by Landeros and Plank, (1996). Buyer-supplier relationship management includes trust, power, commitment and involvement (Giannakis, 2012).

The demand of innovative green procurement has been rapidly changing and firms have adopted more innovativeness to achieve the desired results. Firms use different tools and techniques to measure green procurement performance which differ from the traditional procurement process. The indicators related to this construct have been considered from past studies such as (Dubey et al., 2013; Blome et al., 2014; Bag, 2016b). This construct intend to measure the degree of openness and transparency of the green procurement process, green contract management and supplier performance, level of professionalism of the procurement workforce, green procurement costs and lastly the degree of creativity and innovation achieved from green procurement practices.

DATA ANALYSIS AND FINDINGS

This section presents the data analysis conducted for the research and the related findings.

Exploratory Factor Analysis

Before conducting the EFA analysis data exploration was carried out. Further the data was coded and all necessary assumptions of parametric tests were checked before conducting the data analysis.

In the first step data cleaning was done. All statements are checked for presence of any missing value. However, no missing values were found in the SPSS output. Secondly, the standard deviation of all responses was checked and no values were found to be zero.

Table 1. Sample overview

Type of Companies	Annual Turnover	n	Percentage
Exempted Micro Enterprise (“EME”)	< R10 million	25	25
Qualifying Small Enterprise (“QSE”)	<R50 million	35	35
Generic (‘GEN”)	>R50 million	40	40

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Thereafter, principal component analysis was run to conduct the exploratory factor analysis. Further, the anti image correlation and its diagonal elements was checked. For this purpose the results were copied and pasted in excel and by using conditional formatting so that values greater than 0.60 were highlighted. All diagonal elements were above 0.60 and therefore found fit for further analysis.

Next, we checked the communalities to see if all values are above 0.50 i.e 50%. The values are presented in Table 2 (see appendix). All values were above 50% and therefore all statements were retained for further analysis. The total variance explained by factors is presented in Table 3 (see appendix). The first factor explains more than 18 percent variance; second factor explains over 14 percent variance and third factor explains more than 10 percent variance followed by other 8 factors. Eigen values greater than 1 were only retained. Here 11 factors were retained and cumulative variance explained is more than 84 percent. Also Varimax rotation was done to equally distribute the variance. While running factor analysis the following two options were selected: sorted by size and suppress small coefficients. The component matrix is presented in Table 4 (see appendix). The results of rotated component matrix obtained have been presented in Table 5 (see appendix). Also the component transformation matrix is calculated and presented in Table 6 (see appendix).

Only values above 0.50 were retained and cross loadings were removed. The final 9 factors are presented in Table 7 (see appendix). Here, the reliability of factors was also checked and SPSS output indicates that the instrument and items are reliable for study.

Regression Analysis

Multiple linear regression analysis is conducted to test the functional relationship between variables.

The regression model can be represented in the form of a linear regression equation as:

$$F8=\beta0+\beta1F1+\beta2F2+\beta3F3+\beta4F4+\beta5F5+\beta6F6+\beta7F7+\beta9F9+e \quad (1)$$

$\beta0$ is the Innovative green procurement performance intercept, $\beta1$, $\beta2$, $\beta3$, $\beta4$, $\beta5$, $\beta6$, $\beta7$, $\beta9$ the slopes of F1, F2, F3, F4, F5, F6, F7, F9 and e= error

Regression Model

$$\text{Innovative green procurement performance (F8)} = 2.01+0.118F2+0.005F4+0.067F7+0.048F8+e \quad (2)$$

Table 8 (see appendix) shows the summary of regression model. The VIF value of regression output as shown in Table 8 is less than 5 which shows that regression output is relatively free from multicollinearity effect. From the regression analysis output it is found that Supplier subtle practices; Buyer-Supplier bonding; Continuous education & training and Creativity and innovation are found to be strong determinants of Innovative green procurement performance.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

CONCLUSION

Earlier studies in the field of green procurement have mostly focused in indentifying the drivers and barriers such as (Walker and Phillips, 2008; Eltayeb and Zailani, 2010; Datta et al., 2012; Tate et al., 2012; Dubey et al., 2013). The current study has put an effort to understand the critical factors influencing innovative green procurement performance. This study is unique in the sense that it has considered very important variables such as ethics and buyer-supplier relationship in the study. From the data analysis findings it is found that supplier subtle practice; buyer-supplier relationship; continuous education and training and creativity and innovation are strong determinants of innovative green procurement performance.

In the current study it has been found that supplier subtle practices improve innovative green procurement performance. Green suppliers asking buyer for information about their competitors may basically help suppliers to come up out with more competitive solutions at a competitive pricing. Secondly, if the green supplier approaches personnel in engineering, manufacturing, or other departments outside of purchasing may help them to gather more technical information which in most cases purchaser may not be able to provide. Again this may help the green suppliers in further developing a complete green package with the complete information gathered while interacting with several departments outside of purchase. Thirdly, green supplier need to increase the prices when there is a shortage of raw material or product in the market. This is necessary to sustain in the cut throat competition else the green supplier will lose money and will ultimately be out of the business. Fourthly, supplier offering gifts of nominal value to customers and buyers is basically seen as development of good relationships and is common in South African steel and engineering sector.

The second findings from the data analysis it that buyer-supplier bonding positively influences innovative green procurement performance. Trust and commitment plays a critical role in buyer-supplier relationship. Also compatibility between buyer and supplier is seen as an important variable for successful green procurement projects.

Another interesting point which came out of the analysis is that continuous education and training positively influences innovative green procurement performance. Green procurement workforce requires continuous education and training on a periodical basis to handle complex innovative green procurement process. Top management must provide full technological support and financial support for the success of green procurement project.

Final finding shows that creativity and innovation positively influences innovative green procurement performance. Increased sourcing ideas and analytical thinking is observed among South African buyers practicing innovative green procurement. Also creativity leads to new product development and which ultimately enhances customer satisfaction.

Social Implications

Innovation is considered as a basic mantra for survival in this highly competitive market. South African steel and engineering sector is spending millions of Rand (local currency) annually to innovate and come out with new product and service offerings. However, innovation cannot be sustainable until and unless it is in aligned with triple bottom line elements i.e. Economic, Social and Environmental dimensions. Previous studies have suggested that many companies are ignoring the social element which ultimately

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

influences the innovation performance in the long term. Innovative green procurement must consider the safety and health of workers and surrounding environment. It should also consider the wages, benefits of labours and factory staff. Finally, child labour practice which is prevalent in many African countries should be eliminated and children must get a healthy environment to study and become self dependent in life. South Africa is currently bleeding due to inflation and high rate of unemployment. Large corporations should develop more innovative green products and solutions and bring to local market at economic prices. This is only possible by developing a network of strategic suppliers and cooperation from final customers. Large corporations must contribute a percentage of profit for supporting the society. There are numerous small tool makers, engineering firms who must be supported by large corporations and these expenses can be covered under enterprise development and supplier development projects. This will ultimately enhance the Broad Based Black Economic Empowerment (BBBEE) score level of the large corporations which will benefit them in qualifying government tenders. Therefore, the country can only transform by joining hands together and helping each other.

Limitations and Future Research Directions

The current study suffers from certain limitations. The study was conducted among South African steel and engineering firms based in Gauteng district. Therefore, the results cannot be generalised. Secondly, convenience sampling technique was utilised for the purpose of data collection. Thirdly, cross sectional data was used for the study. To eliminate these limitations author proposes to use longitudinal data and considering different country and sector to validate the results.

REFERENCES

Abd. Rahman, A., Bennett, D., & Sohal, A. (2009). Transaction attributes and buyer-supplier relationships in AMT acquisition and implementation: The case of Malaysia. *International Journal of Production Research*, *47*(9), 2257–2278. doi:10.1080/00207540802471298

Akhavan, R. M., & Beckmann, M. (2017). A configuration of sustainable sourcing and supply management strategies. *Journal of Purchasing and Supply Management*, *23*(2), 137–151. doi:10.1016/j.pursup.2016.07.006

Ateş, M. A., van Raaij, E. M., & Wynstra, F. (2017). The impact of purchasing strategy-structure (mis) fit on purchasing cost and innovation performance. *Journal of Purchasing and Supply Management*. doi:10.1016/j.pursup.2017.05.002

Bag, S. (2012). World Class Procurement Practices and Its Impact on Firm Performance: A Selected Case Study of an Indian Manufacturing Firm. *Journal of Supply Chain Management Systems*, *1*(3), 27.

Bag, S. (2016a). Green strategy, supplier relationship building and supply chain performance: Total interpretive structural modelling approach. *International Journal of Procurement Management*, *9*(4), 398–426. doi:10.1504/IJPM.2016.077702

Bag, S. (2016b). Contextual Relationship among 3 Cs and Innovative Green Procurement Practices Using ISM and Its Validation Using MICMAC Analysis. *International Journal of Applied Logistics*, *6*(2), 33–50. doi:10.4018/IJAL.2016070102

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Bag, S. (2016c). Modeling the Soft Skills of Green Procurement Professionals using Interpretive Structural Modeling Approach. In Strategic Management of Sustainable Manufacturing Operations (pp. 120-131). IGI Global. doi:10.4018/978-1-5225-0350-7.ch006

Bag, S. (2016d). Building Theory of Green Procurement using Fuzzy TISM and Fuzzy DEMATEL Methods. *International Journal of Applied Management Sciences and Engineering*, *3*(2), 21–49. doi:10.4018/IJAMSE.2016070102

Bag, S. (in press). Buyer-Supplier Relationship and Trust theory in Innovative Green Procurement Practices. *International Journal of Logistics Systems and Management*.

Bag, S., & Gupta, S. (2017). Antecedents of Sustainable Innovation in Supplier Networks: A South African Experience. *Global Journal of Flexible Systems Management*, 1-20. Doi:10.100740171-017-0158-4

Birou, L., Lutz, H., & Zsidisin, G. A. (2016). Current state of the art and science: A survey of purchasing and supply management courses and teaching approaches. *International Journal of Procurement Management*, *9*(1), 71–85. doi:10.1504/IJPM.2016.073388

Blome, C., Hollos, D., & Paulraj, A. (2014). Green procurement and green supplier development: Antecedents and effects on supplier performance. *International Journal of Production Research*, *52*(1), 32–49. doi:10.1080/00207543.2013.825748

Brewer, B., & Arnette, A. N. (2017). Design for procurement: What procurement driven design initiatives result in environmental and economic performance improvement? *Journal of Purchasing and Supply Management*, *23*(1), 28–39. doi:10.1016/j.pursup.2016.06.003

Burki, U., & Buvik, A. (2010). Do relationship history and norms matter in overcoming inter-organisational difficulties in the procurement function?. *International Journal of Procurement Management*, *3*(3), 279–291. doi:10.1504/IJPM.2010.033446

Carter, C. R. (2000a). Precursors for unethical behavior in global supplier management. *Journal of Supply Chain Management*, *36*(1), 45–56. doi:10.1111/j.1745-493X.2000.tb00069.x

Carter, C. R. (2000b). Ethical issues in international buyer–supplier relationships: A dyadic examination. *Journal of Operations Management*, *18*(2), 191–208. doi:10.1016/S0272-6963(99)00016-9

Chekima, B., Wafa, S. A. W. S. K., Igau, O. A., Chekima, S., & Sondoh, S. L. (2016). Examining green consumerism motivational drivers: Does premium price and demographics matter to green purchasing? *Journal of Cleaner Production*, *112*, 3436–3450. doi:10.1016/j.jclepro.2015.09.102

CIPS officially adopts new set of values. (2012). *Supply Management, 17*(2), 47.

Cooper, R. W., Frank, G. L., & Kemp, R. A. (1997). The ethical environment facing the profession of purchasing and materials management. *International Journal of Purchasing and Materials Management*, *33*(1), 2–11. doi:10.1111/j.1745-493X.1997.tb00286.x

Cox, A. (2007). Transactions, power and contested exchange: Towards a theory of exchange in business relationships. *International Journal of Procurement Management*, *1*(1-2), 38–59. doi:10.1504/IJPM.2007.015354

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Datta, S., Samantra, C., Mahapatra, S. S., Banerjee, S., & Bandyopadhyay, A. (2012). Green supplier evaluation and selection using VIKOR method embedded in fuzzy expert system with interval-valued fuzzy numbers. *International Journal of Procurement Management*, *5*(5), 647–678. doi:10.1504/IJPM.2012.048880

de Medeiros, J. F., Ribeiro, J. L. D., & Cortimiglia, M. N. (2016). Influence of perceived value on purchasing decisions of green products in Brazil. *Journal of Cleaner Production*, *110*, 158–169. doi:10.1016/j.jclepro.2015.07.100

Dubey, R., & Bag, S. (2013). Exploring the dimensions of sustainable practices: An empirical study on Indian manufacturing firms. *International Journal of Operations and Quantitative Management*, *19*(2), 123–146.

Dubey, R., Bag, S., & Ali, S. S. (2014). Green supply chain practices and its impact on organisational performance: An insight from Indian rubber industry. *International Journal of Logistics Systems and Management*, *19*(1), 20–42. doi:10.1504/IJLSM.2014.064029

Dubey, R., Bag, S., Ali, S. S., & Venkatesh, V. G. (2013). Green purchasing is key to superior performance: An empirical study. *International Journal of Procurement Management*, *6*(2), 187–210. doi:10.1504/IJPM.2013.052469

Ehrgott, M., Reimann, F., Kaufmann, L., & Carter, C. R. (2013). Environmental development of emerging economy suppliers: Antecedents and outcomes. *Journal of Business Logistics*, *34*(2), 131–147. doi:10.1111/jbl.12015

Ellis, N., & Higgins, M. (2006). Recatechizing codes of practice in supply chain relationships: Discourse, identity and otherness. *Journal of Strategic Marketing*, *14*(4), 387–410. doi:10.1080/09652540600947870

Eltantawy, R. A., Fox, G. L., & Giunipero, L. (2009). Supply management ethical responsibility: Reputation and performance impacts. *Supply Chain Management: An International Journal*, *14*(2), 99–108. doi:10.1108/13598540910941966

Eltayeb, T. K., & Zailani, S. (2010). Investigation on the drivers of green purchasing towards environmental sustainability in the Malaysian manufacturing sector. *International Journal of Procurement Management*, *3*(3), 316–337. doi:10.1504/IJPM.2010.033448

Ethical and Sustainable Procurement - CIPS. (2013). Retrieved from https://www.cips.org/Documents/About%20CIPS/CIPS_Ethics_Guide_WEB.pdf

Fernández, I., & Kekale, T. (2007). Strategic procurement outsourcing: A paradox in current theory. *International Journal of Procurement Management*, *1*(1-2), 166–179. doi:10.1504/IJPM.2007.015360

Giannakis, M. (2012). The role of procurement in the management of supplier relationships. *International Journal of Procurement Management*, *5*(3), 368–408. doi:10.1504/IJPM.2012.047173

Green Procurement and Efficient Order Processing. (2015). Available at http://spendmatters.com/2015/04/07/green-procurement-and-efficient-order-processing/

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Gualandris, J., & Kalchschmidt, M. (2016). Developing environmental and social performance: The role of suppliers sustainability and buyer–supplier trust. *International Journal of Production Research*, *54*(8), 2470–2486. doi:10.1080/00207543.2015.1106018

Gupta, M., & Narain, R. (2012). A survey on supplier relationship in e-procurement in Indian organisations. *International Journal of Logistics Systems and Management*, *12*(1), 89–121. doi:10.1504/IJLSM.2012.047060

Hemmert, M., Kim, D., Kim, J., & Cho, B. (2016). Building the suppliers trust: Role of institutional forces and buyer firm practices. *International Journal of Production Economics*, *180*(C), 25–37. doi:10.1016/j.ijpe.2016.05.023

Hooshangi, M., Fazli, S., & Mirhosseini, S. S. (2016). The mediation role of buyers satisfaction in relationship between structural capital with performance. *International Journal of Logistics Systems and Management*, *23*(3), 329–342. doi:10.1504/IJLSM.2016.074715

Jones, T. M. (1991). Ethical decision making by individuals in organizations: An issue-contingent model. *Academy of Management Review*, *16*(2), 366–395.

Kakwezi, P., & Nyeko, S. (2010). *Procurement processes and performance: Efficiency and effectiveness of the procurement function*. Academic Press.

Karjalainen, K., Kemppainen, K., & Van Raaij, E. M. (2009). Non-compliant work behaviour in purchasing: An exploration of reasons behind maverick buying. *Journal of Business Ethics*, *85*(2), 245–261. doi:10.100710551-008-9768-2

Kumar Sahu, N., Datta, S., & Sankar Mahapatra, S. (2014). Green supplier appraisement in fuzzy environment. *Benchmarking: An International Journal*, *21*(3), 412–429. doi:10.1108/BIJ-06-2012-0042

Landeros, R., & Plank, R. E. (1996). How ethical are purchasing management professionals? *Journal of Business Ethics*, *15*(7), 789–803. doi:10.1007/BF00381743

Li, Y. H., & Huang, J. W. (2017). The moderating role of relational bonding in green supply chain practices and performance. *Journal of Purchasing and Supply Management*. doi:10.1016/j.pursup.2017.06.001

Liu, X., Wang, C., Shishime, T., & Fujitsuka, T. (2012). Sustainable consumption: Green purchasing behaviours of urban residents in China. *Sustainable Development*, *20*(4), 293–308. doi:10.1002d.484

Luthra, S., Garg, D., & Haleem, A. (2014). Sustainable purchasing in Indian automobile industry: An ISM approach. *Manufacturing Excellence: Imperatives for Emerging Economies*, 95-108.

Moeller, S., Fassnacht, M., & Klose, S. (2006). A framework for supplier relationship management (SRM). *Journal of Business-To-Business Marketing*, *13*(4), 69–94. doi:10.1300/J033v13n04_03

Norrman, A. (2008). Supply chain risk-sharing contracts from a buyers perspective: Content and experiences. *International Journal of Procurement Management*, *1*(4), 371–393. doi:10.1504/IJPM.2008.018426

Perez-Arostegui, M. N., Benitez-Amado, J., & Huertas-Perez, J. F. (2012). In search of loyalty: An analysis of the determinants of buyer–supplier relationship stability under a quality management approach. *Total Quality Management & Business Excellence*, *23*(5-6), 703–717. doi:10.1080/14783363.2012.669999

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Purchasing Ethics Need. (2002). An Update for 21st-Century Imperatives. *Supplier Selection & Management Report.*, *2*(9), 5.

Rajagopal, S., & Bernard, K. N. (1993). Strategic procurement and competitive advantage. *Journal of Supply Chain Management*, *29*(3), 12–20.

Rest, J. R. (1986). *Moral development: Advances in research and theory*. New York: Praeger.

Revilla, E., Sáenz, M. J., & Knoppen, D. (2013). Towards an empirical typology of buyer–supplier relationships based on absorptive capacity. *International Journal of Production Research*, *51*(10), 2935–2951. doi:10.1080/00207543.2012.748231

Rutherford, B. N., Boles, J. S., Barksdale, H. C., & Johnson, J. T. (2008). Buyers relational desire and number of suppliers used: The relationship between perceived commitment and continuance. *Journal of Marketing Theory and Practice*, *16*(3), 247–258. doi:10.2753/MTP1069-6679160305

Srivastava, V., & Singh, T. (2013). Exploring Determinants of Closeness in Manufacturer–Supplier Relationships: A Study of Select Indian Manufacturing Firms. *Journal of Relationship Marketing*, *12*(1), 1–21. doi:10.1080/15332667.2013.763717

Steinle, C., Schiele, H., & Ernst, T. (2014). Information asymmetries as antecedents of opportunism in buyer-supplier relationships: Testing principal-agent theory. *Journal of Business-To-Business Marketing*, *21*(2), 123–140. doi:10.1080/1051712X.2014.903457

Steward, M. D., Wu, Z., & Hartley, J. L. (2010). Exploring Supply Managers Intrapreneurial Ability and Relationship Quality. *Journal of Business-To-Business Marketing*, *17*(2), 127–148. doi:10.1080/10517120903407857

Tanner, C., & Kast, S. W. (2003). Promoting sustainable consumption: Determinants of green purchases by Swiss consumers. *Psychology and Marketing*, *20*(10), 883–902. doi:10.1002/mar.10101

Tate, W. L., Ellram, L. M., & Dooley, K. J. (2012). Environmental purchasing and supplier management (EPSM): Theory and practice. *Journal of Purchasing and Supply Management*, *18*(3), 173–188. doi:10.1016/j.pursup.2012.07.001

United Procurement Practitioner's Handbook. (n.d.). *Sustainable Procurement*. Retrieved from https://www.ungm.org/Areas/Public/pph/ch04s05.html

Van Weele, A. J. (2006). *Purchasing & Supply Chain Management: Analysis, Strategy, Planning and Practice* (4th ed.). Thomson.

Venkatesh, V. G., & Luthra, S. (2016). Role of Sustainable Procurement in Sustainable Manufacturing Operations: An Indian Insight. In Strategic Management of Sustainable Manufacturing Operations (pp. 132-148). IGI Global.

Walker, H., Miemczyk, J., Johnsen, T., & Spencer, R. (2012). Sustainable procurement: Past, present and future. *Journal of Purchasing and Supply Management*, *18*(4), 201–206. doi:10.1016/j.pursup.2012.11.003

Walker, H., & Phillips, W. (2008). Sustainable procurement: Emerging issues. *International Journal of Procurement Management*, *2*(1), 41–61. doi:10.1504/IJPM.2009.021729

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Wandfluh, M., Hofmann, E., & Schoensleben, P. (2016). Financing buyer–supplier dyads: An empirical analysis on financial collaboration in the supply chain. *International Journal of Logistics Research and Applications*, *19*(3), 200–217. doi:10.1080/13675567.2015.1065803

Weele, A. J., & Raaij, E. M. (2014). The future of purchasing and supply management research: About relevance and rigor. *Journal of Supply Chain Management*, *50*(1), 56–72. doi:10.1111/jscm.12042

Wood, G. (1995). Ethics in purchasing: The practitioners experience. *Business Ethics (Oxford, England)*, *4*(2), 95–101. doi:10.1111/j.1467-8608.1995.tb00235.x

Yan, T., Yang, S., & Dooley, K. (2017). A theory of supplier network-based innovation value. *Journal of Purchasing and Supply Management*, *23*(3), 153–162. doi:10.1016/j.pursup.2017.02.002

Yazici, H. J. (2013). Supplier perceptions of knowledge sharing in buyer-supplier relationships: A service example. *International Journal of Logistics Systems and Management*, *16*(3), 315–339. doi:10.1504/IJLSM.2013.056753

Young, W., Hwang, K., McDonald, S., & Oates, C. J. (2010). Sustainable consumption: Green consumer behaviour when purchasing products. *Sustainable Development*, *18*(1), 20–31.

KEY TERMS AND DEFINITIONS

Buyer-Supplier Relationship (BSR): BSR involves developing strong bonds to accomplish both short and long term organisational goals. Trust and commitment is the base of such a relationship. The customer need to disclose ethical policies, confidential information and long term growth plans with key suppliers to improve the quality of supplier relationships.

Ethical Decision: Ethical decision is a decision that is both legal and morally acceptable to a bigger community. Environmental factors (work, personal, professional, governmental, legal, and social) join individual attributes to affect the ethical decision process.

Exploratory Factor Analysis: A multivariate statistics method used to uncover the underlying structure of a relatively large set of variables. It is a technique within factor analysis whose overarching goal is to identify the underlying relationships between measured variables.

Innovative Green Procurement Performance: Innovative green procurement is the selection of products and services that minimize environmental impacts. It involves sourcing ideas and includes more efficient and effective use of natural resources. Innovative green procurement performance consists of measures such as Efficiency of green procurement process; Openness and transparency of the green procurement process; Green contract management and supplier performance; Professionalism of the procurement workforce; Green procurement costs and creativity and innovation.

This research was previously published in Ethics and Decision-Making for Sustainable Business Practices edited by Ionica Oncioiu, pages 1-23, copyright year 2018 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

APPENDIX

Table 2. Communalities

	Initial	Extraction
VAR00001	1.000	.848
VAR00002	1.000	.932
VAR00003	1.000	.877
VAR00004	1.000	.742
VAR00005	1.000	.798
VAR00006	1.000	.850
VAR00007	1.000	.823
VAR00008	1.000	.867
VAR00009	1.000	.816
VAR00010	1.000	.854
VAR00011	1.000	.896
VAR00012	1.000	.803
VAR00013	1.000	.837
VAR00014	1.000	.781
VAR00015	1.000	.927
VAR00016	1.000	.877
VAR00017	1.000	.783
VAR00018	1.000	.801
VAR00019	1.000	.886
VAR00020	1.000	.906
VAR00021	1.000	.861
VAR00022	1.000	.811
VAR00023	1.000	.937
VAR00024	1.000	.917
VAR00025	1.000	.882
VAR00026	1.000	.819
VAR00027	1.000	.813
VAR00028	1.000	.836
VAR00029	1.000	.846
VAR00030	1.000	.739
VAR00031	1.000	.865
VAR00032	1.000	.925
VAR00033	1.000	.868

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 3. Total variance explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.048	18.326	18.326	6.048	18.326	18.326	3.639	11.029	11.029
2	4.649	14.087	32.413	4.649	14.087	32.413	3.212	9.734	20.763
3	3.386	10.262	42.675	3.386	10.262	42.675	3.191	9.670	30.433
4	2.872	8.703	51.378	2.872	8.703	51.378	2.815	8.530	38.964
5	2.350	7.123	58.501	2.350	7.123	58.501	2.425	7.347	46.311
6	2.156	6.534	65.034	2.156	6.534	65.034	2.406	7.291	53.602
7	1.817	5.507	70.541	1.817	5.507	70.541	2.404	7.284	60.886
8	1.369	4.149	74.690	1.369	4.149	74.690	2.196	6.655	67.541
9	1.191	3.610	78.301	1.191	3.610	78.301	2.160	6.547	74.088
10	1.179	3.572	81.872	1.179	3.572	81.872	1.887	5.719	79.806
11	1.006	3.048	84.921	1.006	3.048	84.921	1.688	5.114	84.921
12	.913	2.768	87.689						
13	.728	2.206	89.895						
14	.592	1.795	91.690						
15	.507	1.537	93.227						
16	.421	1.275	94.502						
17	.365	1.106	95.608						
18	.284	.861	96.469						
19	.249	.756	97.225						
20	.224	.678	97.903						
21	.176	.533	98.435						
22	.141	.428	98.863						
23	.114	.347	99.210						
24	.076	.231	99.440						
25	.058	.176	99.616						
26	.054	.164	99.780						
27	.039	.117	99.897						
28	.019	.056	99.953						
29	.015	.044	99.997						
30	.001	.003	100.000						
31	2.928E-016	8.872E-016	100.000						
32	4.621E-017	1.400E-016	100.000						
33	-2.659E-016	-8.057E-016	100.000						

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 4. Component matrix

	Component										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
VAR00007	.672										
VAR00025	.665	.534									
VAR00002	.632	-.476									
VAR00001	.627										
VAR00024	.586	.472									
VAR00005	.575	-.401									
VAR00019	.560										
VAR00008	.555	-.524									
VAR00023	.506	.492						.403			
VAR00020	.503								-.403		
VAR00022	.493								.453		
VAR00016	.490										
VAR00006	.480	-.436									
VAR00014	.435										
VAR00013		.748									
VAR00017		.702									
VAR00012		.617				.540					
VAR00021	.483	.524									
VAR00027			.603								
VAR00030	-.457		.552								
VAR00028			.550	.432							
VAR00031	-.423		.547								
VAR00026			.538								
VAR00029			.532	.420							
VAR00010			-.456								.416
VAR00004				-.711							
VAR00009		-.437		.612							
VAR00003				-.581							
VAR00033					.757						
VAR00015					.598	.423					
VAR00032			.412		.560						
VAR00018	.482						.513				
VAR00011							.424				

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 5. Rotated component matrix

	Component										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
VAR00023	.931										
VAR00021	.863										
VAR00025	.777										
VAR00024	.686										
VAR00006		.863									
VAR00003		.833									
VAR00004		.650									
VAR00005		.591									
VAR00007		.569									
VAR00008			.796								
VAR00010			.766								
VAR00009			.762								
VAR00031			-.516								
VAR00017			-.456								
VAR00014				.805							
VAR00016				.772							
VAR00018				.621							
VAR00001					.833						
VAR00002					.793						
VAR00012						.737					
VAR00015						.732					
VAR00013						.682					
VAR00029							.898				
VAR00028							.699				
VAR00022							.531				
VAR00026							.491				
VAR00027								.866			
VAR00030								.598			
VAR00032									.899		
VAR00033									.866		
VAR00011										-.907	
VAR00019										.620	
VAR00020											.845

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 6. Component transformation matrix

Component	1	2	3	4	5	6	7	8	9	10	11
1	.489	.435	.365	.380	.361	.075	.034	-.215	.060	.223	.241
2	.527	-.323	-.432	.376	-.327	.389	.062	-.035	-.145	-.076	.011
3	-.198	.208	-.324	.329	.192	-.024	.492	.573	.259	-.069	.158
4	-.214	-.552	.539	.125	-.027	.250	.490	-.078	.061	.143	.097
5	-.155	.005	-.069	.190	-.184	.201	-.316	-.074	.730	.399	-.251
6	-.319	.160	.150	.176	.228	.675	-.324	.180	-.263	-.272	-.176
7	.109	-.427	.064	.305	.420	-.333	-.251	-.032	.272	-.514	-.138
8	.462	-.117	.074	-.487	.314	.197	.121	.399	.127	.141	-.426
9	-.071	.262	-.074	.130	-.007	-.040	.454	-.441	-.037	-.174	-.686
10	.032	.102	-.136	-.417	.070	.357	.155	-.352	.424	-.446	.370
11	.202	.238	.473	.040	-.600	-.078	-.003	.319	.178	-.415	-.074

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 7. Final set of factors

Factors	Variables	Items	Cronbach's Alpha
Factor 1 Satisfaction with Supplier Relationship (SRS)	23	Buyer feel fairly satisfied with the performance of key suppliers	0.82
	21	Innovative problem solving skills improves supplier performance	0.87
	25	Key supplier work efficiently	0.84
	24	Buyer find real enjoyment in dealing with key suppliers	0.87
Factor 2 Supplier Subtle Practices (SBP)	6	Supplier asks buyer for information about their competitors	0.73
	3	Supplier uses backdoor selling techniques such as approaching personnel in engineering, manufacturing, or other departments outside of purchasing	0.73
	4	Supplier increases prices when there is a shortage of raw material supply	0.79
	5	Supplier offers gifts to buyers	0.78
	7	Supplier knowingly over-commits resources or production schedules	0.80
Factor 3 Safety, Health & Environment (SHE)	8	Supplier do not indulge into child labour practices	0.38
	10	Supplier focus on occupational health and safety aspects	0.75
	9	Supplier never violated human rights	0.65
Factor 4 Buyer-Supplier Bonding (BSB)	14	Trust plays a critical role in buyer-supplier relationship	0.65
	16	Commitment plays a critical role in buyer-supplier relationships	0.69
	18	Compatibility between buyer and supplier is essential for building good business relationships	0.79
Factor 5 Supplier Deceitful Practices (SDP)	1	Supplier lies to or grossly misleads buyer in a negotiation	0.92
	2	Supplier uses less competitive prices or terms for buyers who purchase exclusively from the supplier	0.91
Factor 6 Customer Focus (CF)	12	Supplier focus on customer health and safety	0.45
	15	Power balance plays a critical role in customer-supplier relationships	0.77
	13	Complaint handling is effectively done by supplier firms	0.48
Factor 7 Continuous Education & Training (CET)	29	Green procurement workforce receives continuous education and/or training on a periodical basis depending upon the level of competency of individual buyers	0.48
	28	Green procurement workforce is capable to handle complex innovative green procurement process	0.47
	22	Technological support and financial support is extended to key suppliers	0.74
Factor 8 Innovative Green Procurement Performance (IGPP)	27	More openness and transparency is maintained in innovative green procurement process	0.51
	30	Innovative green procurement include more efficient and effective use of natural resources	0.50
Factor 9 Creativity & Innovation (CI)	32	Increased sourcing ideas and analytical thinking is observed among buyers practicing innovative green procurement	0.79
	33	Creativity leads to NPD which enhances customer satisfaction	0.75

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 8. Regression summary

Hypothesis	R	R Square	Beta Coefficient	t Statistics	Durban Watson Statistics	VIF Statistics	Direction of Beta	Conclusion
H1	0.275	0.076	(-0.275)	(-1.765)	1.691	1	The negative beta value suggests that SRS moves in the opposite direction of IGPP.	Hypothesis not supported
H2	0.118	0.014	0.118	0.733	1.799	1	The positive beta value suggests that SBP moves in the direction of IGPP.	Hypothesis supported
H3	0.266	0.071	(-0.266)	(-1.699)	1.948	1	The negative beta value suggests that SHE moves in the opposite direction of IGPP.	Hypothesis not supported
H4	0.005	0.000	0.005	0.032	1.800	1	The positive beta value suggests that BSB moves in the direction of IGPP.	Hypothesis supported
H5	0.073	0.005	(-0.073)	(-0.454)	1.827	1	The negative beta value suggests that SDP moves in the opposite direction of IGPP.	Hypothesis not supported
H6	0.074	0.005	(-0.074)	(-0.458)	1.801	1	The negative beta value suggests that CF moves in the opposite direction of IGPP.	Hypothesis not supported
H7	0.064	0.004	0.064	0.393	1.765	1	The positive beta value suggests that CET moves in the direction of IGPP.	Hypothesis supported
H8	0.048	0.002	0.048	0.298	1.812	1	The positive beta value suggests that CI moves in the direction of IGPP.	Hypothesis supported

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 44
Increased Value Through Sharing in Multi-Sided Markets: Sustainability With Ridesharing

Nina Tura
Lappeenranta University of Technology, Finland

Aino Kuitunen
Lappeenranta University of Technology, Finland

Lauri Lättilä
SimAnalytics, Finland

Samuli Kortelainen
Lappeenranta University of Technology, Finland

ABSTRACT

The demand for more sustainable business models is increasing the need for current businesses to develop their business processes and value creation mechanisms. One way to improve sustainability is sharing resources and services in a new sharing economy paradigm. This chapter builds a conceptual model for taxi ridesharing to describe the value potential that is born by increasing the efficiency of taxi businesses. First, a framework for multisided markets is built to understand the different value elements of taxi ridesharing. Then, a conceptual mathematical model is introduced to understand the value symmetries including the cost saving potential and allocation from the perspectives of the customer and the supplier. The model shows that it is possible to have a system that creates value for both the taxi driver and the passenger, while simultaneously leading to significant reduction in CO2 emissions.

INTRODUCTION

The increasing awareness and interest in sustainable innovation (Boons et al., 2013) have led companies to start looking for opportunities beyond their traditional business areas. Global demand (see, e.g., United Nations, 2015), changing customer behavior and market conditions, together with the development of digital technologies have resulted in the birth of interesting new business models. One example is the

DOI: 10.4018/978-1-5225-7915-1.ch044

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

emergence of the sharing economy where people have started to look for options for the consumption and ownership of resources. Shared services and so called peer-to-peer (P2P) rental markets are growing fast –their value reached $26 billion already in 2013 (Botsman, 2013). Today, sharing business models include a wide range of examples of sharing goods (eBay), services, transportation (Uber), accommodation (AirBnB), and money (crowdfunding) (Owyang, Samuel, & Grenville, 2014; Cohen & Kietzmann, 2014).

This relatively new business field has recently attracted the attention of both academic and managerial audiences (Botsman, 2013; Schor & Fitzmaurice, 2015; Cohen & Kietzmann, 2014; Belk, 2014). Due to urbanization challenges, people have started to look for options for non-satisfactory public transport and technologies, and digitalization has enabled new sharing mobility services to expand (Firnkorn & Mueller, 2011). The main characteristics of the sharing economy include the ability to facilitate sharing between strangers and rely upon impersonal trust. Especially ridesharing has grown in popularity as people want to travel fast, efficiently and at low cost (Kriston, Szabo & Inzelt, 2010).

One interesting sharing application is taxi ridesharing. There are several empirical modeling examples of the potential benefits of taxi ridesharing that show significant cost efficiency potential and positive environmental outcomes. (Santi et al. 2014a; d'Orey, Fernandes & Ferreira, 2012). Santi et al. (2014a; 2014b) have shown that ride combining could result in a 40% cut in cumulative trip length in New York taxi service – a significant benefit in terms of traveled distance versus additional travel time. d'Orey, Fernandes and Ferreira (2012) have estimated a potential of a 48% increase in the average occupancy per traveled kilometer. If passengers accept on average a 5-minute delay, it could be possible to share over 70% of the taxi rides in New York (Shmueli et al. 2015). Despite these examples, so far no many commercially viable services exist for taxi ridesharing.

In this chapter the focus is on understanding the potential for wide market acceptation of taxi ridesharing. There are two sides on the market: taxi drivers and passengers who share rides. In order to build a successful marketplace for sharing taxi rides, both sides of these markets need to have a sufficient number of entities. The second necessary perspective is the perceived value. In order to succeed in significant market penetration, both the buyers and sellers need to accept the new system. The necessary requirement for acceptance is that both sides need to get value from the system - the system needs to create a situation where both the buyers and the sellers feel that they benefit from it.

The challenge is to understand how this system should be built and where the value for the users would be. Introducing a sharing option might increase the level of passengers' discomfort, but as there are other benefits, such as reductions in service costs, the overall utility may rise (Ma, Zheng & Wolfson, 2013). To ensure the implementation of new business in two- and multi-sided markets, the value needs to be addressed from the perspectives of all involved parties (Adner & Kapoor, 2010). The objective of this chapter is to contribute to the literature by offering an analytical framework for understanding the limits for value creation when implementing sharing into an existing taxi company business model. The analysis of this problem requires two significant perspectives: 1) multi-sided markets and 2) value creation for both sides and between the markets. Multi-sided markets describe a business context where value is based on interaction between different types of actors (Adner & Kapoor, 2010; Ethiraj & Posen, 2013). Value can be created by direct network effects where value is created by the interaction of similar actors operating in the same markets or by indirect network effects where value is created by interactions between actors in different markets (Eisenmann, Parker &Van Alstyne, 2006).

The research question in this chapter is *How to create a sustainable business model for a taxi sharing service?* To answer this question, a conceptual framework and a mathematical model are introduced. These combine the value perspectives of both the passengers and drivers and aim at increasing understanding

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

of the acceptance conditions for taxi pairing service. Individual taxi ridesharing is treated as a point-like transaction, and no indirect sustainability effects are taken into account. The model shows that both the driver and the passenger gain perceived benefits but also perceived losses in the pairing of taxi rides. The model also shows that the gained efficiency benefits can be turned into monetary gains, but the division of these gains is a matter of negotiation. Effectively, the division of benefits is a zero sum game between the driver and the passenger. In this chapter value is understood as additional benefits experienced by the implementation of the service, the difference between the evaluation of benefits and costs. Besides market value, value is understood to include intangible value (e.g. soft value elements such as customer satisfaction or societal value) that may not be directly measured in monetary terms. The outcome of the study is a detailed description of how value can be determined in a multi-sided market. Understanding this market is critical in order to get a new service successfully into the market. An important aspect of multi-sided markets is that all sides of the market need to accept the new product. If either side declines adaptation, the new product will not penetrate the market.

The chapter is organized as follows: first there is an overlook to existing literature on two-sided markets and value creation. The theoretical framework is followed by an in-depth description of a taxi-sharing case. After these, the final framework for calculating the value of using a taxi sharing service is introduced, which is followed by solutions, recommendations for future research, and conclusion.

BACKGROUND

Motivation Towards Sharing Business Models

Today, sustainability is strongly present in the development of new products and services. In addition to creating sustainable value by products, technologies and processes, recent literature has paid particular attention to the creation of sustainable business models (e.g. Abdelkafi & Täuscher, 2016; Gauthier & Gilomen, 2016). In these business models the focus is on adding value to the company and stakeholders, but also to the environment and the society (Boons & Lüdeke-Freund, 2013). The practical implication of this is that monetary measurements, such as revenue or profit, are no longer necessarily the main drivers for development (Schaltegger & Wagner, 2011; Porter & Kramer 2011). Instead, sustainability-oriented measurements, such as carbon performance (Hoffmann & Busch, 2008) and resource efficiency (Chee Tahir & Darton, 2010) have become part of business and innovation development (Nidumolu, Prahalad & Rangaswami, 2009; Seebode, Jeanrenaud & Bessant, 2012). In customer markets this can be seen in the emergence of multiple examples of services based on sharing. These examples, such as transportation (Uber) and accommodation (e.g. Airbnb) demonstrate new economic thinking in which otherwise private resources (car or home) are shared by other, often anonymous, users of the same system. Both these services have been widely adopted by users around the globe, which has led to major commercial success evident in the valuation of companies such as Uber (51B$) and AirBnB (21,5B$) (Austin, Canibe & Slobin, 2015). These business models are successful examples of a sharing economy (Hamari, Sjöklint & Ukkonen, 2013).

Sharing business models rely on the idea of sharing and collaborative consumption (Botsmann & Rogers, 2010b) and P2P activities where people give, obtain and share resources (both human and physical). Value is created in many forms, including financial value (monetary rewards) and so called soft value streams of ecological and social rewards. Different types of services are emerging (e.g. bike

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

and car sharing services) and increasing in importance (for example in AirBnB there were 10 million overnight stays by 2012). The sharing economy has also strong reliance on digital technologies and it involves the participation of so called high cultural capital consumers, who, instead of sharing out of necessity, elect to share (Schor & Fitzmaurice, 2015). According to Schor and Fitzmaurice (ibid.), the main motivations for participation in the sharing economy include positive economic impacts, reduced ecological impacts, increase in social connections and building social networks, as well as ideological commitment to the concepts of sharing and collaborating. The value creation activities are usually co-ordinated through community-based online services (Albinsson & Perera, 2012; Belk, 2010; Botsman & Rogers, 2010a; Hamari et al., 2015) or platforms that aim at facilitating exchanges between groups of people, establishing so called circuits of commerce (Zelizer, 2010). Platforms give common rules and build mutual trust among relative strangers taking part in sharing activities (Zelizer 2010; Belk 2014).

The motivation towards the sharing economy can arise from social, economic or technological premises. A key social driver is the increased population density that necessitates new urban solutions (Kriston, Szabo & Inzelt, 2010). The economic drivers include financial flexibility, monetizing excess or idle inventory, valuating access over ownership, or reduced transaction costs (Chui et al. 2012; Henten & Windekilde, 2016). Technological drivers are the enabling techniques, such as the increase of mobile devices, platforms and enabling payment systems (Black & Lych, 2004). Some criticism has risen concerning the complexity related to the sustainability of the sharing economy, such as deterioration of workers' rights, the sustainability benefits becoming captured into existing non-sustainable business models, or an undesirable substitution effect, such as a rebound effect resulting from increased total consumption of resources (Martin, 2016; Lopez et al.2014; Schor & Fitzmaurice, 2015; Henten & Windekilde, 2016).

Paying attention to the value proposition is crucial in establishing a functioning business model (Osterwalder & Pigneur, 2010). The interest towards sharing options is increasing, which means that companies need to pay attention to the characteristics of sharing business models. These include creating understanding of the involved stakeholders and their impact on the overall value creation and the acceptance of the business. In the following, particular attention is payed to the features of value creation in multi-sided markets.

Value Creation in Multi-Sided Markets

Value creation is a complex concept which has been studied by multiple researchers. Due to its subjective nature and multiple levels of analysis, no ultimate definition exists (Lepak, Smith & Taylor, 2007). Many sharing economy business models rely on so called two- or multi-sided markets (Adner and Kapoor, 2010; Ethiraj & Posen, 2013). According to Eisenmann, Parker and Van Alstyne (2006), in traditional value chains value is understood as flow from costs to revenue (moving from left to right). In two- (or multi-) sided markets the costs and revenue are allocated for both sides instead. This is due to distinct groups of stakeholders (such as customers and suppliers) on each side.

The literature on two- or multi-sided markets pays attention to the use of platforms to connect different consumers or consumer groups in order to internalize indirect network externalities and share their value via a functioning pricing system (e.g. Evans 2003; Eisenmann et al. 2006; Ambrus & Argenziano 2009). Network externalities are born when the utility of a consumer depends on the purchase decision of another consumer (Ambrus & Argenziano 2009). Realized positive network externalities can be seen as value appropriation. In the case of sharing the extra capacity of taxi rides, multiple positive and negative externalities are born.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

In order to establish successful business models for the sharing economy, we need to create more clear understanding of how value is created and divided among the participating groups (suppliers and customers). From the business perspective, the focus is more or less in earning profits. However, understanding value from the customer perspective is more complex. Generally, the marketing literature sees customer value as a trade-off between benefits and costs that result from an exchange (see e.g. Ulaga & Eggert, 2006). Furthermore, it can also be seen as a trade-off between quality and price (e.g., Bolton & Drew, 1991; Grewal et al, 1998). The consumer behavior literature goes beyond monetary costs to include understanding psychological, emotional and cognitive factors through benefits and sacrifices (e.g. Cronin et al., 2000; Graf & Maas, 2008). Besides monetary benefits and costs, in this chapter value is seen to include also intangible factors – the additional benefits and sacrifices (i.e. value reducing elements) experienced by the taxi ridesharing service implementation. These value elements are discussed below.

Customer Perspective on Value Creation in Sharing Economy

From the perspective of the customer (taxi passenger), sharing offers an opportunity for *immediate economic impacts,* i.e. *money savings* (Schor & Fitzmaurice, 2015), as customers may *split the fares* of the service (Santi et al. 2014b). Splitting fares aims at covering the possible drawbacks of the service (e.g. the loss of privacy and extra time), with the goal of achieving wider passenger acceptance for shared services (ibid.). Furthermore, the possible benefits include *higher flexibility*, *practicality* and *better access to services*. In the sharing economy, in addition to rational value elements (such as the usefulness and quality of a product or service), we need to consider also emotional elements (Elster, 1998). These elements include *enjoyment of the activity* (Hamari et al. 2015) and the so called *"feel-good factor",* as well as other *psychological benefits* (e.g. promoting sustainability, or in rideharing fulfilling a request for help) (Schor & Fitzmaurice, 2015), as ideological issues (e.g. lifestyle, generosity, feelings and cultural issues) are strongly related to the driving motivations of the sharing economy. According to Hamari and Ukkonen (2013) the emergence of the sharing economy may help people in learning the social norms of sharing and collaboration. Furthermore, the benefits include also longer-term rewards such as *community experience* and *gift-exchange systems* (Schor & Fitzmaurice, 2015).

Although benefits exist, we should not underestimate the possible drawbacks of shared services. These drawbacks include *requirements for extra time* and *loss of privacy* (Santi et al., 2014b; Teal, 1987). For example, in the case of taxi sharing this means *passenger discomfort* quantifiable in terms of a longer travel time (Santi et al. 2014b) or sharing the ride with a stranger. In addition to emotional benefits, there might exist emotional factors hindering the development of shared business models. These could be *cognitive costs,* as there may be *perceptions of possible discomfort, risk* and *embarrassment* (Schor & Fitzmaurice, 2015). Although sharing services are argued to provide economic benefits for the customer, they may also involve *unexpected costs,* as more time and effort is needed in searching and coordination (Hamari et al. 2015).

Supplier Perspective on Value Creation in Sharing Economy

From the supplier perspective, value creation is often understood via profit – monetary revenue earned from the customer minus costs. However, from the supplier perspective, the sharing business involves also other, intangible value elements, which are not always possible to measure in monetary terms.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

From the economic perspective, the sharing economy provides opportunities to deliver more value to the consumer, but also create new opportunities for the producers to *earn income*. According to Schor and Fitzmaurice (2015, pp. 12), this is because "these sites are peer-to-peer and able to re-distribute value across the supply chain, to producers and consumers, and away from middlemen." However, this can also have a negative impact on old business areas (e.g. the emergence of AirBnB has reduced the number of rented hotel rooms), and the development of internet-based platforms has created new markets that do not only complement but substitute existing markets (e.g. transportation) (Henten & Windekilde, 2016). The emergence of shared services can thus *decrease the need for the number of service providers* (e.g. reduce the need of taxi service providers / individual taxis) and *reduce the use of existing services.*

In theory, the sharing economy reduces ecological impacts (e.g. lowers greenhouse gas emissions) by circulating goods (e.g. Martin & Shaheen, 2010). For example, ridesharing is argued to help in solving traffic problems, lowering the environmental load and allowing more efficient use of all kinds of resources (Kriston, Szabo & Inzelt, 2010). From the supplier perspective, the increased efficiency can help in *reducing costs* such *as fuel and production costs* (Santi et al. 2014b). However, little research has been done on whether these benefits are actually realized or whether they are largely assumed (Schor & Fitzmaurice, 2015). *Economic rationalization* (including institutional dependencies and development realism) is seen as one of the most important barriers for companies implementing sustainability actions (Eckhardt, Belk & Devinney, 2010), which may also be relevant for the implementation of sharing models. As sharing services usually means splits in fares (Santi et al. 2014b), it is uncertain whether the incomes of executing P2P business will cover the additional costs (e.g. fuel and depreciation). Furthermore, little is known about possible *unexpected costs* (such as maintaining technologies, coordination) (Hamari et al. 2015).

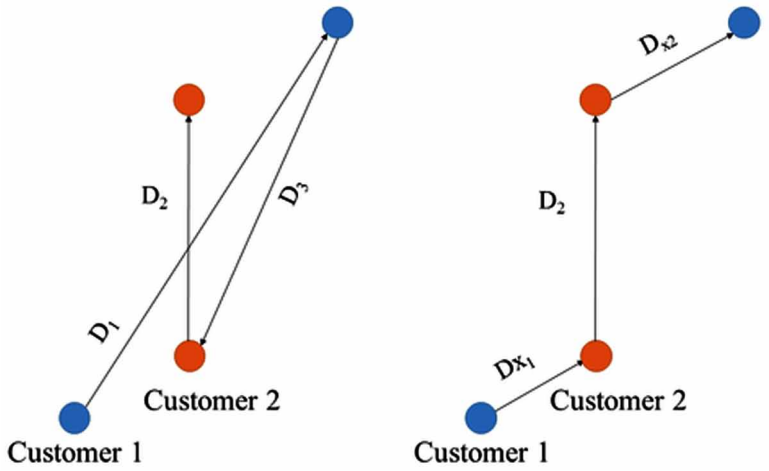
The motivation for participating in sharing economy activities may also arise from the desire to increase social connections and build social networks. This may offer community experience for the customer but also allow the suppliers to *market their services, increase the awareness of the company and create new partnerships.* However, according to Schor and Fitzmaurice (2015, pp. 13): "number of platforms advertising this feature of business fail to deliver durable ties". Many shared models are highly *dependent on technologies and platforms* and require learning and adoption efforts, which may involve significant *investments* (time and monetary efforts). Also *technological risks* need to be taken into account.

Framework of the Value Impacts of Sharing Economy

In general, ridesharing business is based on sharing vehicles by passengers, including different transportation models such as carpooling and public transportation. Furthermore, dynamic (or real-time) ridesharing refers to services or systems that arranges matching rides in short notice (Agatz et al., 2012). This business of dynamic ridesharing has increased significantly over the past few years including hundreds of thousands of riders and millions of customers (Helling & Ajmal, 2017). This is an example of a new, growing industry within sharing economy (Kriston, Szabo & Inzelt, 2010) with the possibilities to provide multiple sustainability-related benefits such as reducing the number of vehicle trips and thus lowering emissions. One application of ridesharing is taxi ridesharing. This refers to model where passengers share their taxi-rides instead of taking individual rides. Figure 1 demonstrates two taxi rides that have synergies. The rides do not need to overlap fully to provide efficient pairing. The biggest benefit of pair-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 1. Example of combining two rides



ing the rides is the decrease of the total driven distance. When combining the rides, the total distance is reduced significantly, which creates financial benefit potential and leads directly to CO_2 emission savings.

The sharing economy has been argued to bring multiple benefits by reducing the environmental load, increasing social well-being, and providing possibilities to gain profits (e.g. Schor & Fitzmaurice, 2015), and to work as a potential driver for radical sustainability improvements at local and global levels. As urbanization is increasing fast globally, the new forms of business are more than welcome to address the challenges of people accumulating to live in certain areas (Cohen & Kietzmann, 2014). Despite the rapid emergence of the sharing economy, little research has been done regarding value creation in the sharing economy and whether the benefits are actually realized or are just largely assumed (Schor & Fitzmaurice, 2015). In the sharing economy, the value creation of many business models is dependent on two or more independent stakeholder groups, being examples of two- or multi-sided markets (Evans, 2003). In order to take advantage on sustainability and the emerging sharing models of business we need to understand how value is created for the wide range of actors involved. Successful establishment of business in the two-sided market requires understanding of value creation and capturing activities for both stakeholder groups, as all sides of the market need to accept the new product or service.

The potential of taxi ridesharing is estimated to be huge with multiple monetary and non-monetary benefits (Santi et al. 2014a; d'Orey et al., 2012). Figure 2 summarizes the value elements of the taxi ridesharing in a two-sided market as a theoretical framework. Value is divided between the customer (passenger) and supplier, including both positive and negative value elements (i.e. benefits and sacrifices).

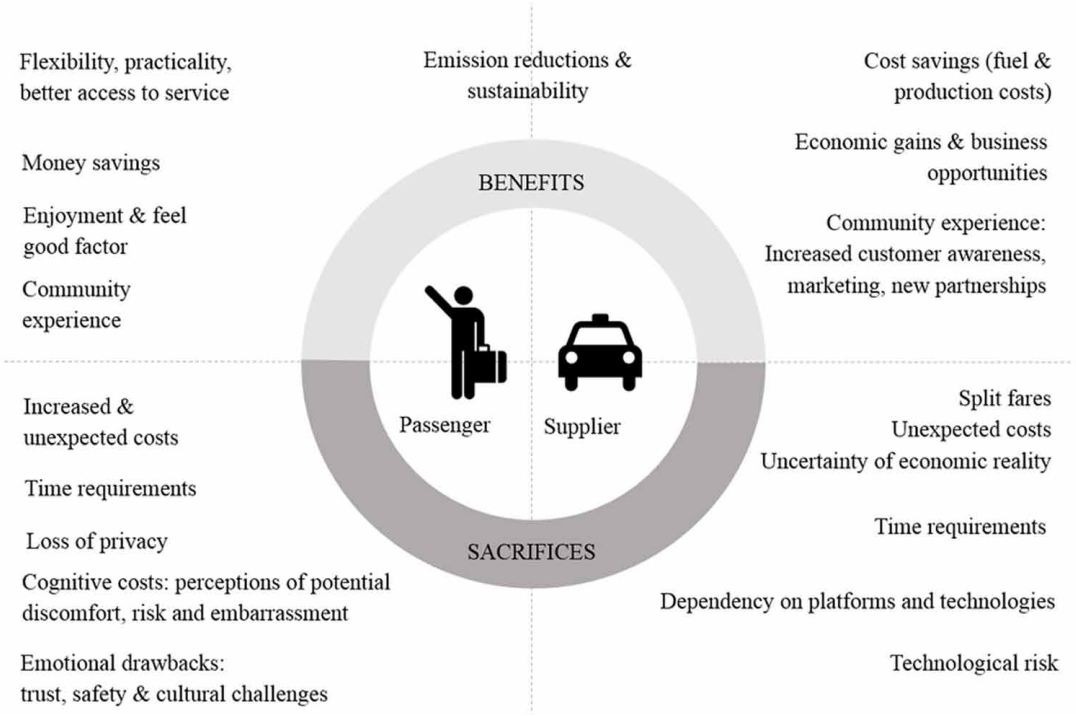
DESCRIPTION OF THE MODEL

In this part, a conceptual mathematical model describing the value creation in taxi sharing is presented. The model describes the allocation of different elements of value in a single sharing transaction. Value is presented as the net benefits of the monetary and non-monetary values described in the framework.

The core of understanding both driver and passenger acceptance is in understanding the logic of how value is created for both the taxi driver and the customer. The decision to adopt is a simple yes or no

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 2. Framework of the value impacts of taxi ridesharing



situation. It is assumed that the customers and the driver will accept the pairing option when their net benefits exceed zero (1, 2), i.e. acceptance is likely if they both benefits from the pairing.

Acceptance functions (1)

$$a_c = \begin{cases} 1; NB_{c,n} > 0 \\ 0; NB_{c,n} \leq 0 \end{cases} \quad (1)$$

$$a_d = \begin{cases} 1; NB_d > 0 \\ 0; NB_d \leq 0 \end{cases} \quad (2)$$

The first part of the model is the calculation of an individual customer's net benefit (3). The two sources of value for the customer are created by monetary savings that are dependent on the price without pairing ($R_{n,a}$) and the price of a paired ride ($R_{n,s}$). In addition to monetary value, there are also various perceived non-monetary benefits (PB_n) and losses (i.e. sacrifices) (PL_n) that are created due to pairing. These components are described in the framework above. Evaluation of the size of these value components at the general level is challenging, because their relative value compared to the monetary

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

value is highly individual, as they are based on personal preferences. They can thus be argued to exists, but in our model we describe these components as compound variables.

$$NB_{c,n} = R_{n,a} - R_{n,s} + PB_n - PL_n \tag{3}$$

For the drivers, the net benefits can be argued to be composed mostly from monetary value (4). From the revenue perspective, pairing the rides reduces the expected revenue, depending on the unpaired price ($S_{n,a}$) and paired prices ($S_{n,s}$). Pairing also leads to diminished driving costs, which are dependent on the total costs of unpaired rides (c_n) and the distance of paired rides (c_s). In addition to direct cost savings, drivers also get other, indirect benefits from pairing (PB_d). These benefits are created e.g. through good publicity due to green awareness and increased revenue enabled by opportunity revenues, as cars are available for additional rides.

$$NB_d = \sum_{1}^{n=c}\left(R_{n,s} - R_{n,a}\right) + \sum_{1}^{n=c} c_n - c_s + PB_d \tag{4}$$

The true value of the system can be evaluated by looking more closely at the value addition and reduction from combining value creation and perceived losses. (5,6,7). In the end, the added value of the system is created from driver's perceived benefits, cost savings from more efficient use of taxies, and each customer's perceived benefits from pairing. The only negative side at the system level is the customer's perceived loss.

$$NB_s = \sum_{1}^{n=c} NB_{c,n} + NB_d \tag{5}$$

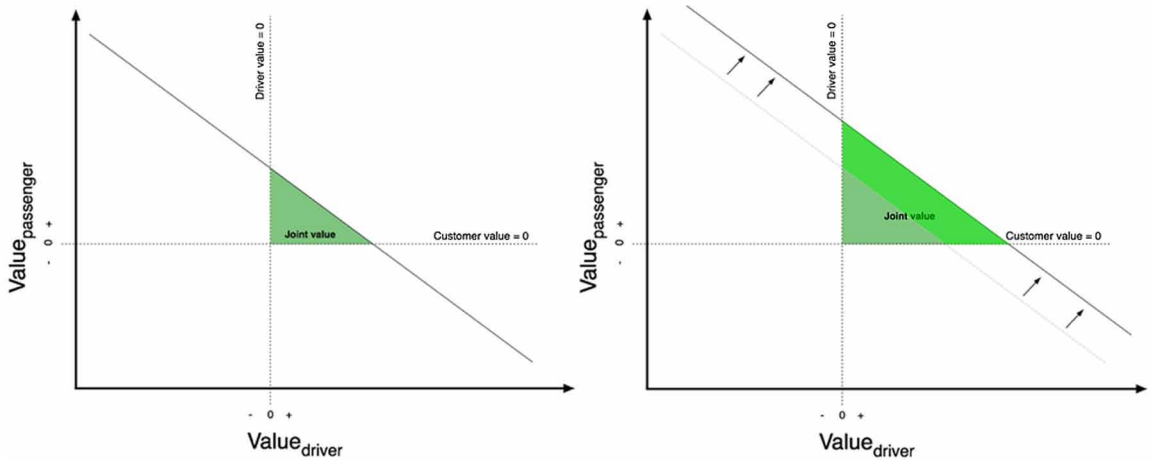
$$NB_s = \sum_{1}^{n=c}\left(R_{n,a} - R_{n,s} + PB_n - PL_n\right) + \sum_{1}^{n=c}\left(R_{n,s} - R_{n,a}\right) + \sum_{1}^{n=c} c_n - c_s + PB_d \tag{6}$$

$$NB_s = PB_d + \sum_{1}^{n=c}\left(c_n + PB_n - PL_n\right) - c_s, \begin{matrix} \forall a_c = 1 \\ \forall a_d = 1 \end{matrix} \tag{7}$$

Pricing has a significant role when looking at the decision at the individual level. At the system level, pricing is not an issue as the total system benefit remains the same, independent of the prices. However, price is critical in defining the balance of benefits between customer and driver as these benefits from a zero-sum game (Figure 3). The more these pricing benefits are moved to the customer side (implies a low price for a combined ride), the higher levels of PLn are allowed, while the driver needs more benefits from PB_d. The opposite is true when pricing is moved to benefit the drivers more.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 3. Perceived passenger and driver value



Non-monetary value components have a significant effect on the system level value creation. If the positive non-monetary variables are higher than the negative aspects, the overall value increases (Figure 3, right). The practical outcome of additional value creation is that it is easier to find a pricing combinations that will lead to joint value creation. The effect is reversed, if the negative non-monetary components are larger, making the creation of joint value combinations harder. This also implies that if the non-monetary benefits are extremely high, there is no opportunity for joint value creation. This may be the case when e.g. the customer finds significant discomfort from sharing a taxi and there is no monetary compensation that will negate this inconvenience.

SOLUTIONS AND RECOMMENDATIONS

This study has focused on understanding the value potential of taxi ridesharing. Taxi sharing has been found to create direct benefits for the society, such as reduced CO_2 emissions (d'Orey et al., 2012) and providing a pathway to sustainability (Heinrichs, 2013; Cohen & Kietzmann, 2014). Although the viability and benefits of taxi sharing have been identified empirically (Santi et al. 2014a; d'Orey et al. 2012; Shmueli et al., 2015), these models have not yet achieved a substantial place in the market. This raises the question of why these models have not yet become a common practice.

In order to answer the question presented above, the focus needs to be turned from system level analysis to understanding value creation for the customers and drivers. In this study, a model describing value creation for the driver and the passenger from sharing taxies has been created. The chapter presented a conceptual model for defining the conditions for the creation of a fair system for each participant. From the supplier perspective, the benefits can be defined relatively simply as the value created directly from increased revenue potential and more efficient use of resources. These value components have also been confirmed by previous studies on the topic (d'Orey et al. 2012). The customer perspective is more complex, as value from sharing is created as a combination of monetary and social value. The measurement

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

of monetary value is relatively straightforward, but the measurement of the more abstract social value is challenging, as the comparison of these value components is hard and highly individual.

The goal for creating the model was to understand how a situation where all the participating actors would benefit could be constructed in taxi sharing. All combinations were found to be extremely good for the whole system, but they may not necessarily provide additional value for the participants involved. There is significant value potential in combining taxi rides, but how this value should be divided between the driver and the passenger is not self-evident. Although value is created from both monetary and social value components, value appropriation is done with the monetary component.

On the basis of the conceptual model, it is clear that an optimal value allocation scenario can be built for sharing taxies. In order to operationalize this kind of a concept for wide use, a platform is needed to facilitate ride pairing and value appropriation. As there are no current widely implemented solutions on the market, this means that a platform needs to be created for this purpose. As two-sided markets are highly dependent on a wide acceptance of the service, without sufficient density (number of necessary passengers and taxi drivers), the chance of finding a ride decreases and may also outweigh especially the financial benefits (Agatz et al., 2012). Therefore, any new system should be done initially on a large scale or the benefits from the system might be significantly decreased.

Practical examples of ridesharing are now starting to rise. Modern alternatives to traditional taxies, like Uber and Lyft have started their ride sharing services (Uber: uberPOOL and Lyft: Lyft line). Both services are still relatively new on market, but they have been steadily growing. E.g. uberPOOL service has grown from a single city pilot to cover 45 cities in the world (Uber, 2017). So far no extensive independent study on the performance level of these services and their potential social impact exist.

Another perspective to the future of ridesharing is the role of governments. Agatz et al. (2012) suggest an establishment of subsidized rideshare system (supported by the government and local businesses, such as taxis), to increase the capacity and efficiency of the urban transportation system relatively inexpensively. Some experiments on so called "hybrid" business models have also already been executed. For example, in 2012 the city of Helsinki adopted a pilot model of on-demand bus service, Kutsuplus, which combined characteristics of public transport and taxi. As an emerging service, Kutsuplus was argued to be one of the world's most highly developed trip-combining hardware using new technology and providing a solution to congestion problems (see e.g. Brustein, 2014), and it grew fast in popularity among consumers. Despite these factors, after two and half years of working, the test is now in hold, as the necessary economic and technical conditions to move the service to the hands of private actors do not exist (Sulopuisto, 2016).

The example above highlights the importance of the impact of public sector support. The society can have an effect on the birth of these models by supporting their development (for example by taxation) and encouraging the use of the systems. On the other hand, the decision makers have the power to slow down the development. Policy makers should thus provide support for the emergence of the types of platforms that make sense from economic, environmental and social perspectives. This is in line with the notion of Cohen and Kietzmann (2014) of the importance of economic and non-economic incentives by agencies in improving overall system performance and reducing conflicts between the private and the public sector. According to Demailly and Novel (2014), making the sharing economy into a sustainable economy is much dependent on public authorities and their support (i.e. ecological taxation and regulations, efficient public transportation) to reinforce the value and environmental benefits of sharing.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

FUTURE RESEARCH DIRECTIONS

This chapter has presented a model that describes the value components for drivers and customers, but so far there is little to no information about the numerical sizes of these components or their priorities. First, this sets a clear need for future research to understand the different customer preferences in sharing taxi rides. One example of value asymmetry is that some customers might value the reduced CO_2 emissions as positive compared to a regular taxi ride, whereas other users would value the reduced personal space while traveling in a negative way. Even though there are several challenges in the incommensurability of different value types, the utilization of a numerical valuation method could offer interesting insights into how different customers perceive value in this context. Thus, the intangible cultural and behavioral factors that affect the value perceived by individuals could be further incorporated into the model. These could be e.g. the variables tested by Möhlman (2015), such as 'trust', that have an effect on the satisfaction experienced by the customer when choosing the sharing option.

Second, better understanding on the long-term effects of such a model to taxi markets is needed. Increasing the potential profit of a taxi car and potentially lower user prices can have a significant effect on both the supplier and customer markets. If sharing rides lowers prices significantly, it is likely that the total number of passengers will increase, thus increasing the need for more taxi services. On the driver side of the market, increasing the profit potential should also lead to an increasing interest in offering taxi services. However, for example if the increasing effect of lowering prices is not very significant, the effect from sharing might be negative to the supplier side of the market. These long-term effects need to be thoroughly analyzed in order to understand the long-term effects of taxi sharing service on the market. Understanding these dynamics may also be necessary to get drivers to accept this new service concept.

Thirdly, creating a platform for sharing taxi rides offers interesting possibilities for both drivers and passengers. This value creation ability will also create opportunities for new businesses. Finding a good way to organize such a business and the appropriate business model for the platform is a clear follow-up question for future research.

In order to create successful innovations within the sharing economy and ensure their diffusion, we need to create scenarios where all the parties involved accept the conditions and the value created. Although this chapter has shed some light on the perceptions of creating sustainable sharing business models, more knowledge is needed on how to manage public-private partnerships (Cohen & Kietzmann, 2014) and to ensure the value creation for both sides in two- (or multi-) sided markets.

CONCLUSION

Careful design and management of the business model is crucial in order to get wide acceptance for sharing models such as taxi sharing service. Although sharing business models have been identified to have an impact on promoting sustainability (Heinrichs, 2013), research on the implementation and approval conditions for these models remains insufficient. Therefore, the main contribution of this chapter is showing the potential for wide market acceptation of sharing business models. The study contributes to the literature by focusing on the case of taxi ridesharing, illustrating an example of value creation in two-sided markets. Second, authors have introduced a conceptual mathematical framework in which the value perspectives of passengers and taxi drivers are combined. Thus the study proposes boundary conditions for building the system and creating a sustainable business model for taxi ridesharing.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Taxi sharing models are an example of business in a two-sided market (e.g. Evans, 2002) in which the successful adoption of the model is dependent on the involvement of the society. Redesigning the transportation system means a structural change to the socioeconomic system, and to facilitate both firm-level and system-level sustainability, sustainable business models are needed (Stubbs & Cocklin, 2008). The emergence of the sharing economy has already enabled the birth of new types of business models and information-based systems (such as Uber). Relying purely on these often privately owned models can, however, fail in achieving the desired environmental and social goals (Cohen & Kietzmann, 2014). According to Schor (2014), the sharing economy includes a wide potential for the creation of economic value. However, this value needs to be equally shared among the different types of actors, which requires collaboration within the private and the public sector.

From the supplier perspective, the model presented in this chapter helps in understanding the possibilities to do business in a new way. As value is usually understood through money and the price of the ride, the models helps in seeing the actual business benefits of combining rides. The tighter the margins the driver gets (e.g. if the fuel prices rises), the more willing the supplier should be to combine taxi rides (as the margin of a single ride falls, the profitability of combining rides rises).

From the passenger perspective (rational decision making), combining taxi rides involves also many soft value elements (e.g. enjoyment of the activity, enhancing sustainability) which is why some passengers may be willing to share rides without higher (monetary) benefits. On the other hand, Hamari et al. (2015) argue that although people may have a positive attitude towards collaborative consumption, it does not necessary translate into actual participation. Economic benefits, such as saving money and time, have a significant effect on behavioral intentions.

In this chapter, authors have proposed a conceptual model of value sharing, which in turn raises interesting openings for further research, including better understanding of different customer preferences and long-term effects of taxi sharing (and related) models. Furthermore, to create a sustainable business model for sharing taxi rides requires the creation of a platform and management practices. An interesting aspect about the mathematical model is that it shows how pricing questions are irrelevant at the system level. However, price contributes to value allocation between individual agents and therefore plays a major role in the decision making of an individual, and the eventual acceptance of sharing. This finding underlines the importance of this study – in sustainability issues it is important to move beyond system level value towards the level of individual decision makers. This is a challenge for future research, as it should increase understanding of individual agents and the effect of their behavior on system level sustainable value creation.

REFERENCES

Abdelkafi, N., & Täuscher, K. (2016). Business Models for Sustainability From a System Dynamics Perspective. *Organization & Environment*, *29*(1), 74–96. doi:10.1177/1086026615592930

Adner, R., & Kapoor, R. (2010). Value creation in innovation ecosystems: How the structure of technological interdependence affects firm performance in technology generations. *Strategic Management Journal*, *31*(3), 306–333. doi:10.1002mj.821

Agatz, N., Erera, A., Savelsbergh, M., & Wang, X. (2012). Optimization for dynamic ride-sharing: A review. *European Journal of Operational Research*, *223*(2), 295–303. doi:10.1016/j.ejor.2012.05.028

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Albinsson, P. A., & Perera, B. Y. (2012). Alternative marketplaces in the 21st century: Building community through sharing events. *Journal of Consumer Behaviour*, *11*(4), 303–315. doi:10.1002/cb.1389

Ambrus, A., & Argenziano, R. (2009). Asymmetric Networks in Two-Sided Markets. *American Economic Journal. Microeconomics*, *1*(1), 17–52. doi:10.1257/mic.1.1.17

Austin, S., Canibe, C., & Slobin, S. (2015). *The Billion Dollar Startup Club. Dow Jones VentureSource and The Wall Street Journal*. Retrieved March 29, 2016, from http://graphics.wsj.com/billion-dollar-club/

Belk, R. (2014). You are what you can access: Sharing and collaborative consumption online. *Journal of Business Research*, *67*(8), 1595–1600. doi:10.1016/j.jbusres.2013.10.001

Black, S. E., & Lynch, L. M. (2004). Whats driving the new economy?: The benefits of workplace innovation. *The Economic Journal*, *114*(493), 97–116. doi:10.1111/j.0013-0133.2004.00189.x

Bolton, W., & Drew, J. H. (1991). A multistage model of customers: Assessment of service quality and value. *The Journal of Consumer Research*, *17*(4), 375–384. doi:10.1086/208564

Boons, F., & Lüdeke-Freund, F. (2013). Business models for sustainable innovation: State of the art and steps towards a research agenda. *Journal of Cleaner Production*, *45*, 9–19. doi:10.1016/j.jclepro.2012.07.007

Boons, F., Montalvo, C., Quist, J., & Wagner, M. (2013). Sustainable innovation, business models and economic performance: An overview. *Journal of Cleaner Production*, *45*, 1–8. doi:10.1016/j.jclepro.2012.08.013

Botsman, R. (2013). The Rise of the Sharing Economy. *The Economist.* Retrieved April 15, 2016, from http://www.economist.com/news/leaders/21573104-internet-everything-hire-rise-sharing-economy

Botsman, R., & Rogers, R. (2010a). Beyond Zipcar: Collaborative consumption. *Harvard Business Review*, *88*(10), 30. PMID:20607961

Botsman, R., & Rogers, R. (2010b). *What's mine is yours: The rise of collaborative consumption*. New York, NY: Collins.

Brustein, J. (2014). *Helsinki's Uber for Buses Is Stuck in First Gear Bloomberg, Finland's quasi-public Kutsuplus isn't nearing a profit*. Retrieved May 10, 2016, from http://www.bloomberg.com/news/articles/2014-05-16/helsinkis-uber-for-buses-is-stuck-in-first-gear

Chee Tahir, A., & Darton, R. C. (2010). The Process Analysis Method of selecting indicators to quantify the sustainability performance of a business operation. *Journal of Cleaner Production*, *18*(16-17), 1598–1607. doi:10.1016/j.jclepro.2010.07.012

Chui, M., Manyika, J., Bughin, J., Dobbs, R., Roxburgh, C., & Sarrazin, H. (2012). *The social economy: Unlocking value and productivity through social technologies*. McKinsey Global Institute.

Cohen, B., & Kietzmann, J. (2014). Ride On! Mobility Business Models for the Sharing Economy. *Organization & Environment*, *27*(3), 279–296. doi:10.1177/1086026614546199

Cronin, J. J. Jr, Brady, M. K., & Hult, G. T. M. (2000). Assessing the effects of quality, value and customer satisfaction on consumer behavioral intentions in service environment. *Journal of Retailing*, *76*(2), 193–218. doi:10.1016/S0022-4359(00)00028-2

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

D'Orey, P. M., Fernandes, R., & Ferreira, M. (2012). Empirical Evaluation of a Dynamic and Distributed Taxi-Sharing System. *Intelligent Transportation Systems (ITSC), 2012 15th International IEEE Conference on Intelligent Transportation Systems*, 140-146. 10.1109/ITSC.2012.6338703

Demailly, D., & Novel, A. S. (2014). *The sharing economy: make it sustainable*. Studies N°03/14. IDDRI.

Eckhardt, G. M., Belk, R., & Devinney, T. M. (2010). Why dont consumers consume ethically? *Journal of Consumer Behaviour*, *9*(6), 426–436. doi:10.1002/cb.332

Eisenmann, T. R., Parker, G. G., & Van Alstyne, M. W. (2006). Strategies for Two-Sided Markets. *Harvard Business Review*, *84*(10), 92. PMID:16649701

Elster, J. (1998). Emotions and Economic Theory. *Journal of Economic Literature*, *36*(1), 47–74.

Ethiraj, S. K., & Posen, H. E. (2013). Do product architectures affect innovation productivity in complex product ecosystems? *Advances in Strategic Management*, *30*, 127–166.

Evans, D. S. (2002). *The antitrust economics of two-sided markets.* Available at SSRN 332022

Evans, D. S. (2003). Some Empirical Aspects of Multi-Sided Platform Industries. *Review of Network Economics*, *2*(3), 191–209. doi:10.2202/1446-9022.1026

Firnkorn, J., & Müller, M. (2011). What will be the environmental effects of new flee-floating car-sharing systems? The case of car2go in Ulm. *Ecological Economics*, *70*(8), 1519–1528. doi:10.1016/j.ecolecon.2011.03.014

Gauthier, C., & Gilomen, B. (2016). Business Models for Sustainability, Energy Efficiency in Urban Districts. *Organization & Environment*, *29*(1), 124–144. doi:10.1177/1086026615592931

Graf, A., & Maas, P. (2008). Customer value from a customer perspective: A comprehensive review. *Working Papers on Risk Management and Insurance, 52*, 1-37.

Grewal, D., Monroe, K. B., & Khrisnan, R. (1998). The effects of price-comparison advertising on buyers perception on acquisition of value, transaction value, and behavioral intentions. *Journal of Marketing*, *62*(2), 46–59. doi:10.2307/1252160

Hamari, J., Sjöklint, M., & Ukkonen A. (2015). The Sharing Economy: Why people participate in collaborative consumption. *Journal of the Association for Information Science and Technology*.

Heinrichs, H. (2013). Sharing economy: A potential new pathway to sustainability. *GAIA-Ecological Perspectives for Science and Society*, *22*(4), 228–231. doi:10.14512/gaia.22.4.5

Helling, B., & Ajmal, S. I. (2017). *The Year The Rideshare Industry Crushed The Taxi*. Retrieved January 17, 2017, from https://rideshareapps.com/2015-rideshare-infographic/

Henten, A. H., & Windekilde, I. M. (2016). Transaction costs and the sharing economy. *Info, 18*(1), 1-15.

Hoffmann, V. H., & Busch, T. (2008). Corporate Carbon Performance Indicators, Carbon Intensity, Dependency, Exposure, and Risk. *Journal of Industrial Ecology*, *12*(4), 505–520. doi:10.1111/j.1530-9290.2008.00066.x

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Kriston, A., Szabo, T., & Inzelt, G. (2010). The marriage of car sharing and hydrogen economy: A possible solution to the main problems of urban living. *International Journal of Hydrogen Energy*, *35*(23), 12697–12708. doi:10.1016/j.ijhydene.2010.08.110

Lepak, D. P., Smith, K. G., & Taylor, M. S. (2007). Value creation and value capture: A multilevel perspective. *Academy of Management Review*, *32*(1), 180–194. doi:10.5465/AMR.2007.23464011

López, L. A., Domingos, T., Cadarso, M. Á., & Zafrilla, J. E. (2014). The smarter, the cleaner? Collaborative footprint: A further look at taxi sharing. *Proceedings of the National Academy of Sciences of the United States of America*, *111*(51), 5488–5488. doi:10.1073/pnas.1420242112 PMID:25503369

Ma, S., Zheng, Y., & Wolfson, O. (2013). T-share: A large-scale dynamic taxi ridesharing service. In *Data Engineering (ICDE), 2013 IEEE 29th International Conference,* (pp. 410-421). IEEE.

Martin, C. J. (2016). The sharing economy: A pathway to sustainability or a nightmarish form of neoliberal capitalism? *Ecological Economics*, *121*(3), 149–159. doi:10.1016/j.ecolecon.2015.11.027

Martin, E., Shaheen, S., & Lidicker, J. (2010). Impact of carsharing on household vehicle holdings: Results from North American shared-use vehicle survey. *Transportation Research Record: Journal of the Transportation Research Board*, *2143*, 150–158. doi:10.3141/2143-19

Möhlmann, M. (2015). Collaborative consumption: Determinants of satisfaction and the likelihood of using a sharing economy option again. *Journal of Consumer Behaviour*, *14*(3), 193–207. doi:10.1002/cb.1512

Nidumolu, R., Prahalad, C. K., & Rangaswami, M. R. (2009). Why sustainability is now the key driver of innovation. *Harvard Business Review*, *87*(9), 56–64.

Osterwalder, A., & Pigneur, Y. (2010). *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers*. Hoboken, NJ: Johan Wiley & Sons.

Owyang, J., Samuel, A., & Grenville, A. (2014). *Sharing is the new buying: How to win in the collaborative economy (Report). Vision CriticalBlog*. Retrieved April 15, 2016, from http://www.web-strategist.com/blog/2014/03/03/report-sharing-is-the-new-buying-winning-in-the-collaborative-economy/

Porter, M. E., & Kramer, M. (2011). Creating shared value: Redefining capitalism and the role of the corporation in society. *Harvard Business Review*, *89*(1/2), 62–77.

Santi, P., Resta, G., Szell, M., Sobolevsky, S., Strogatz, S. H., & Ratti, C. (2014). Quantifying the benefits of vehicle pooling with shareability networks. *Proceedings of the National Academy of Sciences of the United States of America*, *111*(37), 13290–13294. doi:10.1073/pnas.1403657111 PMID:25197046

Santi, P., Resta, G., Szell, M., Sobolevsky, S., Strogatz, S. H., & Ratti, C. (2014). Reply to Lopez et al.: Sustainable implementation of taxi sharing requires understanding systemic effects. *Proceedings of the National Academy of Sciences of the United States of America*, *111*(51), 5489–5489. doi:10.1073/pnas.1421300112 PMID:25503368

Schaltegger, S., & Wagner, M. (2011). Sustainable entrepreneurship and sustainability innovation: Categories and interactions. *Business Strategy and the Environment*, *20*(4), 222–237. doi:10.1002/bse.682

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Schor, J. B. (2014). *Debating the Sharing Economy. A Great Transition Initiative Essay*. Retrieved April 26, 2016, from http://greattransition.org/publication/debating-the-sharing-economy

Schor, J. B., & Fitzmaurice, C. J. (2015). *Collaborating and Connecting: The emergence of the sharing economy. In Handbook on Research on Sustainable Consumption*. Cheltenham, UK: Edward Elgar.

Seebode, D., Jeanrenaud, S., & Bessant, J. (2012). Managing innovation for sustainability. *R & D Management*, *42*(3), 195–226. doi:10.1111/j.1467-9310.2012.00678.x

Shmueli, E., Mazeh, I., Radaelli, L., Pentland, A. S., & Altshuler, Y. (2015). Ride sharing: a network perspective. In Social computing, behavioral-cultural modeling, and prediction, (pp. 434-439). Springer. doi:10.1007/978-3-319-16268-3_55

Stubbs, W., & Cocklin, C. (2008). Conceptualizing a Sustainability Business Model. *Organization & Environment*, *21*(2), 103–127. doi:10.1177/1086026608318042

Sulopuisto, O. (2016). *Why Helsinki's innovative on-demand bus service failed*. Retrieved May 15, 2016, from http://citiscope.org/story/2016/why-helsinkis-innovative-demand-bus-service-failed

Uber. (2017). *uberPOOL Share your ride and save*. Retrieved January 18, 2017, from https://www.uber.com/ride/uberpool/

Ulaga, W., & Eggert, A. (2006). Value-based differentiation in business relationships: Gaining and sustaining key supplier status, *Journal of Marketing, 70*, 119-136.

United Nations. (2015). *Global Sustainable Development Report 2015 Edition*. Advance Unedited version. Retrieved March, 2016, from https://sustainabledevelopment.un.org/content/documents/1758GSDR%202015%20Advance%20Unedited%20Version.pdf

Zelizer, V. A. (2010). *Economic Lives: How Culture Shapes the Economy*. Princeton, NJ: Princeton University Press. doi:10.1515/9781400836253

KEY TERMS AND DEFINITIONS

Business Model: Description of an organization's value creation, capturing and delivering principles and related activities.

Market Penetration: A measure of the market volume of a service (or product) compared to the total sales volume of competing services. It includes activities aiming at increasing the market share of a new or an existing service.

Monetary Value: The value of a service (or product) that is received by selling. It is the sum of money that the customer is willing to pay for the service and what is consumed in providing the service.

Multi-Sided Markets: Economic platforms that have two or more distinct user groups participating in the value creation and capturing activities. These groups provide network benefits for each other.

Sharing Economy: Collaborative consumption and peer-to-peer activities based on sharing resources (goods, services), which are usually coordinated through online platforms.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Societal Value: A concept including benefits that are addressed by the society and promote the well-being of wider areas and groups of people. The benefits include for example value elements that promote the development of transportation, healthcare, education and the environment.

Sustainability: Continued economic development without reducing natural productive capacity.

Sustainable Development: Development that aims to fulfill the needs of the present without compromising the needs of future generations. Sustainability is understood through three dimensions: ecological, economic and social.

Value: The worth of all benefits and rights experienced by ownership or participation, including both hard benefits such as money and soft benefits like enjoyment of the activity.

Value Allocation: A strategy which aims at balancing the overall amount of value between the participating actors. For example in taxi ridesharing, this includes negotiations between the taxi driver and the passenger about the price of the ride. A related term is value appropriation, in which the stakeholders involved compete to capture the value created by the business action.

This research was previously published in Value Sharing for Sustainable and Inclusive Development edited by Mario Risso and Silvia Testarmata, pages 252-269, copyright year 2018 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 45
The Italian Doctrine *Economia Aziendale* and the Primary Interest of the Organizations

Emiliano Di Carlo
University of Rome "Tor Vergata", Italy

ABSTRACT

The aim of this chapter is to enter into the debate on the objective of the firm and more in general of the organizations, in order to discuss the contribution that the Italian doctrine Economia Aziendale (EA) can give to this debate and to the sustainable economic development. To this end, it is pro-posed the concept of primary interest of the organizations, the aziende according to the EA (i.e., business entities, public administrations and non-profit organizations), which is to satisfy human needs through the production of useful goods and services (the objective of the azienda) ensuring a sustainable value creation in the short and long term (the condition for the survival and growth of the azienda). For business entities, the primary interest supports the so called 'integration thesis' according to which business and ethics can be achieved together, since the profit is considered as a condition that allows the survival and growth of the firm favouring all stakeholders and the community.

INTRODUCTION

In the aftermath of the global financial crisis, several scholars of the Italian discipline *Economia Aziendale* (*EA*) have been committed in recognizing its possible causes in the alienation of individuals involved in business from what are the right rules to well conduct the business itself, suggested by the *EA* (Cavalieri, 2009; Coda, 2010). In this line, the lecture by Prof. Massimo Saita, held at the University of Milan Bicocca in December 2014, entitled 'The foundations of *Economia Aziendale* forgotten before the crisis.'

The aim of this chapter is to enter into the debate on the objective of the firm and more in general of the organizations, the *aziende* according to the *EA* (i.e. business entities, public administrations and non-profit organizations), in order to discuss the contribution that the *EA* can provide to this debate and to the sustainable economic development.

DOI: 10.4018/978-1-5225-7915-1.ch045

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The need to explore the suggestions of that doctrine comes from at least the following considerations:

1. The limits of some of the most popular theories on the objective of the firms, in particular shareholder theory and agency theory, that diffused the gloomy vision of human nature (Hirschman, 1970) in universities and business schools around the world (Agle, Donaldson, Freeman, Jensen, Mitchell, & Wood, 2008; Ghoshal, 2005; Giacalone & Wargo, 2009);
2. The alternatives to the shareholder theory (e.g. stakeholder theory) often do not clarify how and in what time companies should create value, with the risk to be vague and ambiguous, favouring the opportunistic behaviour of the insiders (i.e. managers and controlling shareholder) (Phillips, Freeman, & Wicks, 2003, p. 495);
3. The possibility to focus the attention on the concept of *azienda* (almost unknown outside the Italian context) using the heritage of teachings of some Masters of the *Economia Aziendale* (Amaduzzi, 1978; Ferrero, 1968; Giannessi, 1960; Masini, 1982; Onida, 1971; Zappa, 1957) about the finalism and the conditions that all *aziende* must achieve in order to survive and growth;
4. The ability to broaden the observation from the business entities (firms) to all types of economic entities (public administrations and non-profit entities), all considered as cells of the society (Amaduzzi, 1978, p. 19; Cassandro, 1969). Indeed all the economic entities can ensure the development of the economy and society (Cavalieri, 2009), participating to the common good (Caldarelli, Fiondella, Maffei, Spanò, & Zagaria, 2011);
5. With specific regards to for profit entities, the scope of analysis covers not only large, publicly held corporation, but also small and medium-sized companies, contrasting 'the tendency of management scholars more generally to concentrate on large, multinational corporations as the objects of their research' (Phillips et al., 2003, p. 495).
6. The *Economia Aziendale* connects the ethics with business decisions (Costa & Ramus, 2012; Signori & Rusconi, 2009), giving elements to support the integration thesis, in the sense that moving from the interest of the shareholders to that of the firm it can be said that not only 'good ethics is good business' (Davis, 1994), but also 'good business (for the firm) is good ethics (for all stakeholder)', in the sense that if you really care about stakeholders you should conduct the business in a profitable way.

It is then proposed the concept of 'primary interest of the *azienda*', as a principle of good governance for all organizations. This interest includes two elements: 1) the objective of the *azienda* (i.e. satisfy human needs through the production of useful goods and services); 2) a condition for the survival and growth of the *azienda* (i.e. ensuring a sustainable value creation in the short and long term). The primary interest of the *azienda* wants to support the so-called 'integration thesis' (Agle et al*.,* 2008), according to which business and ethics can be achieved together. The term "primary" is used in order to distinguish that interest from the particular (and sometimes temporary) interest of the stakeholders, which become secondary when in contrast with the primary interest of the *azienda*.

Such a proposal tries to answer the following questions which find only partial answers in the Anglo-American theories: "for whom", "how" and "in what times" companies should create value?

From a methodological point of view, the choice of the elements included in the primary interest is based on the following criteria:

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

1. Consider the effect of the objective of the *azienda* on its continuity as well as on the economic problem resolution and the ability to steer the governance toward the common good;
2. Mitigate the opportunistic behaviour against the *azienda* by the various stakeholders;
3. Avoid that the goal of the *azienda* coincides with the particular (and sometimes temporary) interest of a specific stakeholder or group of stakeholders, and at the same time avoid assigning more objectives, or an objective that is vague and ambiguous;
4. Promote the dissemination of a culture of sustainable value creation even in public administration and in non-profit organizations.

The methodological approach used in the analysis of the literature is descriptive/narrative and the points listed above represent the criteria that led to select certain authors instead of others. Thus the limit of that approach derives from the goodness of these criteria.

The chapter consists of five sections. In section two the main Anglo-American theories on corporate objective are analysed. Section three is dedicated to the description of the *Economia Aziendale* and to the concept of *azienda*. Section four proposes the concept of primary interest of the *azienda*. Section five concludes.

THE ANGLO-AMERICAN THEORIES ON CORPORATE OBJECTIVE

The Anglo-American theories on the objective (or purpose) of the corporation are shown in Table 1. The debate on what should be the most appropriate purpose of the firm aims to achieve the best solu-

Table 1. Anglo-American theories on the objective of the corporation: 'for whom', 'how' and 'in what time' create value

	Idea of Corporation as a Separate Institution	**"*For Whom*" Create Value**	**"*How*" Create Value**	**"*In What Time*" Create Value**	**Authors**
Shareholder theory	Absent	Shareholders	Resolving conflicts with stakeholders, in order to maximize profit for shareholders. The corporation is an instrument of the shareholders	Not specified, but the market pushes toward the short term	Friedman, 1970
Stakeholder theory	Absent	Stakeholders	Managing relationships with stakeholders who have conflicting interests, through the balance between contributions and rewards. The corporation is an instrument of the stakeholders	Not specified	Freeman, 1984
Enlightened value maximization theory	Absent	Shareholders	Managing relations with stakeholders, in order to maximize profit for shareholders. The corporation is an instrument of the shareholders	Long term	Jensen, 2001
Organic theory	Strong	Corporation	Not specified	Not specified	Arthur, 1987
Social entity theory	Strong	Community	Not specified	Not specified	Allen, 1992

Source: Our elaboration

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

tion, according to an utilitarian perspective (Singer, 2010), for what concern the effect that it may have on both the survival and growth of the firm and the social well being.

For example, according to the shareholder theory the welfare is maximized when firms create value for their shareholders, while for the stakeholder theory this purpose could be unsustainable, being necessary take into account and satisfy the expectations of all stakeholders.

Normally, the objective is referred to the individual, i.e. "for whom" the corporation should create value (e.g. shareholder, stakeholder, corporation itself). In addition Table 1 also contains "*how*" and "*in what time*" these theories suggest to create value. In this regards, Cavalieri (2010) argues that 'talk about creating value without any clarification on the content of that term is meaningless. Indeed, one must understand for whom, by what time references and how (i.e., under what equilibrium conditions) the *azienda* must create value' (p. 25, our translation). The specification of these elements is central for the continuity of the *azienda*, as well as for giving a guide to managers, mitigating their eventual opportunistic behaviour.

According to Meynhardt (2009) the term "Values" 'is one of those ambiguous container terms with enormous promise of insight but no widespread consensus' (p. 196). Rescher (1969) states that 'Philosophers and social scientists concerned with value questions have long recognized the need for a more precise value terminology to facilitate the exact formulations needed in scholarly and scientific contexts' (p. 2).

Only the enlightened value maximization theory explicits all the value creation conditions. As part of the theories mentioned, it is possible to distinguish those with a strong idea of the firm as a separate institution from its stakeholders and, therefore, with its own purpose, from those for which the company is an instrument to satisfy the interests of a group of individuals (e.g. shareholder or stakeholders).

The *shareholder theory* has influenced the attention of scholars of management and governance for several years clarifying strategies and behaviour of firms (Friedman, 1970; Rappaport, 1990). For that theory, the agents (managers) have a moral obligation to maximize the principals (shareholders) wealth, i.e. 'conduct the business in accordance with their desires, which generally will be to make as much money as possible' (Friedman, 1970). Being the firm a legal fiction, an instrument owned by the shareholders to maximize their profit (Jensen & Meckling, 1976), the interests of the firm and shareholders coincide (Allen, 1992). This is confirmed by the fact that in some cases the concept of creating value for the shareholders is used as a synonym for creating value of the corporation (e.g. Alexander & Cohen, 1999, p. 3). The short-term orientation of that theory comes from the fact that markets are not likely to capture the ability of the company to create value in the medium and long term (myopic market model), or they are simply interested in the short term (Dallas, 2011; Hayes & Abernathy, 1980).

Unlike the shareholder theory, the *stakeholder theory* (Freeman, 1984) draws attention to the need to balance the value creation for shareholder with the value creation of all the other stakeholders. The firm is an instrument to create value for all its stakeholders. The reason behind that theory derives from two approaches: normative and instrumental (Donaldson & Preston, 1995). The normative approach recognizes the existence of an ethical dimension (Phillips et al. 2003, p. 481) in addition to the economic and legal ones, a moral duty for those who governs the company to consider the rights of all those involved. According to the instrumental approach, managers have to pay attention to the other stakeholders because is the best way to create value for the shareholders (Jones, 1995; Plender, 1997).

However, one of the limits of the stakeholder theory is viewed as leaving too much discretion to managers (Keay, 2008, p. 20). In this regards (Tirole, 2010) states that 'management can almost always rationalize any action by invoking its impact on the welfare of some stakeholder' (p. 62). Moreover,

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Jensen (2001) points out that stakeholder theory 'allows managers and directors to devote the firm's resources to their own favourite causes—the environment, art, cities, medical research (…) By expanding the power of managers in this unproductive way, stakeholder theory increases the agency costs in the economic system.' (p. 14). Phillips et al. (2003, p. 495), analysing the challenges of stakeholder theory, state that managerial opportunism still represents a threat to the organizational effectiveness.

The shareholders *vs* stakeholders debate has interested many scholars in the last decade (Asher et al*.,* 2005; Freeman, et al. 2004; Jensen, 2001; Keay, 2008; Sundaram & Inkpen, 2004; Tirole, 2010). Comparing shareholder theory and stakehodler theory, Jensen (2001) argues that shareholder theory and stakeholder theory can be considered jointly in what he calls '*enlightened value maximization*' (also called 'enlightened stakeholder theory'). This approach draws many concepts of the stakeholder theory, but at the same time puts the maximization total long-term firm market value as a necessary criterion to define a compromise between the various stakeholders. In other words, the long-term orientation is the element that allows, in maximizing the shareholder value, to take into account the expectations of the other stakeholders.

This orientation provides the solution to the problems that arise in the identification of multiple objectives of stakeholder theory, providing managers with the criteria for the right balance between stakeholders. In this regards, Jensen (2001) points out that 'telling a manager to maximize current profits, market share, future growth in profits, and anything else one pleases will leave that manager with no way to make a reasoned decision. Indeed, it leaves the manager with no objective. The result will be confusion and a lack of purpose that will handicap the firm in its competition for survival' (p. 11), increasing the agency costs and damaging the social wealth.

Unlike the settings that move between shareholder and stakeholder theory, organic theory and social entity theory consider the firm as a separate institution from all its stakeholders and with its own interest (Lan & Heracleous, 2010).

The *organic theory* does not accept that only the individual can be considered as a legal person worthy of protection. In fact, with specific reference to the corporation, they are separate legal entities with respect to the owners (Arthur, 1987). For this reason, corporations, having legal personality, should be compared to a citizen with its responsibilities (Dodd, 1932). The assumption that the enterprise is comparable to an individual is clearly opposed to the agency theory (Jensen & Meckling, 1976) and contractual theory (Coase, 1937, p. 311), which sees the company as a set of contracts, an artificial person created by the law.

The *social entity theory* considers the corporation as a social entity formed through political and legal processes, in order to meet social welfare (Allen, 1992). In this sense, the corporation can be considered as a political tool for social purposes. The company would be formed through political and legal processes, in order to meet social welfare (Allen, 1992; Arthur, 1987; Lan & Heracleous, 2010). The company, therefore, would not only have financial obligations towards the shareholders, but also to the community. As good citizens, businesses should contribute to the social well-being.

The problem with organic theory and social entity theory is that the concept of value creation is vague and ambiguous, since they do not clarify: 1) how the corporation should create value, in particular how to solve the trade-off between the interest of the company and the interest of its stakeholders; 2) what is the role of stakeholders in the value creation for the corporation; 3) in what time the corporation should create value; 4) how to minimize the managerial opportunism against the interest of the company and its stakeholders.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

THE *ECONOMIA AZIENDALE* AND THE CONCEPT OF *AZIENDA*

Economia Aziendale (*EA*) is an Italian doctrine founded in 1927 by Gino Zappa (1927) who focuses on the '*azienda*' as a coherent unity (i.e. inseparability) of 'economic operations' (Cinquini & Marelli, 2007; Viganò & Mattessich, 2007, p. 25), which characterises institutions (i.e. for-profit organization, public administrations, and non-profit organizations). Zappa (1956) defines the *azienda* as an 'economic institution intended to last for an indefinite length of time and that, with the aim of meeting human needs, manages the production, procurement or consumption of resources in continuous coordination' (p. 37, our translation), and *EA* as a unitary science that studies the 'existence conditions and life manifestations of the *azienda*' (Zappa, 1927).

The Italian School of Accounting and *Economia Aziendale* (Sidrea, 2009) proposes the following three attributes that allow distinguishing the *azienda* from the world of economic organizations (see also Cavalieri, 1999):

- Systemic coordination;
- Decision-making autonomy;
- Economicità;

The *azienda* is a system in the sense that its parts (e.g. assets such as machinery, equipment) and participants (i.e. persons involved in the production process) are not separated; instead they are coordinated and integrated, they are bounded together in order to achieve the *azienda*'s interest (Bertini, 2014; Coda, 2010). The *azienda* 'is not identified with the owners, the capital, the assets, the people taking part in it or with the contracts or the relationships among its components, but rather it is an autonomous and real entity composed of all these elements and the relationships among them. It is very important to point out the concept of system which is used by Zappa but not fully explored (…) In the *azienda*, the components will change, the elements will modify, but the whole will persist' (Signori & Rusconi, 2009, p. 308). Onida (1971) emphasizes this concept, defining the *azienda* as a dynamic system in which the 'unity in the variety and permanence in mobility, comes true in a vital synthesis' (p. 4, our translation).

Amaduzzi (1936) points out that the *azienda* is 'a system with economic dynamics for the achievement of one given purpose' (p. 18, our translation). Such a system 'can be understood and studied only as a coordination of forces which act and change without interruption' (p. 18, our translation).

The systemic vision basically involves the integration of all operations in order to achieve the objective of the organization and allows understanding the importance and the relativity of each behaviour and operation.

The *azienda* should have a decision-making autonomy (the second attribute) in the sense that in achieving its purpose it should be not subjected to the direction of other individuals or organizations (Airoldi, Brunetti & Coda, 2005; Cavalieri, 1999, p. 119). In other words, the *azienda* must be independent from external dominant pressures. For instance, if Entity A controls and manages Entity B (i.e. Entity A and Entity B form a business group), thus entity B does not have a decision-making autonomy, being a sub-system of entity A, consequently A and B are parts of the same *azienda*. More precisely, the *azienda* has a decision-making autonomy when it can autonomously achieve its objective. The objective can be also assigned by other entities (e.g. entity A gives the objective to Entity B), what it is relevant is that the *azienda* is autonomous in achieving that objective and that its activity is not related to the activity of other entities (e.g. entity A has a business model related to that of entity B, since the former

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

produces cars while the latter trucks). Thus, if: 1) entity A controls entity B without manage it; 2) its objective is different from the entity B's objective and; 3) the activity of Entity A is not related to the activity of entity B (e.g. because of entity A produces cars, while entity B produces computers), thus entity A and entity B are two autonomous *aziende*, even if they belong to the same business group (Di Carlo, Fortuna & Testarmata, 2015).

The *economcità* (the third attribute) implies that the entire activity of the *azienda* is permanently inspired by the logic of strategic effectiveness and operational efficiency (Cavalieri, 1999; Onida, 1971, pp. 55-112). The strategic effectiveness is the ability of the *azienda* to allocate the available resources to the achievement of winning objectives, or, rather, to select suitable products to meet and satisfy the overall expectations of the customers/users. Operational efficiency is the *azienda*'s ability to achieve these productions reducing the use of resources.

The *aziende* can then be classified as: business entities, public administrations and non-profit organizations (Cavalieri, 2010). Business entities, unlike the other categories, operate in the market, both for the acquisition of factors production, and for the placement of products. From the legal point of view, there are three different types of business entities: sole proprietorships, partnerships and corporations. The corporation is therefore a type of *azienda* that has the legal status of corporation, that is, a juridical person with juridical personality. It means that the corporation is an incorporated business (i.e. the business is recognized as a separate legal entity).

However, unlike shareholder and stakeholder theories, according to the *EA* the *azienda*-corporation is an institution intended to last for an indefinite length of time. It allows distinguishing the particular (and sometimes temporary) interests of the stakeholders from the interest of the *azienda*.

Thus, all the *aziende* are organizations while there are some organizations that cannot be qualified as *aziende*, because they do not possess all the three attributes listed above. For instance a subsidiary within a group of companies is a productive organization but is not an *azienda* if, for example, its business model is integrated with that of the other affiliated group companies and/or is directed by the parent company of the group (Di Carlo, Fortuna & Testarmata, 2015).

The attributes of *aziendalità* are not always present and do not emerge, therefore, as a predetermined condition following the mere establishment of a legal institution (Cafferata, 2016). Conversely, they are rather difficult to possess, but at the same time necessary for a long-term continuity of the *azienda*.

THE PRIMARY INTEREST OF THE *AZIENDA*

The Need of the Organizations' Objective

Any type of productive organization must be oriented to the achievement of an objective (Parsons, 1960; Simon, 1964). For corporations, Keay (2008) points out that 'establishing the objective is critical. First, it provides some guidance for directors in the carrying out of their functions. Secondly, it enables us to assess whether directors have done what they should have done. Thirdly, it helps us to formulate corporate governance mechanisms' (p. 665).

Following the *EA* thought, the objective is important to give a sense to the three attributes (systemic coordination, decision-making autonomy and *economicità*) that allow recognizing the *azienda* among the world of organizations. Indeed, the *azienda* is a finalized system, in that it must be aimed at achieving a specific *objective*, its governing bodies must have decision-making autonomy in the attainment of

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

the assigned *objective*, and the *economicità*, as method of action, should have an objective as a guide for the behaviour. Indeed, two managers, both acting with *economicità*, may behave in different way considering the same situation, because of the different objective to achieve (e.g. Do an investment in research and development? The one oriented to the profit maximization in the short term will refuse it, while the other with a long term orientation will accept the investment).

The research of a single objective for the universe of all *aziende*, that is valid regardless of the context and time, cultural and regulatory system in which the *aziende* operate, should take into consideration at least the following elements:

1. The effect that the objective has on the *azienda* continuity and on the resolution of the so-called economic problem, i.e. the ability to meet – in a sustainable way, – unlimited needs in the presence of scarce resources, and thus the ability to orient the governance and management toward the common good of the stakeholders and community;
2. The answer that business entities can give to the pressure generated by contemporary business regulations towards 'internal mechanisms to bring management standards and business practices in line with prevailing legal requirements including corporate compliance and ethics programs and employee grievance procedures' (Peterson, 2003, p. 1029);
3. Avoiding that the objective of the *azienda* coincides with the particular interest of a specific stakeholder or a group of stakeholders (Koslowski, 2000, p. 138), since the *azienda* needs the contribute of all its stakeholders, and at the same time avoid assigning more purposes that could lead trade-off difficult to manage (Argenti, 1997; Jensen, 2001), increasing the agency costs due to the managerial opportunistic behaviour.

The first two elements are particularly relevant considering the global financial crisis, which saw its genesis in the lack of ethics in financial market as well as in the purpose of the corporation mainly focused on the profit maximization in the short-term (Kemper & Martin, 2010; Lazonick, 2011; Zamagni, 2009).

The *azienda* should be seen as a cell of the economic system that contributes to the social well-being. Indeed, there cannot be the growth of the country economy without the growth of the singular cells, the *aziende*, where national wealth is concretely produced (Amaduzzi, 1978, p. 19; Cassandro, 1969).

The sustainable growth of the economy asks for the 'sustainable growth of the *aziende* that can promote, slowed down or prevent the economic growth' (Cavalieri, 2010, pp. 10-11, our translation). This approach broadens the range of responsibilities, in the sense that the irresponsible (or unsustainable) behaviour of the *azienda* is determined not only by those who govern and manage it, but also by the irresponsible behaviour of the funders, customers/users, citizens (with their vote), politicians and so on.

The Primary Interest of the *Azienda* in Its Mission Statement

The mission statement is a key elements to orient the governance and management of the *azienda*, for both private and public sectors (Bolon, 2005).

According to Arthur (1987) a mission is 'the charter that defines the basic business or businesses in which the enterprise will engage, the type of products it will make or the services it will provide, the markets it will serve, and how the company will conduct its affairs' (pp. 65-66). In this definition, there

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

are two elements commonly identified in the company's mission, which are the 'what' the company produces and 'how' it produces.

Bart (2001) defines the mission statement as 'a formal written document intended to capture an organization's unique *raison d'etre*. It should answer such vital questions as: why do we exist, what is our real purpose and what are we trying to accomplish' (p. 360). That definition underlines the purpose of the organization, the 'why' it produces. The term '*unique*' indicates the necessity to differentiate the organization from other organizations that produce similar goods or services.

Even if there is not consensus as to what mission statements should include or should not include, the purpose appears to be the most common dimension (Baetz & Kenneth, 1998). The purpose (or objective) is central also because it allows to understand the responsibilities of the organization in conducting the activity (Gallino, 2005, p. 7). Omran, Atrill and Pointon (2002) point out that 'one way of discovering whether a company adopts a shareholder or stakeholder orientation is through an examination of its mission statement' (p. 319).

Since the aim of this chapter is to propose an objective that is able to orient the *azienda* towards the common good of the community, integrating business and ethics, we embrace the definition proposed by Melé (2009) who states that 'a corporate mission consistent with the principle of the common good becomes a practical way of introducing business ethics at the top of a company, and an effective implementation of such a mission a way of implementing business ethics' (p. 238). Moreover, 'the common good principle provides a compass for social life, including business. Business as a part of society should contribute to the common good through its specific mission. Within the business firm, all must contribute to the common good of the firm, which should be consistent with the common good of the society at large' (p. 238).

According to Argandoña (1998) the common good consists 'in producing useful goods and services, and producing them efficiently (so as to create wealth) and sustainably, so as to guarantee the conditions in which each participant receives from the company what he or she can reasonably expect' (p. 1097).

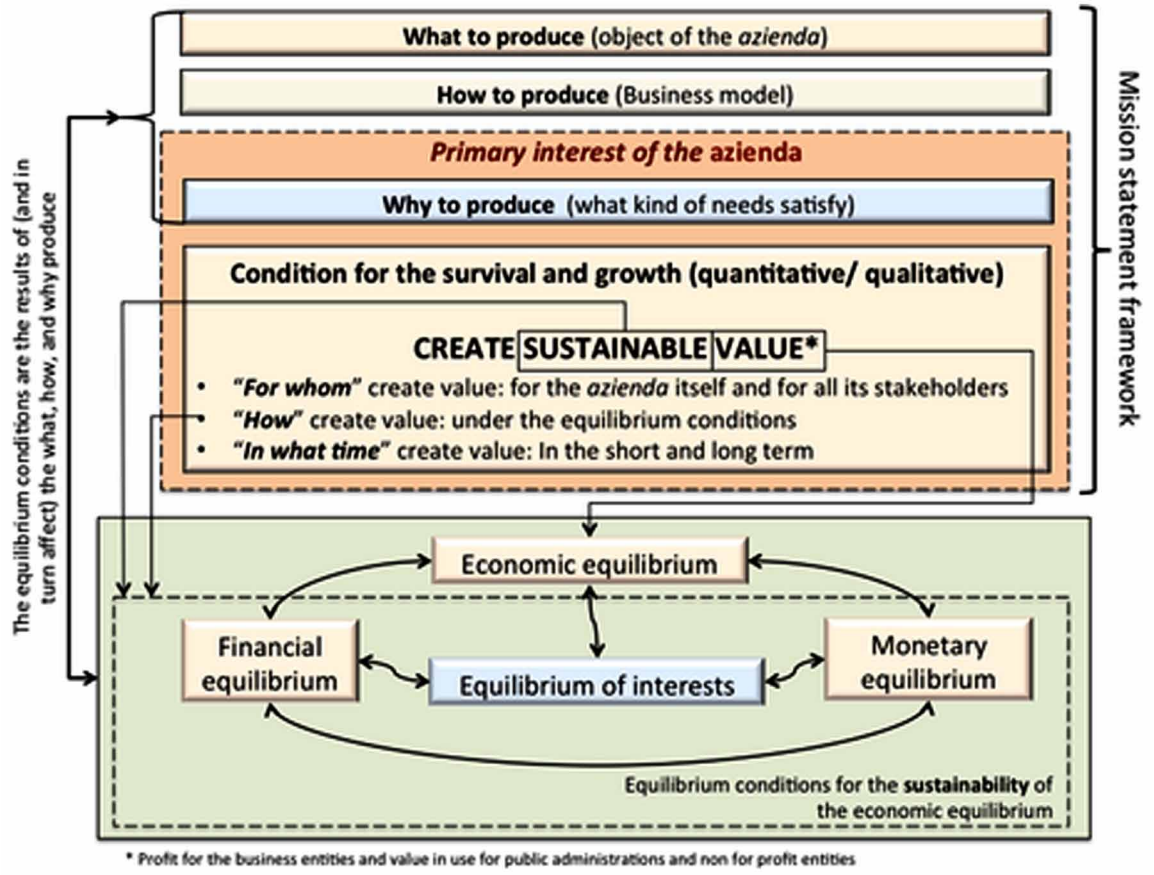
Figure 1 contains a purpose of framework for the *azienda*'s mission. The framework includes two elements: 1) the primary interest of the *azienda*; 2) as well the 'what' the *azienda* produces (i.e. the object), and the 'how' it produces (i.e. its business model).

The primary interest of the *azienda* includes two elements: the objective of the *azienda* (the 'why' produce i.e. satisfaction of client/user needs through the production of useful goods and services) and the condition of survival and growth, summarised with the term sustainable value creation. Thus organizations that meet human needs can be distinguished in two categories: those that create value and those that destroy value (and lives). The social function of the company lies in its primary interest, in the sense that achieving that interest contributes to the common good of the *azienda*'s stakeholders and community. In this regards, several articles compared the *EA* to the theory of the common good (Caldarelli et al., 2011; Costa & Ramus, 2012).

The proposed framework reduces the ambiguity and vagueness of the organization's objective leaving low margins of discretion in the interpretation of the company mission. This allows the mission to serve as a compass to guide both top and middle level managers and to limit their opportunistic behaviour also clarifying under which balance's conditions the firm must create value. Moreover the primary interest model gives a framework that allows an integrated thinking, connecting the management choices with the effect of those choices on the equilibrium conditions.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 1. Primary interest as a part of the Azienda's mission
Source: Our elaboration



Distance Between the Interest of the Controlling Party and the Interest of the *Azienda*

The framework proposed in Figure 1 allows measuring the eventual distance between the peculiar interest of the controlling party (e.g. the dominant shareholder in a company with concentrated ownership, managers in a widely held corporation, politicians in a public administration) and that of the *azienda*. Figure 2 shows two extreme situations: 1) perfect alignment between the two interests, as can happen in a company governed and managed by an entrepreneur who looks for the satisfaction of its customers' needs, posing as a condition for the survival and growth of his/her business the sustainable value creation (i.e. sustainable profit) over time, 2) maximum misalignment between the two interests as happens in widely held corporations where the controlling party is represented by managers who, in making the interests of shareholders motivated only by profit in the short term, run the company irresponsibly, leading the company toward the crisis.

The maximum misalignment can also occur in a municipality governed and managed, for political will, in uneconomic and predatory way.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Sometimes, the controlling party while wanting to achieve the primary interest of the *azienda*, participating to the common good of the society, he/she is forced to move away from that interest as certain environmental variables could undermine the viability of the company. For example, consider the contexts in which the irresponsible companies have a better durability conditions than those responsible because of the poor legislation regulating deviant behaviours.

So, the primary interest of the *azienda* expresses an interest to which it is appropriate to tend, but the striving for such interest depends on internal and external variables to the company, not always under the control of the dominant party. In other words, not always the ethics expressed in the concept of primary interest is sustainable from an economic point of view.

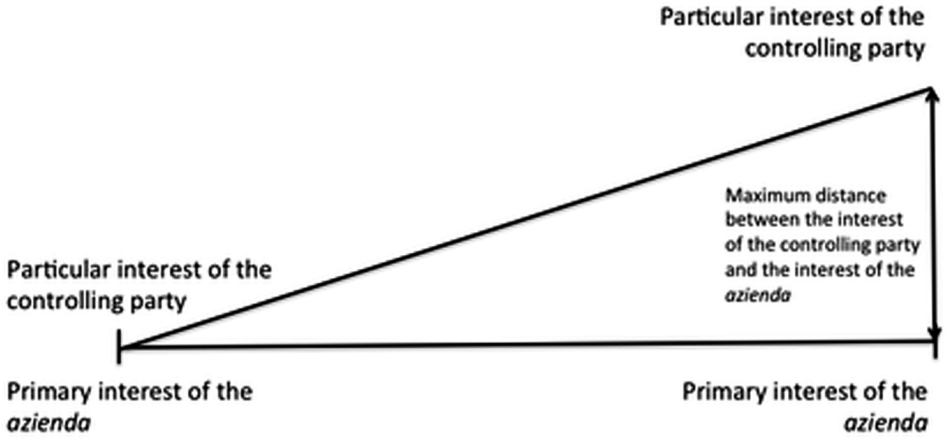
From the Objective of the Corporation to the Objective of all *Aziende*: The Why to Produce Goods and Services

According to distinguished scholars of Italian *EA*, the general purpose of all *aziende* is to satisfy human needs, through the production of useful goods and services (Amaduzzi, 1978, p. 19; Amodeo, 1964, p. 12; Cavalieri, 1999, p. 118; Coda, 2006, p. 11; De Dominicis, 1966, p. 43; Ferrero, 1968, pp. 3-4; Onida, 1971, p. 3; Sidrea, 2009; Zappa, 1957, p. 37).

Often *EA* scholars do not specify to what needs they refer (Signori & Rusconi, 2009). However, the needs to be met can be divided into two categories: those of the recipients of goods and services produced by the economic activity and those of the other stakeholders. The aim of the *azienda* is here referred to the first category. Thus, according to the proposed framework, needs satisfaction is the first element of the primary interest of the *azienda* that is its objective, its *raison d'etre*.

Since the 'what' to produce is not included within the primary interest, the framework of the mission is more user-oriented than product-oriented. Indeed, the 'what' and 'how' are excluded from the primary interest (even if included in the mission statement) because the *azienda* must be ready, in its interest and thus in the interest of its stakeholders and community, to react (i.e. to change its own 'what' and / or 'how to' produce) when the productions are no longer able to meet the needs of the client/user.

Figure 2. Distance between the interest of the controlling party and the interest of the Azienda
Source: Our elaboration



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

An excessive focus on the 'what' and 'how' is likely to orient toward the short term, not to look at the real needs of the market (or users), and thus making difficult to get out of moments of economic crisis.

Needs satisfaction, through the production of useful goods and services, should be the objective of all *aziende*, not only of business entities. Coda (2010) points out that 'Each kind of productive institution – be it a for profit or not-for-profit organization as well as a local public entity – exists to implement and achieve its mission, consisting in the production of goods or services intended to meet specific needs, in compliance with certain rules involved in business. It follows that, if this mission comes to be vague and confused and the firm is not completely focused and devoted to its fulfilment, a crisis due to a lack of sense will have its way opened' (p. 25, our translation).

This approach is based on a broad concept of production that is separate from the fact that the production is destined to the market exchange. Therefore, even economic entities that do not sell on the market but give the produced goods and services to the users (i.e. public administrations and non-profit organizations), sometimes for free, are considered as productive economic entities.

Moreover, this approach allows interpreting the economic activity of all *aziende* as a phenomenon of production. Considering the production process also in the non-business entities gives relevance to the attribute the *economicità* and to the value creation condition also in those organizations. Indeed, also the non-business entities must be managed with strategic effectiveness and operational efficiency, guaranteeing a value creation in the short and long term.

This is the reason why, instead of distinguish the producing economic entities (in Italian, *aziende di produzione* or *imprese*) from the consuming economic entities, (in Italian, *aziende di erogazione*, such as public administrations and non-profit organizations), following Cavalieri (1999) *aziende* are distinguished in organizations that produce for the market (business entities) from those that do not produce for the market (public administrations and non-profit organizations). In this regard, according to Coda (2006) 'all *aziende* – whether business or government or non-profit organizations – perform a function of production (goods or services) to the satisfaction of certain needs' (p. 11, our translation).

Being an institution, the objective (the purpose) of the *azienda* is distinguished from the scope of the individual or group of people that establish the *azienda* (e.g. the entrepreneur, the owner, the founder of the *azienda*), as well as from the scope of all of those that participate in various ways to the economic activity (e.g. employees, lenders, suppliers).

The purpose of those who decide to establish the *azienda* becomes important to understand why he/she wants to meet certain needs: while in some cases individuals have the profit (particular interest of the owner) as an extrinsic motivation, in other cases is, for example, a philanthropic interest (e.g., in certain foundations or associations). As Adam Smith said with specific reference to the business entities, 'it is not from the benevolence of the butcher, the brewer, or the baker that we expect our dinner, but from their regard to their own interest' (i.e. the interest to the profit). Thus the butcher, the brewer and the baker want to satisfy their clients needs because they can earn profit from those activities. However, their economic activities are oriented to satisfy people needs. In other terms, the profit could be considered as the financial result of the needs satisfaction.

Value Creation as a Condition for the Survival and Growth (Quantitative and/or Qualitative) of the *Azienda*

In meeting human needs the *azienda* must achieve a condition of survival and growth (quantitative and/or qualitative), summarized by the term 'value creation' (Figure 1). This implies that 'the value of the

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

resources consumed to make and distribute the product is systematically lower than the value of production, to be placed on the market or to assign to the users' (Cavalieri, 2012, p. 12, our translation). Thus, the value creation is referred to the typical input-transformation-output process (Argandoña, 2011), and according to our framework it is the second element of the primary interest of the *azienda* (Figure 1).

The condition of value creation that all *aziende* in satisfying human needs should meet can be summarized as indicated in Table 2 (Cavalieri & Ferraris Franceschi, 2008, p. 218):

Therefore, the value creation condition (the economic equilibrium in Table 2) requires that the utility generated (i.e. the economic value of the production to be placed on the market or assign to the users in case of a public administration or a non-for profit organization - vp^t) is systematically (in the short and long term) higher than the utility consumed (i.e. the value of input that are consumed in the production process - vf^t); the difference is the value created by the economic activity (v).

Thus, the economic entity could satisfy human needs creating and destroying value.

With specific reference to the business entities (i.e. the firms), since they operate on the market, the value of productive inputs (vf^t) derived from the purchase price multiplied by the quantity of inputs acquired (costs), while that of the output from the sale price multiplied by the quantity of products sold (revenues) (vp^t). For business entities meeting human needs is necessary but not sufficient for their survival and growth (Amaduzzi, 1978, p. 192; Cavalieri & Ferraris Franceschi, 2008, p. 221). For business entities 'v' is represented by the profit that is a difference between revenues and costs. Since the costs include the satisfactory remuneration of the owners in terms of distributed dividends, the profit (also called economic residual) is what remains after the remuneration of the various factors of production (such as labour, capital, and the State). According to the *EA* the 'pure' profit is what it should be left in the company in the form of non-distributed income, and then used by the firms to finance its quantitative and/or qualitative growth (Amaduzzi, 1948, p. 305; Cassandro, 1969; Onida, 1971 p. 84). Thus, the economic value is created when the net income (revenues minus costs) is positive (net profit) and includes two elements: a) the profit for the owners (distributed dividends); b) the profit for the firm and all its stakeholders (undistributed income that remains in the business entity allowing its growth).

Consequently the profit is not a positive net income, since it arises when revenues suitably remunerate all the factors of production, including the ownership and the entrepreneur for the work done in the firm. The undistributed profit increase also the value of the owners share – indeed, owners have a double remuneration: dividend and capital gain – as well as it satisfy all the stakeholders since it favourites the continuity of the firm. Thus, all stakeholders should be interested to the profit, not only the shareholders.

Table 2. Condition of Economic Value Creation (or economic equilibrium) applicable to all economic entities

$$\sum_{t=t_0}^{t_z} \mathrm{vp}^t = v + \sum_{t=t_0}^{t_z} \mathrm{vf}^t$$

where:
vp^t = value of production over time;
vf^t = value of factors of production consumed to enable the production (realized in the time frame of reference);
v = new value created by the economic activity;
t_0-t_z = entire lifetime of the *azienda*, tending to infinity

Source: *Cavalieri & Ferraris Franceschi (2008, p. 218)*

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

'Consider the profit, according to its true nature, as an indispensable means of the existence and growth of the firm it allows also to remove every weapon at those critics (…) who would attack it in moral terms, seeing it as something reprehensible' (Cassandro 1969, p. 828, our translation).

As a result, the firm is in economic equilibrium when it is able to congruously remunerate all the factors of production (Ferrero, 1968, p. 200; Onida, 1971, p. 18). The value creation condition must be met in the long-term. This obviously does not mean that the short-term equilibrium is not important, but rather that imbalances in the short term do not affect the going concern assumption, when it derives from accidental factors that will be absorbed by an effective and efficient management.

Following this logic, the profit is not the objective of the firm (which is, in the primary interest view, the needs satisfaction), but a condition for its survival and growth. The profit is what remains after suitably remunerated subjects who participated in the value creation, such as labour, capital, loan and property, and the State (Cassandro, 1969). According to Cassandro, with regard to the business entities, 'limiting the objective of the company to the profit maximization will diminish the fundamental economic and social functions of the company. The most important ones are to create new wealth for the community and distribute it among those that to it have contributed' (Cassandro, 1969, p. 826, our translation).

Therefore, profit and corporate objective should not be confused; it would be like saying, because I need to work for live the end of my life is work. In this regard, it was noted that 'profits and purpose are two different ideas, and collapsing them is like concluding from the fact that I need red blood cells to live, that the purpose of my life is to make red blood cells' (Agle et al., 2008, p. 166). 'The profit, even if it were, at best, the only stimulus for private initiative (...) could never constitute the objective of the business entity' (Ferrero, 1968, pp. 30-31, our translation).

It follows a central aspect that leads to distinguish the business entities from the non-business entities, i.e. the possibility to verify if the *azienda* is run with *economicità* (i.e. efficiently and effectively) using its financial results (for example, the result for the period, the revenue growth, return on investment). Moreover, for business entities meeting human needs is a necessary condition for the survival and growth, not being able to see their durability guaranteed by the support of third economies.

Explained the concept of 'value creation', it remains to be clarified 'for whom', 'how' and 'in what time' the *azienda* must create value.

The answer to this question wants to find inspiration in the proposal of Sidrea (*Società Italiana dei Docenti di Ragioneria ed Economia Aziendale*) that suggests that the *azienda* must create value for 'itself and for the different categories of stakeholders involved and socially recognized, in a long and short-term' (Sidrea, 2009, p. 31, our translation; see also Cavalieri, 2012, p. 12).

'For Whom' Create Value: The Azienda and Its Stakeholders

Stakeholders to take care during the value creation process are widely intended here, including the azienda itself, its primary stakeholders (owners, employees, customers, suppliers, lenders) and secondary stakeholders (media, activist, government authorities) (Clarkson, 1995). This approach is closed to the setting of those scholars who consider the corporation as a distinct stakeholder (Clarke, 1998; Kay, 1997; Magill, Quinzii, & Rochet, 2015; Metcalfe, 1998).

Stakeholders participate to the economic activity in the expectation of an adequate remuneration for their contribution. In this sense, they have a particular, and sometimes temporary, interest that motivates (intrinsically and extrinsically) their behaviour (Argandoña, 2011).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The primary interest logic has some important differences compared to the following theories on the company objective (see Table 1):

1. Shareholder theory and enlightened value maximization theory;
2. Stakeholder theory;
3. Organic theory and social entity theory.

With regard to the business entities, unlike the shareholder theory, according to the primary interest idea the agents are responsible not only towards shareholders, but also towards a plurality of stakeholders, and the profit is not considered as an end but as a condition of survival and growth of the firm. This last aspect also distinguishes the primary interest idea from the enlightened value maximization theory.

Thus, the proposed approach may seem to be aligned with the stakeholder theory of the firm. However, it also requires responsibility towards the survival and growth (qualitative and/or quantitative) of the azienda that is seen as an economic institution (Zappa, 1957) separated from its stakeholders.

In particular, following the EA, the azienda is not here conceived as a juridical fiction, as just a set of contracts with its stakeholders, instead it is viewed as an institution (Costa & Ramus, 2012) that is distinct from its stakeholders, with its own interest to survive and develop, in order to satisfy human needs and create sustainable value. According to this approach it can be also said, for example as regards to the business entities, that the shareholder interest toward the profit maximization is particular and should be compatible with the interests of the azienda and other stakeholders. In other words, when the profit is achieved in an irresponsible or fictitious way, it becomes secondary if compared to the primary one that considers the firm as part of the community, that contribute to the common good. Considering the azienda as an organization that contributes to the common good it allows adding the interest of the azienda among the peculiar interests of the stakeholders (Masini, 1970, p. 11), that is, the interest of the azienda becomes part of the interest of its stakeholders. 'The common good has to do with creating the conditions that will enable those involved in the business to achieve their personal goals, we can say that there is no conflict between the common good and the individual or personal good' (Argandoña, 1998, p. 1097).

The proposed approach is also different from the one followed by those who ask to create value for the company (e.g. organic theory and social entity theory), taken for granted that by doing so, they strive to create value for all stakeholders. Brief, Buttram & Dukerich (2001) state that belief in the sanctity of the firm is so a strong message that managers tend to believe that by serving the corporation's interests they are also serving the interests of the community: what's good for Microsoft is good for the country.

However, the corporate scandals show that this automatism does not always occur. For example, a company could improve its value destroying the environment, by failing to ensure appropriate working conditions for its employees especially if they have very limited possibility to change their job.

For this reason, in order to achieve its primary interest the azienda has to maintain good relations with the stakeholders, while stakeholders, including community, should understand the problems of the azienda. Thus, reciprocal duties exist among corporate stakeholders, as well as between stakeholder and the azienda. According Fassin (2012) 'Whereas stakeholders are widely seen as having rights, they may also have duties and obligations' (p. 85).

In other words, the proposed approach differs from the theory of value creation for the organization as it offers practical solutions to reconcile the interests of the azienda with those of its stakeholders.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Cavalieri (2010) argues that 'it is just in this subtle game of balance between the value recognized to different stakeholders and the value recognized to the organization itself useful to ensure it's survival and growth, that the professionalism of those who do business is expressed' (pp. 26-27).

As pointed out by Adams, Licht and Savig (2011), 'we contrast shareholderism with stakeholderism as ideal-type, polar strategies. Between them resides a continuum of intermediate stances that find merit in both views. There may be purists who subscribe to strong versions of either view regardless of the circumstances. Most decision makers, however, will follow their principles to find a middle ground depending on the context' (p. 1332). It is almost evident that this middle ground derives from the consideration of a further interest, which can only be that of the firm.

'How' Create Value: The Sustainability of the Economic Equilibrium

The 'how' question wants to specify under what conditions the economic equilibrium expressed in Table 2 should be achieved and it is related to the sustainability of that equilibrium over time. Two organizations can be distinguished by the different ways on how they create value, even if they make the same product and satisfy the same needs. The answer to the 'how' question is necessary in order to mitigate the opportunistic behaviour of the management.

Indeed, the economic equilibrium condition does not say anything yet about the sustainability of that value. In other words, a car company, while operating with efficiency and effectiveness, may not be ethical, social and environmental responsible, as well as a public administration that create an economic value, it may not behave in a sustainable way in respect to certain stakeholders (think of the delay in payments to suppliers).

- *Financial, Monetary and Interests Equilibriums*

The conditions to achieve in order to create sustainable value, or sustainable economic equilibrium, are: financial, monetary and interests equilibriums. The first three conditions (economic, financial and monetary equilibriums) derived from the theory of the business entity equilibrium proposed by Aldo Amaduzzi (1948), one of the Zappa's pupils. The theory of equilibrium, which initially covered only the business entities, was later revisited by Cavalieri (2010), an Amaduzzi's pupil, who expands the scope of the theory of equilibrium to all types of organizations, adding a fourth condition, the so-called *overall strategic equilibrium* intended as 'equilibrium position simultaneously against the different social partners and the markets' (Cavalieri, 2010, p. 28, our translation). However, in the primary interest model the *overall strategic equilibrium* was substitute with the equilibrium of interests. For non-business entities the concept of revenue is substitute by that of value of production over time, while the concept of cost by the value of factors consumed in the production process.

In particular, the sustainability over time of the economic value creation includes three conditions: 1) have a balanced capital structure (financial equilibrium) in order to guarantee the solidity of the *azienda* and overcome unfavourable economic periods that have a negative impact on the economic equilibrium, because of losses that decrease the level of the equity; 2) meet regularly its payments (monetary equilibrium); 3) be socially and environmentally sustainable (equilibrium of interests).

- *Financial equilibrium* is the necessity (of the *azienda*) to develop appropriate correlations (in quantitative and qualitative terms) between investments (assets) and financial sources (liability

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

and equity), in order to maintain a systematic capability to satisfy its obligations timely and in a correct manner, without prejudice in the future.

- *Monetary equilibrium* is achieved when the company is able to meet at any time, the payment commitments, for example, with employees, suppliers, financiers. This equilibrium then binds to the concept of liquidity, through which measures the company's solvency in the short term.
- *Equilibrium of interests* is intended as a balancing of interests of stakeholders who participate in various ways to the value creation. This equilibrium is connected to the shared value creation and it is reached when the rewards (not only monetary) received by stakeholders are aligned to the contributions they provide to the *azienda*.

Under the *azienda*'s equilibrium model the stakeholder management does not see any contrast between normative and instrumental approach (Donaldson e Preston, 1995), due to the fact that the instrumental approach is not referred to the shareholder's interest, but rather to the company's interest. Indeed, managers have to deal with the stakeholders – in order to achieve the equilibrium of interest – in accordance to the company's interest and, by trying to find (according to internal and external contingencies) the right balance between a fair behaviour (regardless of the economic results) and a behaviour that has to be instrumental to the survival and growth of the company itself. However, going deeply in the investigation, the primary interest theory sees the instrumental approach as a way to exalt the fairness approach toward all other stakeholders. The need to preserve the business continuity has to be considered in fact the right behaviours even if a possible consequence could be the short-term sacrifice of some stakeholders' expectations.

- *The Overall Equilibrium*

The *azienda* achieves the *overall equilibrium* when it cannot improve a single equilibrium (economic, financial, monetary and interests) without damaging, in the long term, its condition of survival and growth. It can be also stated, in the mathematical sense, that the overall balance is a system of four interrelated equilibriums that the solution of the system (survival and growth in the long term) should meet simultaneously. The equation is solved when it has chosen the best composition of the balance for the survival and/or growth of the *azienda*. The manager can evaluate the impact of his/her choices on the overall equilibrium. Improve that equilibrium is a fair behaviour towards all the stakeholders.

Thus, an increase of welfare of a single stakeholder is acceptable when it has a positive effect on the overall balance. Indeed, the unitary vision of the *azienda* suggests connecting the effect of the stakeholder management to the economic, financial and monetary equilibrium. If increasing the well being of a stakeholder improves, in the long term, the overall equilibrium the *azienda* the manager should do that, also because increasing the possibility of the *azienda* to survive and growth is the right thing to do for all the actual and future stakeholders.

'In What Time' Create Value

The last element of the value creation condition is referred to the period in which that value should be created. The short-termism has been considered as one of the causes of the global financial crisis (Dallas, 2011; Treviño & Nelson, 2011).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The value creation condition must be achieved in the short and long term. Cavalieri (2010) observes that 'the simultaneous long and short-term management of a business has to belong to the set of task of a conscious management team' (p. 27, our translation). The short, as well as the long run, can be referred to the economic, financial, monetary and interest equilibriums. The value creation condition should be read in the short and long term, in order to understand how today's behaviors may impact on the overall balance of tomorrow. An orientation to the income in the short-term reduces the importance assumed by the other equilibriums, necessary to ensure that the former is durable and sustainable in the long term.

The azienda is not an organization with a short life-time, instead is an organization set to continue. In this regard, the term azienda is normally translated with the term 'going concern'.

Bertini (2013) argues that 'on one hand, whether management uncertainties are experienced focusing on a long-term perspective, all issues are reconsidered in the light of the company continuity dominant theme. (...) profit in turn becomes an instrument useful to ensure to the company an higher level of stability. (...) On the other hand, if a short term approach prevails, everything tends to be exasperated: the daily search for profit would sacrifice future profit opportunities; conflicts of interest among different stakeholders would be dominated by the need for an immediate and self-interested achievement of each related expectations; therefore, the entire system equilibrium would be close to reach the point of crisis' (p. 99, our translation).

'The organization durability goes beyond the permanence of that people constituting in a specific moment the organization itself. A group or a single individual who is committed to tie the life of the organization to its own interests or specific objectives, would surely produce economic damages with moral effects both for other organization's members as well as for the whole economy' (Airoldi et al., 2005, p. 163, our translation). Thus, 'human beings could not defeat the course of time while aziende could reach the immortality' (Anselmi, 2014, p. 39, our translation).

In other words, it is the consideration of the azienda as an economic institute interested in its time continuity and in the creation of a sustainable value that lead to a long-term focus rather that a short-term one.

The 'how' and 'for whom' create value assumes a significant relevance in the choice between short and/or long-term orientation. Creating value in a sustainable way means having a better perception of how an irresponsible behavior (i.e. disequilibrium of interests) of today may affect the survival and growth of the azienda. In other words, sustainability can bring out future costs and benefits associated with the current choices.

The temporal problem of the value creation becomes particularly relevant looking to the peculiar interests of the party (or parties) that govern the azienda. Indeed, a dominant party that is oriented to the short term will lead the company following this logic, jeopardizing the azienda's continuity, while long-term oriented dominant party might not realize the effects that poor management of the short term may have in the long term and indeed hope that in the long run the short imbalances can be reabsorbed. In other terms, it cannot be underestimated the effect of the short term on the long-term. However, sometimes the problem is not thinking to the long term, but have adequate decision-making tools to link the effect of short-term choices with long-term consequences, and to contrast psychological factors that lead the agent to the short term even if he/she is oriented to the long term (Ariely & Zakay, 2001).

In this regard, an important factor that may caused the corporate fraud – at least in the initial stage – was that related to the good profitability condition of the defrauded corporations (think of Parmalat, called after the default "the European Enron"), and the prospects for future growth that they would have to absorb, in the long term, the costs of expropriation generated by the controlling party (the so called

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

wishful thinking effect). In other words, the predators "entrepreneurs" seem not to have perceived the risk that the destruction of the economic equilibrium in the short-term could cause catastrophic consequences in the medium-long term. Moreover, the manipulation of the financial statements gave to the market just the appearance of equilibrium conditions, not allowing the external observers, even to the actors involved in the expropriation, to understand the severity of the situation and, therefore, to take action to avoid disaster.

To conclude, what it has to be underlined is that, the long-term orientation, thus, the endless life of the firm, concerns the survival and growth conditions of the azienda (that is the creation of sustainable value) and not the achievement of those goals useful to reach these conditions.

All economic and extra-economic goals could concern even very short periods. The sustainability of value creation in a long-term perspective allows to set goals that are coherent with such condition, solving possible trade-off between economic and extra-economic purposes.

CONCLUSION

The analysis of the main Anglo-American theories on corporate objective shows several weak points for what concern 'for whom', 'how' and 'in what time' corporations must create value.

The most critical aspect is connected to the fact that some theories ask for the value creation of specific actors (e.g. the owners in the shareholder theory), or for several stakeholders, without considering the distance between those interests and the primary interest of the corporation to survive and growth. On this aspect the Italian doctrine Economia Aziendale gives an important contribution.

From the critical review of the thoughts of the Masters of the EA, at least three significant aspects emerge: 1) having considered the interest of the all the economic organizations as a central governance issue, instead of the peculiar (and sometimes temporary) interests of certain individuals (e.g. shareholders, managers, politicians), emphasizing the importance of protecting the azienda equilibrium over time and, therefore, its survival and growth (quantitative and / or qualitative); 2) having had as object of study not only the entity that produce for the market (i.e. the business entities, or for-profit organization), but also the non-business entities (i.e. public administrations and non-profit entities) 3) having assigned to all the aziende the common goal of meeting the needs, while the distinction between profit, non-profit organizations and public institutions is based on the scope of the individual or group of people that establish the azienda; 4) providing different insights on 'for whom', 'how' and 'what time' such organisations should create value, specifying that the azienda must create value not only for its stakeholders but also for itself.

The main contribution of this chapter is to propose a principle of governance (an objective) common to all types of organizations. The nature of this need comes from the proliferation of the last twenty years' corporate scandals and economic crisis, whose origin lies in the violation of those rules of good conduct recommended and transmitted by Economia Aziendale. Indeed, the searching for common rules and principles is one of the main objectives of this discipline.

The main point of the analysis is the distinction between the primary interest of the azienda and the interests of the controlling party as well as of the other stakeholders. The corporate governance literature is often focused on conflict of interest between owners and managers in companies with disperse ownership (i.e. the agency problem type I, Berle & Means, 1932; Fama & Jensen, 1983; Jensen & Meckling, 1976) and between controlling shareholder and minority shareholders in companies with concentrated ownership (i.e. the agency problem type II, Claessens, Djankov, & Lang, 2000; Shleifer & Vishny, 1997).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

This study suggests a third type of agency problem, that is, the conflict of interest between the primary interest of the firm and its managers and/or shareholders. That third type of conflict may coexist with the type I and II. Thus, further studies should explore this type of conflict in different types of ownership (e.g. widely held corporation, family firms, State owned firms).

Another key aspect of the Masters of Economia Aziendale is reflected in their consideration of the azienda as a mean for the improvement of the collective welfare, thus its consideration as a common good, rather than as an instrument for some groups to achieve their personal (and sometimes temporary) interests. Therefore, the discipline of corporate behaviours cannot be only left in the hands of the market and regulators, finding some interesting guidance in the Economia Aziendale rules of good conduct.

REFERENCES

Adams, R. B., Licht, A. N., & Sagiv, L. (2011). Shareholders and stakeholders: How do directors decide? *Strategic Management Journal*, *32*(12), 1331–1355. doi:10.1002mj.940

Agle, B. R., Donaldson, T., Freeman, R. E., Jensen, M. C., Mitchell, R. K., & Wood, D. J. (2008). Dialogue: Toward superior stakeholder theory. *Business Ethics Quarterly*, *18*(2), 153–190. doi:10.5840/beq200818214

Airoldi, G., Brunetti, G., & Coda, V. (2005). *Economia Aziendale*. Bologna, Italy: Il Mulino.

Alexander, C. R., & Cohen, M. A. (1999). Why do corporations become criminals? Ownership, hidden actions, and crime as an agency cost. *Journal of Corporate Finance*, *5*(1), 1–34. doi:10.1016/S0929-1199(98)00015-7

Alexander, D., & Servalli, S. (2011). Economia Aziendale and financial valuations in Italy: Some contradictions and insights. *Accounting History*, *16*(3), 291–312. doi:10.1177/1032373211407052

Allen, W. T. (1992). Our schizophrenic conception of the business corporation. *Cardozo Law Review*, *14*, 261–281.

Amaduzzi, A. (1936). Aziende di erogazione. Primi problemi di organizzazione gestione e rilevazione. Casa editrice Giuseppe Principato.

Amaduzzi, A. (1948). *Il sistema produttivo dell'impresa nelle condizioni del suo equilibrio e nel suo andamento*. Rome, Italy: Kappa Edition.

Amaduzzi, A. (1977). Situazione e prospettive degli studi aziendali. *Rivista Italiana di Ragioneria e di Economia Aziendale*, 1.

Amaduzzi, A. (1978). *L'azienda nel suo sistema e nell'ordine delle sue rilevazioni*. Turin, Italy: Utet.

Amodeo, D. (1964). *Ragioneria generale delle imprese*. Naples, Italy: Giannini.

Anselmi, L. (2014). *Percorsi aziendali per le pubbliche amministrazioni*. Turin, Italy: Giappichelli.

Argandoña, A. (1998). The stakeholder theory and the common good. *Journal of Business Ethics*, *17*(9-10), 1093–1102. doi:10.1023/A:1006075517423

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Argandoña, A. (2011). *Stakeholder theory and value creation*. Working paper, IESE Business School, 922, 1–13.

Argenti, J. (1997). Stakeholders: The case against. *Long Range Planning*, *30*(3), 442–445. doi:10.1016/S0024-6301(97)00004-6

Ariely, D., & Zakay, D. (2001). A timely account of the role of duration in decision making. *Acta Psychologica*, *108*(2), 187–207. doi:10.1016/S0001-6918(01)00034-8 PMID:11569762

Arthur, E. E. (1987). The ethics of corporate governance. *Journal of Business Ethics*, *6*(1), 59–70. doi:10.1007/BF00382949

Baetz, B., & Kenneth, C. (1998). The relationship between mission statements and firm performance: An exploratory study. *Journal of Management Studies*, *35*(6), 823–853. doi:10.1111/1467-6486.00121

Bart, C. K. (2001). Exploring the application of mission statements on the world wide web. *Internet Research: Electronic Networking Applications and Policy*, *11*(4), 360–368. doi:10.1108/10662240110402812

Berle, A. A., & Means, G. C. (1932). *The modern corporation and private property*. New York: MacMillan.

Bertini, U. (2013). *Scritti di politica aziendale. Quarta edizione riveduta e ampliata* (Vol. 33). Turin, Italy: Giappichelli.

Bertini, U. (2014). *La corporate governance, fattore di superamento della crisi e di sviluppo dell'economia*. Opening speech at the inauguration of the academic year of Unicusano University.

Bolon, D. S. (2005). Comparing mission statement content in for-profit and not-for-profit hospitals: Does mission really matter? *Hospital Topics*, *83*(4), 2–9. doi:10.3200/HTPS.83.4.2-10 PMID:16425696

Borgonovi, E. (2014). La rilevanza del concetto di istituto per l'economia aziendale. *Economia Aziendale Online*, *5*(1), 3–10.

Brief, A. P., Buttram, R. T., & Dukerich, J. M. (2001). Collective corruption in the corporate world: Toward a process model. In M. E. Turner (Ed.), *Groups at Work: Theory and Research* (pp. 471–499). Mahwah, NJ: Erlbaum.

Cafferata, R. (2016). Darwinist connections between the systemness of social organizations and their evolution. *Journal of Management a Governance*, *20*(1), 19–44. doi:10.100710997-014-9303-z

Caldarelli, A., Fiondella, C., Maffei, M., Spanò, R., & Zagaria, C. (2011). The common good and Economia Aziendale theory: Insights for corporate social responsibility from the Italian perspective. *Journal of the Asia-Pacific Centre for Environmental Accountability*, *7*(4), 197–216.

Cassandro, P. E. (1969). Il profitto dell'impresa, mezzo e non fine. *Dirigenti Industria*, 7-8.

Cassandro, P. E. (1978). Sul concetto di impresa come "comunità". *Rassegna Economica*, 1.

Cavalieri, E. (1999). Organizzazioni produttive, aziende e imprese: considerazioni di carattere istituzionale. *Rivista Italiana di Ragioneria e di Economia Aziendale*, 3/4.

Cavalieri, E. (2009). Una riflessione sulle cause e sulle responsabilità della crisi globale. *Rivista Italiana di Ragioneria e di Economia Aziendale*, 5/6.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Cavalieri, E. (2010). *Le nuove dimensioni dell'equilibrio aziendale: Contributo alla rivisitazione della teoria*. Turin, Italy: Giappichelli.

Cavalieri, E. (2012). Dottrina e organizzazioni produttive verso nuovi modelli di sviluppo. *Rivista Italiana di Ragioneria e di Economia Aziendale*, 1/2.

Cavalieri, E., & Ferraris Franceschi, R. (2008). Economia aziendale: Vol. I. *Attività aziendale e processi produttivi*. Turin, Italy: Giappichelli.

Cinquini, L., & Marelli, A. (2007). Accounting history research in Italy, 1990–2004: An introduction. *Accounting Business & Financial History*, *17*(1), 1–9. doi:10.1080/09585200601127509

Claessens, S., Djankov, S., & Lang, L. H. P. (2000). The separation of ownership and control in East Asian corporations. *Journal of Financial Economics*, *58*(1), 81–112. doi:10.1016/S0304-405X(00)00067-2

Clarke, T. (1998). The stakeholder corporation: A business philosophy for the information age. *Long Range Planning*, *31*(2), 182–194. doi:10.1016/S0024-6301(98)00002-8

Coase, R. H. (1937). The nature of the firm. *Economica*, *4*(16), 386–405. doi:10.1111/j.1468-0335.1937.tb00002.x

Coda, V. (2006). Economia Aziendale: alla ricerca di punti di convergenza. In Società Italiana dei Docenti di Ragioneria e di Economia Aziendale (Eds.), Manifesto dei soci fondatori, in "Appunti per un dibattito sulla cultura aziendale". Academic Press.

Coda, V. (2010). Insegnamenti dalle "crisi di senso". *Sinergie*, *81*, 25–30.

Costa, E., & Ramus, T. (2012). The Italian Economia Aziendale and catholic social teaching: How to apply the common good principle at the managerial level. *Journal of Business Ethics*, *106*(1), 103–116. doi:10.100710551-011-1056-x

Dallas, L. (2011). Short-termism, the financial crisis, and corporate governance. *The Journal of Corporation Law*, *37*, 264–363.

Davis, J. J. (1994). Good ethics is good for business: Ethical attributions and response to environmental advertising. *Journal of Business Ethics*, *13*(11), 873–885. doi:10.1007/BF00871701

De Dominicis, U. (1966). *Lezioni di ragioneria generale*. Bologna, Italy: Azzoguidi.

Di Carlo, E., Fortuna, F., & Testarmata, S. (2015). Boundaries of the business model within business groups. *Journal of Management and Governance*, *20*(2), 321–362. doi:10.100710997-015-9338-9

Dodd, M. E. (1932). For whom are corporate managers trustees. *Harvard Law Review*, *45*(7), 1145–1163. doi:10.2307/1331697

Donaldson, T., & Preston, L. (1995). The stakeholder theory of the corporation: Concepts, evidence and implications. *Academy of Management Review*, *20*(1), 65–91.

Fama, E., & Jensen, M. C. (1983). Separation of ownership and control. *The Journal of Law & Economics*, *26*(2), 301–325. doi:10.1086/467037

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Fassin, Y. (2012). Stakeholder management, reciprocity and stakeholder responsibility. *Journal of Business Ethics*, *109*(1), 83–96. doi:10.100710551-012-1381-8

Ferrero, G. (1968). *Istituzioni di economia d'azienda*. Milano, Italy: Giuffrè.

Freeman, R. E. (1984). *Strategic management: A stakeholder approach*. Prentice-Hall.

Friedman, M. (1970). The social responsibility of business is to increase its profits. *New York Times Magazine, 33*, 122–126.

Ghoshal, S. (2005). Bad management theories are destroying good management practices. *Academy of Management Learning & Education*, *4*(1), 75–91. doi:10.5465/AMLE.2005.16132558

Giacalone, R. A., & Wargo, D. T. (2009). The roots of the global financial crisis are in our business schools. *Journal of Business Ethics Education*, *6*, 147–168.

Giannessi, E. (1960). *Le aziende di produzione originaria: Vol. 1. Le aziende agricole*. Pisa, Italy: Cursi.

Hayes, R. H., & Abernathy, W. J. (1980). Managing our way to economic decline. *Harvard Business Review*, *58*, 67–77.

Hirschman, A. O. (1970). The search for paradigms as a hindrance to understanding. *World Politics*, *22*(3), 329–343. doi:10.2307/2009600

Jensen, M. C. (2001). Value maximization, stakeholder theory, and the corporate objective function. *Journal of Applied Corporate Finance*, *14*(3), 8–21. doi:10.1111/j.1745-6622.2001.tb00434.x

Jensen, M. C., & Meckling, W. (1976). Theory of the firm: Managerial behavior, agency costs, and capital structure. *Journal of Financial Economics*, *3*(4), 305–360. doi:10.1016/0304-405X(76)90026-X

Jones, T. M. (1995). Instrumental stakeholder theory: A synthesis of ethics and economics. *Academy of Management Review*, *20*(2), 404–437.

Kay, J. (1997). The stakeholder corporation. In G. Kelly, D. Kelly, & A. Gamble (Eds.), *Stakeholder capitalism* (pp. 125–141). London: Macmillam Press.

Keay, A. (2008). Ascertaining the corporate objective: An entity maximization and sustainability model. *The Modern Law Review*, *71*(5), 663–698. doi:10.1111/j.1468-2230.2008.00711.x

Kemper, A., & Martin, R. L. (2010). After the fall: The global financial crisis as a test of corporate social responsibility theories. *European Management Review*, *7*(4), 229–239. doi:10.1057/emr.2010.18

Koslowski, P. (2000). The limits of shareholder value. *Journal of Business Ethics*, *27*(1-2), 137–148. doi:10.1023/A:1006438000855

Lan, L. L., & Heracleous, L. (2010). Rethinking agency theory: The view from law. *Academy of Management Review*, *35*(2), 294–314. doi:10.5465/AMR.2010.48463335

Lazonick, W. (2011). From innovation to financialization: how shareholder value ideology is destroying the US Economy. The Handbook of the Political Economy of Financial Crises.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Magill, M., Quinzii, M., & Rochet, J. C. (2015). A Theory of the stakeholder corporation. *Econometrica*, *83*(5), 1685–1725. doi:10.3982/ECTA11455

Masini, C. (1982). *Lavoro e risparmio*. Turin, Italy: Utet.

Melé, D. (2009). Integrating personalism into virtue-based business ethics: The personalist and the common good principles. *Journal of Business Ethics*, *88*(1), 227–244. doi:10.100710551-009-0108-y

Metcalfe, C. E. (1998). The stakeholder corporation. *Business Ethics (Oxford, England)*, *7*(1), 30–36. doi:10.1111/1467-8608.00083

Meynhardt, T. (2009). Public value inside: What is public value creation? *International Journal of Public Administration*, *32*(3-4), 192–219. doi:10.1080/01900690902732632

Moore, M. H. (1995). *Creating public value: Strategic management in government*. Harvard University Press.

Omran, M., Atrill, P., & Pointon, J. (2002). Shareholders versus stakeholders: Corporate mission statements and investor returns. *Business Ethics (Oxford, England)*, *11*(4), 318–326. doi:10.1111/1467-8608.00291

Onida, P. (1971). *Economia d'azienda*. Turin, Italy: Utet.

Parsons, T. (1960). *Structure and process in modern societies*. New York: The Free Press.

Peterson, E. A. (2013). Compliance and ethics programs: Competitive advantage through the law. *Journal of Management and Governance*, *17*(4), 1027–1045. doi:10.100710997-012-9212-y

Phillips, R., Freeman, R. E., & Wicks, A. C. (2003). What stakeholder theory is not. *Business Ethics Quarterly*, *13*(4), 479–502. doi:10.5840/beq200313434

Plender, J. (1997). *A Stake in the Future: The Stakeholding Solution*. London: Nicholas Brealey.

Rappaport, A. (1990). *La strategia del valore*. Milano, Italy: Franco Angeli.

Rescher, N. (1969). *Introduction to Value Theory*. Washington, DC: University Press of America.

Shleifer, A., & Vishny, R. (1997). A survey of corporate governance. *The Journal of Finance*, *52*(2), 737–783. doi:10.1111/j.1540-6261.1997.tb04820.x

Signori, S., & Rusconi, G. (2009). Ethical thinking in traditional Italian Economia Aziendale and the stakeholder management theory: The search for possible interactions. *Journal of Business Ethics*, *89*(3), 303–318. doi:10.100710551-010-0391-7

Simon, H. A. (1964). On the concept of organizational goal. *Administrative Science Quarterly*, *9*(1), 1–22. doi:10.2307/2391519

Singer, A. E. (2010). Integrating ethics and strategy: A pragmatic approach. *Journal of Business Ethics*, *92*(4), 479–491. doi:10.100710551-009-0176-z

Società Italiana dei Docenti di Ragioneria e di Economia Aziendale (SIDREA). (2009). L'oggetto degli studi di Economia Aziendale. In Atti del I convegno Nazionale su 'La Ragioneria e L'Economia aziendale: dinamiche evolutive e prospettive di cambiamento'. Milan, Italy: Franco Angeli.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Sundaram, A., & Inkpen, A. (2004). The corporate objective revisited. *Organization Science*, *15*(3), 350–363. doi:10.1287/orsc.1040.0068

Tirole, J. (2010). *The theory of corporate finance*. Princeton University Press.

Treviño, L. K., & Nelson, K. A. (2011). *Managing business ethics. Straight talk about how to do it right* (5th ed.). New York, NY: Wiley.

Vigano, E., & Mattessich, R. (2007). Accounting research in Italy: Second half of the 20th century. *Review of Accounting and Finance*, *6*(1), 24–41. doi:10.1108/14757700710725449

Vilanova, L. (2007). Neither shareholder nor stakeholder management: What happens when firms are run for their short-term salient stakeholder? *European Management Journal*, *25*(2), 146–162. doi:10.1016/j.emj.2007.01.002

Zamagni, S. (2010). La lezione e il messaggio di una crisi annunciata. In *Crisi economica, crisi antropologica. L'uomo al centro del lavoro e dell'impresa*. Rimini, Italy: Il Cerchio.

Zappa, G. (1927). *Tendenze Nuove negli studi di Ragioneria, Opening Speech of the Academic Year 1926–1927*. University of Venice.

Zappa, G. (1950). *Il reddito di impresa.* Giuffré Editore.

Zappa, G. (1954). La nozione d'azienda nell'economia moderna. *Il Risparmio*, *8*, 1255–1278.

Zappa, G. (1956). *Le produzioni nell'economia dell'impresa. Tomo primo*. Milan, Italy: Giuffré Editore.

KEY TERMS AND DEFINITIONS

***Azienda*:** Economic organization with three attributes: systemic vision, decision-making autonomy, and *economicità*.

Business Model: An organization's business model is its system of transforming inputs, through its business activities, into outputs and outcomes that aims to fulfil the organization's strategic purposes and create value over the short, medium and long term.

***Economia Aziendale*:** Is an Italian doctrine founded in 1927 by Gino Zappa as a unitary science that studies the 'existence conditions and life manifestations of the *azienda*'.

***Economicità*:** Is one of the attributes used to define the concept of *azienda*. It is a method of action, in the sense that the *azienda* operates with *economicità* when it is effective and efficient.

Primary Interest of the *Azienda*: Is a principle of good governance for all organizations. This interest includes two elements: 1) the objective of the *azienda* (i.e. satisfy human needs through the production of useful goods and services); 2) a condition for the survival and growth of the *azienda* (i.e. ensuring a sustainable value creation in the short and long term).

This research was previously published in Value Sharing for Sustainable and Inclusive Development edited by Mario Risso and Silvia Testarmata, pages 49-74, copyright year 2018 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 46
Green Brand Personality: Its Relevance to the Green Marketing Practices

Anitha Acharya
ICFAI Foundation for Higher Education (IFHE), India

Manish Gupta
ICFAI Foundation for Higher Education (IFHE), India

ABSTRACT

The main purposes of this chapter are to define a green brand, describe its characteristics, and outline its implications. This chapter would help readers understand the need for studying green brand personality and appreciate its importance in the current market scenario. Moreover, it provides a detailed outline of the ways and means that companies can use to market such brands. It highlights the steps companies can take to increase the sales of green brands and get an edge over non-green brands. In addition, it explores certain best practices in the industry to illustrate how well green products can be sold without compromising on sales targets.

INTRODUCTION

Marketing strategists have long achieved competitive advantage by assigning a set of personality characteristics to their brands (Aaker, 1997). Conventional brand-personality strategies focus on products or services and their corresponding utilitarian benefits. However, a recent sharp rise in the number of similar brands coupled with globalization has made it difficult for the marketers to distinguish their brands on the basis of functional attributes alone.

Therefore, the marketers are increasingly realizing the need of attaching symbolic meanings to their brands to achieve brand distinction. One of the emerging ways to fulfill the need for brand distinction is by promoting green marketing – a set of activities to generate and facilitate an exchange to satisfy human needs or wants so that the products cause minimal damage to the environment (Acharya & Gupta, 2016; Polonsky, 1994). Marketers need to know when and how do customers relate themselves to green

DOI: 10.4018/978-1-5225-7915-1.ch046

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

brand personality and its impact on the purchase decision. The objective of this chapter is to identify the benefits of green brand personality on companies marketing practices. It helps the companies to promote their products and also attracts new customers to switch to products which are environmental friendly. This will benefit the company in the long run by way of profits and also helps them to distinguish their products from that of their competitors.

The six dimensions of green brand personality proposed by Acharya and Gupta (2016) were security, sincerity, competence, sophistication, compassion, and excitement. Dimensions sincerity, competence, and excitement, capture the innate part of human personality, whereas sophistication, security, and compassion tap a dimension that individual's would like to have.

NEED FOR GREEN MARKETING

Companies are now getting inclined to green marketing mainly because of four reasons. These include rise of green consumers, government initiatives, thrust by non-governmental organizations (NGOs), and change of lifestyle. Each of these has been detailed below:

- **Rise of Green Consumers:** Consumers are aware of the environmental degradation that can happen if they use non-green products (Zhu & Sarkis, 2016). Not surprisingly, according to a survey conducted by Cone Communications in 2013, as much as 71% of Americans are inclined to buy green product (Walker, 2013). More recently, Nielsen global online study reported that almost three out of four respondents were willing to pay extra price for buying green products in 2015 (Global, 2015). It was also found that Millennials were also particularly passionate about sustainability while shopping and were interested in buying green products in order to save the environment.
- **Government Initiatives:** Governments around the world are responding positively to the call of the United Nations (UN) for taking green initiatives to control global warming (Bhattacharya, 2016). Indeed, the main agenda for the UN conference in September, 2015 in Paris was to give countries an opportunity to join Paris Agreement to overcome climate change. A major decision was that developed countries would share a major chunk of monetary cost relating to supporting green initiatives (Davenport, Gillis, Chan, & Eddy, 2015). Countries have already started providing funding for this purpose. For example, the Federal Government of Canada offers incentives and funding to boost research and development in Canada. These are relating to conducting research on those products that run on clean energy (Natural Resources Canada, 2016).
- **Thrust by Non-Governmental and Non-Profit Organizations:** NGOs and nonprofit organizations have come forward in support of going green (Kleindorfer, Singhal, & Wassenhove, 2005). These organizations are popularly termed as green NGOs (Herrera, 2010). For example, Carbon Trust, a nonprofit organization based in UK helps companies in formulating strategies with respect to overcome climate change. It had worked with product carbon footprinting which contributed to PAS 2050, a standard for product life cycle. Similarly, Conservation International a NGO advises Starbucks on issues relating to sustainability. EarthShare, another NGO, is famous for developing package of services which helps its clients in implementing green activities in their organizations. Rainforest Alliance has been working with leading brands which produces chocolate, coffee, and tea in sourcing raw materials which are sustainable.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- **Lifestyle Change:** Consumers feel that the presence of green element in an ordinary product makes it extra-ordinary because of the uniqueness it involves (Rao & Bhargav, 2016). These consumers are labeled as 'eco-fashion' consumers. Marketers have started capturing the pulse of these 'eco-fashion' consumers. They do not use raw materials which are hazardous to the health of their workers and the environment. They also ensure that the working conditions of the workers are good (Chan & Wong, 2012). Popular brands which incorporate these strategies are study NY, Alabama Chanin, Titania Inglis, Feral Childe, Awamaki Lab, Carrie Parry, Loomstate, M. Patmos, 100%NY, And Elroy (Phelan, 2012).

WHAT IS GREEN MARKETING

According to researchers Kärnä, Hansen, & Juslin (2003), the definition of marketing considers a utilitarian approach to social responsibility by emphasizing on maximizing the shareholders wealth. Several, marketing epitomizes voracity and they are responsible for the consequences which is arising from over development and over-consumption, where the main motive is to maximize their personal wealth instead of society's welfare and good quality of life. However, marketing helps in promoting consumption which is environment friendly as well they help consumers in leading a better life. Since the scope of marketing is very vast it helps consumers in finding a suitable trade-off between economy and environment. According to (Charter, 1992) the objective of a green marketing philosophy is long term sustainability and for those companies whose main objective is to create sustainable businesses, then green marketing is the way ahead. Peattie (1995) defined green marketing as management practices which considers satisfying the needs of the consumers and the society in such a way that it is profitable and sustainable in the long run. In similar terms, Charter (1992) conceptualized green marketing as management practices that fulfills the needs of the stakeholder and also considers the safety of the consumers and the environment. The supporters of green marketing and sustainability thinking actively take part in wide range of activities in which the company is involved. Holistically, the process of green marketing should not be concerned merely about the end product they should also place more emphasis on activities like developing new products, logistics planning, packaging of the products, etc. (Ottman & Books, 1998; Wasik, 1996). According to Fuller (1999) green marketing must consider the impacts of the entire product life cycle on the environment, because how a product is produced cannot be secluded from how it is consumed and its impact on the environment. If such a vision is lacking, the company can be accused of greenwashing. Its portrayal of a green image will backfire, and this might harm the environment (Grant, 2007; Peattie, 1999).

EMERGENCE OF GREEN BRAND PERSONALITY

Marketing practitioners and advertisers are the first ones to coin the term 'brand personality', much before the concept was studied and accepted by academics. Martineau (1958) used the word brand personality to refer to the dimension which is not materialistic and which makes the store special — its character. According to King (1970) consumers do not look for physical characteristics in a brand but they like brands as people and they choose their brands the same way they choose their friends.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The notion of brand personality can be traced back to its origins through the theory of symbolism (Smith, Graetz, & Westerbeek, 2006; Sirgy, 1982). It is argued that consumers view their preferred products as an extension of themselves, and therefore they purchase only those products which have symbolic value (Elliott, 1994). The self-esteem of the consumers is enhanced when they use products which have symbolic value (Hong & Zinkhan, 1995). The self-concept theory elucidates the motives behind consumers buying products which have symbolic value (Sirgy, 1982). While making a purchase decision consumers try to appraise the degree of similarity between the personality traits communicated by a particular product and the personality which they want to project themselves (Dobni & Zinkhan, 1990).

Though consumers have difficulty in assigning human personality traits to inanimate objects, the theoretical explanation of product personality is relatively underdeveloped (Allen & Olson, 1995). Theories from anthropomorphism (Boyer, 1996) help us to understand why people endow brands which are inanimate objects with qualities of human personality. To interpret the outside world people use their own self-schema as a basis for concepts and labels. Sparks & Guthrie (1998) argued that humans do not want to be associated with objects which are non-human. Prior studies have given evidence that in social gatherings, people are attracted to those who possess similar personality because they feel that it is emotionally rewarding. Emotional and cognitive needs motivate humans to form humanlike models to understand and mitigate events. According to Blackstone (1993), consumers form relationships with brands based on their symbolic value, which results in brand becoming alive and it is no longer considered as a passive object but an active partner in the minds of the consumer.

In practice, celebrity endorsements have helped brands in being personified. With the aid of celebrities and their personalities marketers position their brands in such a way that they can attract consumers who can identify themselves with these celebrities. In other words, consumers perceive a fit between their ideal or actual perceived selves and that of the celebrity, and get attracted towards the brand (Sirgy et al., 1997). According to Levy (1959) this personality endowment gives the brand a meaning in the eyes of the consumer. In fact, consumers perceive brands as having personality traits. In a study conducted by Kapferer (1998) on medical doctors, the results revealed that medical doctors had no difficulty in attributing personality traits to pharmaceutical brands; in addition, the results also revealed that these traits were actually significantly correlated to medical prescription itself. Due to which brand personality has an important role to play in managing the brands.

According to Geuens et al. (2008) brand personality forms a major component of brand identity. Brand identity is defined as a brand's meaning as put forward by the firm (Kapferer, 2008). In other words it is defined as how the company wants to present its brand to its target customers. Customers who give importance to branded possessions value their relationships with companies that own and manage the brand (Alexander, Schouten, and Koenig, 2002). The brand identity of a company needs to focus on differentiating their products from that of their competitors so that they are able to attain sustainable competitive advantage (Aaker & Joachimsthaler, 2000). A thorough understanding of competitor, environment, and customers can form the base for companies brand identity. The brand identity should reflect that the brand will live up to the promise it has made to the customers. The benefits of building strong brand identity are greater customer satisfaction, greater share of customer's wallet, and brand equity (Aaker & Joachimsthaler, 2000). Brand image is defined as the consumer's perception and interpretation of the brands identity (Geuens, Weijters, & De Wulf, 2009). Researchers have conceptualized brand identity and brand image as a multidimensional construct with brand personality as one of the important component. According to Keller, Apéria, & Georgson (2008) brand image consists of: (a) values and personality, (b) profile of the user, (c) history, heritage and experiences of the consumers, and

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

(d) consumers purchase and usage situations. Aaker & Joachimsthaler (2000) identified four elements of brand identity namely: (1) the brand as a symbol (2) the brand as an organization, (3) the brand as a product, and (4) the brand as a people. Building on prior research Kapferer (2012) developed a brand identity prism in which brand was considered as a message flowing from the sender to the receiver. The dimensions of brand identity prism were physique, personality, reflection, self-image, culture, and relationship. He further stated that brand identity dimension physique which is defined as physical features and qualities and personality which means human personality traits depict the sender. Whereas the brand identity dimensions reflection which focuses on the image of the target group and self-image which refers to how the brand makes consumers feel depict the receiver. The dimension culture which refers to values and relationship forms the link between the sender and receiver.

To date, the focus on the application of the brand personality scale on management was only on restaurant settings (Siguaw, Mattila, & Austin, 1999), consumer goods (Kim, 2000), and web sites (Müller & Chandon, 2003). However, green brand personality has recently evolved as an emerging area of research in the field of brand management (Acharya & Gupta, 2016; Goh & Wahid, 2015).

THE KEY CHARACTERISTICS OF GREEN BRANDS

Before elaborating the characteristics of green brands, it is important to know the characteristics of a brand personality in general that include sincerity, excitement, competence, sophistication, and ruggedness (Aaker, 1997); (a) Sincerity which represented attributes like wholesome, honest, cheerful, and down-to-earth; (b) Excitement which consisted of attributes like spirited, up-to-date, daring, and imaginative; (c) Competence which represented attributes like successful, reliable and intelligent; (d) Sophistication consisted of charming and upper class; and (e) Ruggedness comprised of outdoorsy and tough. The innate part of human personality is captured by dimensions Competence. Sincerity, and Excitement. Whereas Sophistication and Ruggedness tap a dimension that individual's desire but do not necessarily have.

However, these dimensions do not refer to the way consumers relate to a brand but rather how consumers view the brand (Brakus, Schmitt, & Zarantonello, 2009). Of these dimensions, excitement and sincerity are fundamental to the marketing landscape because these comprise two of the three partner ideals in intimate personal relationships (Aaker, Fournier, & Brasel, 2004). In a study conducted by Aaker et al. (2004) it was found that consumers form stronger relationships with sincere brands such as Ford and Coca-Cola than exciting brands such as Yahoo and Virgin. The rationale is that for short-term relationships exciting brands are more suitable, whereas for long-term relationships sincere brands are more useful (Aaker, 1997). Sincere brands are considered warmer such as Gateway and more down to earth such as MetLife, Coke, whereas exciting brands are related with a younger demographic such as Mountain Dew and are viewed as possessing cultural vitality such as BMW. Interestingly, exciting brands are often considered as appealing, attractive, and capable of bringing about interest and trial (Altschiller, 2000). In quintessence, a brand's personality influences how its actions and behaviors are professed by the consumers. Such consumer actions can be inferred from consumer reviews, company advertisement, and prior experiences.

According to Acharya and Gupta (2016) the dimensions of green brand personality are: security, sincerity, competence, sophistication, competence, and excitement. In comparison to the original brand personality dimensions, 'security' and 'compassion' emerged as new dimensions in their study. These new dimensions require confidence and protection (security) and concern and humanity (compassion).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

ADVANTAGES OF GREEN MARKETING

Some of the advantages of green marketing that are listed below include customer betterment, innovative products, and customer participation.

- **Customer Betterment:** Marketer should give the best to customers; this is possible only if they use green marketing strategy. They can use environmental friendly packages to pack their products and if they are into manufacturing food product they can give more attention to consumer health benefits. This will help them to attract more customers through positive word-of-mouth. According to Carrie Walsh, Marketing Director, Frito-Lay: "Our customers are consumers who care about their personal health and planetary health".
- **Innovative Products:** Marketers can come out with innovative green products to attract customers. Successful product innovation can lead not just to products that satisfy the existing needs of customers; the company can be the market leaders and have a competitive advantage compared to the other players in the market. Some of the benefits of product innovation are
- **Increased Market Share:** An innovative product that satisfy the needs of the customer and which disrupts the target market can greatly enhance market share, which in-turn can lead to economies of scale and augment a company's market power.
- **Increased Profit:** According to Forbes report (2015) developing an innovative product that's exceptional and of better-quality to what the competition offers can lead to profit growth. In fact, more than 90% of the world's 100 most innovative companies have experienced increased profit due to innovation.
- **Customer Participation:** Green marketing activity campaign by the marketers will allow the customers to participate in the campaigns. There are very few people who realize the importance of safeguarding the environment, this opportunity can be used by marketers by providing them a platform which will allow them to work directly in preserving the environment, for example use of social media like Facebook, Twitter are some of the medium which are considered to be more effective than any other medium.

ROADMAP FOR GREEN MARKETERS

The green marketers need to generate convincing, pertinent, and efficient messaging that differentiates a company and its products and services from its competitors. As Gbadamosi (2016) points out, the first and foremost thing is to include the green elements in the business strategy such as striving hard to achieve sustainability goals, believing integrated thinking, taking a long-term orientation, relying on mutual responsibility, and accounting ecological costs. In all these efforts, the marketers need to convey a message which is convincing, pertinent, efficient, and different (Ottman, Stafford, & Hartman, 2006), as detailed below:

- **Convincing:** Companies need to provide convincing messages by supporting their statements with appropriate facts and figures. The level of information may depend on the image or environmental history of their sector and the target audience. One of the best ways is by using eco-labeling schemes. A product with an eco-label is a product that is proven environmentally preferable.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

It shows that the manufacturer is adhering to the guidelines that are required to manufacture an eco-friendly product. Marketers need to highlight the eco-friendly benefits that the product has on the consumers as well as on the society.

- **Pertinent:** A pertinent message reports sustainability success that is in line with the company's impacts. For instance, if a pharma company focuses on advertising its efforts to green its facilities while not delivering on quality of its medicines then its green message is not relevant to its key environmental impacts. If a company, markets its strong community benefit programs but does not provide good working condition for its employees then its advertising message will be misleading.
- **Efficient:** An efficient message translates the sustainability information to make sense of the extent of your achievements. For example, a company may have used its limited resources in an efficient manner then the same has to be communicated in such a way that it is easily understood. The efficiency of the message also depends on how the message is communicated to the intended audience.
- **Differentiate:** Companies often strive hard to make their message unique and distinct from competing products and services. Since their target segment is limited to the green consumers. They often face the challenge of differentiating their products not only from the producers of green products but also from their non-green counterparts. For this, the marketers are required to highlight the uniqueness of their products both in terms of the benefits it promises for the environment and in creating brand value by placing their brand as an in thing.

ALIGNING GREEN MARKETING WITH BUSINESS STRATEGY

In order to shift its focus from conventional marketing to green marketing, companies need to align their new business strategy with that of the existing one. It can be done in several ways including reducing greenwashing, increasing transparency, promoting green culture, assisting other environmental causes, and getting into third party collaborations. Each of these is elaborated in the subsequent sections.

- **Greenwashing:** It is a technique in which an organization spends more money on advertising green, sustainable behaviors instead of putting them into practice. For example an automotive company may call itself environmental friendly since it uses battery to run the car. But they might dispose their waste in sea, by doing that they are harming the environment, consumers, and finally their business.
- **Environment**: Greenwashing is bad for the environment because it can promote consumers to do the opposite of what's good for the environment. Greenwashing makes claims that are neither good nor bad for the environment. In order to increase their sales company makes false promises.
- **Consumers**: When it comes to money consumers do not like to be cheated and taken for granted. They avoid spending more money on a product or service which they believe is going to harm the environment.
- **Businesses**: Companies have realized that by being environmental friendly does increase their profits. Even though there are many ways to produce goods and use processes that do not harm the environment, it is saddening to know that the companies still do not do it. It is even worse when they don't make changes and claim to be a green company only to push their products in the

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

market. Environment friendly consumers can see right through their green screen. It backfires and harms the company's reputation and profits.

- **Transparency:** In order to gain the trust of the consumers, companies should conduct their business in an open way. Being transparent is the new goal for many businesses, which will help them to win over shareholders, employees, and the general public. If a business is open about its operations, it can earn a level of trust that it wouldn't have established otherwise. For example Starbucks company prides itself as the world's largest environment friendly company by proving it in the marketing campaign 'Transparency'. For Starbucks, 'Transparency' is a company-wide philosophy in which customers are treated honestly and where prices are actually low.
- **Green Culture: "**Going green" motto should be practiced and embedded in the organization's culture. For example, Go Lite, an outdoor clothing and equipment maker in Boulder, CO which was founded in the year 1998 by Kim and Demetri, the company specializes in ultra-light packs, sleeping bags and down jackets. The main objective of the company is to mitigate 100% of its environmental footprint. To do this, it uses so-called Environmentally Preferred Materials" (EPMs) like recycled nylon and polyester, instead of newly-produced petro-chemical-based fabrics and parts. Till date, 67% of its materials are EPMs and it is aiming for 100% by 2016. It also encourages customers to return their old clothes where it pledges to recycle and reuse items returned by its customers. The company is also trying to make its headquarters a zero waste facility, where it composts or recycles all of its garbage. Some of the strategies which the companies can follow are:
- **Sustainability***:* Companies should identify sustainability as a core corporate value. Companies should carry this theme through all of their communication and environmental activities.
- **Company Tradition**: It should be company's tradition of encouraging and constantly pursuing environmental programs. As a result, it will be well ingrained in the company's operations and understandings. For example, Aeon has been running programs for 25 years.
- **Founder's Philosophy**: Some companies, such as IKEA and LUSH, have imbued their employees with the founder's long-held ethical thinking.
- **Engaging Employees**: More recent adopters of environmental best practices create a sustainability culture in their organization. For example, Wal-Mart and Sam's club have introduced Personal Sustainability Projects (which is now called as My Sustainability Plan) which encourages employees to develop goals to improve their health and also the health of the environment.
- **Communication**: Companies can communicate their sustainability goals to every employee to develop a common understanding and a culture of sustainability.
- **Amenities to Encourage Employee Participation:** Companies should actively encourage and facilitate sustainable practices for employees. For example, Mountain Equipment Co-op (MEC) provides change rooms, showers and lockers for their employees, and currently 82 per cent of their employees use alternative transportation to travel to work every day.
- **Assist Other Environmental Causes:** Organizations should give back to the community. This helps the organizations in building a good overall image of caring for the betterment of society and the environment in the eyes of the consumer. For example Patagonia, Inc. headquartered in Ventura, California, is an American clothing company founded by Yvon Chouinard in the year 1973 it sells and showcases mainly sustainable outdoor clothing with more than 1,300 employees. The company uses organic raw materials which are environmentally preferred. The company also set asides 1% of their profits to environmental preservation groups. It also encourages its employ-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

ees to volunteer for an environmental organization with two months full pay. It also buys wool only from farmers who use sustainable gazing practices.

- **Collaborating:** Collaborating with third parties is a good way. For example Adobe developed a Green Team that works on corporate sustainability initiatives. They came out with a project which allowed its employees to volunteer to help with the solar installation process for a low-income family. There are several other examples (Makower, 2014) that follow such as (1) General Motors working with Honda to develop cars that can run on hydrogen fuel, (2) Nestle joined hands with beverage company Coca-Cola and other beverage companies to form an alliance of Bioplastics Feedstock that encourages formation of plastic material from plants. Universities are also taking collaborative route to promote green activities. It includes 'Penn Green Campus Partnership' in which Penn has collaborated with a number of organizations such as Delaware Valley Green Building Council. The students have formed a group called Student Sustainability Association at Penn for spreading awareness among students and teach them sustainable practices (Penn, 2016).

LEARNING FROM THE BEST PRACTICES

Starbucks has extensively used green marketing campaign to defeat its competitors. Starbucks Corporation is an American coffee company and coffeehouse chain. Starbucks was founded in Seattle, Washington in the year 1971. The company believes in the importance of caring for the planet and working with and encouraging others to do the same. Some of the strategies which they follow include recycling, energy saving, water conservation, making green building, and addressing climate change issues. All these are discussed below:

- **Recycling:** The organization is trying to develop more environmentally friendly cups, and is working hard to expand their recycling program in an effort to reduce the waste they create. A lot of their customers are also working to reduce their own environmental impact. The company offers 10-cent discount to the US and Canada customers to encourage them to use their own reusable mugs or tumblers for their beverages. Customers staying in a store are also encouraged to use ceramic mug for their beverage. By doing this they are helping in keeping the natural resources i.e forest intact.

The company also introduced Grounds for Your Garden in 1995, which offers customers' complimentary five-pound (2.27-kilogram) bags of used coffee grounds to enrich garden soil. And where commercial composting is available, many stores are able to divert other food waste and coffee grounds from the landfill as well.

- **Energy Saving:** The organization has minimized their energy consumption by using renewable sources of energy to lower their impact on the planet. They have installed Energy Management Systems in approximately 4,000 stores. Energy Management Systems optimize heating and cooling and they enable the company to identify additional opportunities for savings going forward. They are also continuing to focus on driving energy savings in their stores through optimization of equipment and lighting specifications.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- **Water Conservation:** Since water is one of the most valuable natural resources, Starbucks understands its responsibility of preserving it. The company is evaluating their store design, equipments, and operations to identify ways to continue to reduce the amount of water they use. The company installs efficient fixtures, monitors consumption to identify spikes in water usage and targeting leak repairs, and upgrades the water filtration systems in the stores.
- **Green Building:** Starbucks is making its stores as green as they can by using responsible building materials and energy efficient designs to reduce their environmental footprint. It is often termed as the 'green building leader'. It employs around 300 Leadership in Energy and Environmental Design (LEED) certified designers. LEED is given by US Green Building Council to the organizations that follow its rules for green construction and design (GBES, 2015).
- **Addressing Climate Change Issues:** Because climate change poses a serious threat to the world's coffee-growing regions, the company is aggressively pursuing strategies to address this problem and help farmers mitigate the impact. It encourages programmes that facilitate farmers' right to use to carbon markets. It allows them to make additional income while helping to prevent deforestation.

CONCLUSION

Due to the increased awareness of the people toward environment, the growing inclination of consumers to green products is apparent. The emergence of green marketing is all set to modify the existing norms of the marketing strategies. It not only has the ability to address the profitability concern of the companies but also has the potential to attract the society to opt for green solutions and participate in this movement. Governments across the globe are increasingly taking steps to promote eco-friendly products. However, the marketers need to take the lead and innovate ways or follow existing best practices to promote green brands. The private players are also expected to collaborate with the local governments to ensure a greener future for the next generation.

Future studies can investigate whether culture has any impact on green brand personality. In addition future work can investigate the antecedents and consequences of green brand personality. They can also investigate the moderating role of relationship length.

REFERENCES

Aaker, D. A., & Joachimsthaler, E. (2000). The brand relationship spectrum: The key to the brand architecture challenge. *California Management Review*, *42*(4), 8–23. doi:10.2307/41166051

Aaker, D. A., & Joachimsthaler, E. (2012). *Brand Leadership*. New York: Free Press.

Aaker, J., Fournier, S., & Brasel, S. A. (2004). When good brands do bad. *The Journal of Consumer Research*, *31*(1), 1–16. doi:10.1086/383419

Aaker, J. L. (1997). Dimensions of brand personality. *JMR, Journal of Marketing Research*, *34*(3), 347–356. doi:10.2307/3151897

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Acharya, A., & Gupta, M. (2016). An Application of Brand Personality to Green Consumers: A Thematic Analysis. *Qualitative Report*, *21*(8), 1531–1545.

Allen, D. E., & Olson, J. (1995). Conceptualizing and creating brand personality: A narrative theory approach. *Advances in Consumer Research. Association for Consumer Research (U. S.)*, *22*(1), 392–393.

Altschiller, D. (2000). Do Dot-Coms' Ads Reveal a More Basic Flaw? *Brandweek*, *41*(12), 32.

Banytė, J., Brazionienė, L., & Gadeikienė, A. (2010). investigation of green consumer profile: A case of lithuanian market of eco-friendly food products. *Economics & Management*, *15*, 374–383.

Bhattacharya, C. B. (2016). Responsible Marketing: Doing Well by Doing Good. *GfK Marketing Intelligence Review*, *8*(1), 8–17. doi:10.1515/gfkmir-2016-0002

Blackston, M. (1993). Beyond brand personality: Building brand relationships. In D. Aaker & A. Biel (Eds.), *Brand equity and advertising: Advertising's role in building strong brands* (pp. 113–124). Hillsdale, NJ: Erlbaum.

Boyer, P. (1996). What makes anthropomorphism natural: Intuitive ontology and cultural representations. *Journal of the Royal Anthropological Institute*, *2*(1), 83–98. doi:10.2307/3034634

Brakus, J. J., Schmitt, B. H., & Zarantonello, L. (2009). Brand experience: What is it? How is it measured? Does it affect loyalty? *Journal of Marketing*, *73*(3), 52–68. doi:10.1509/jmkg.73.3.52

Chan, T. Y., & Wong, C. W. (2012). The consumption side of sustainable fashion supply chain: Understanding fashion consumer eco-fashion consumption decision. *Journal of Fashion Marketing and Management: An International Journal*, *16*(2), 193–215. doi:10.1108/13612021211222824

Charter, M. (1992). *Greener marketing: A responsible approach to business*. Greenleaf Publishing.

Crane, A. (2000). Facing the backlash: Green marketing and strategic reorientation in the 1990s. *Journal of Strategic Marketing*, *8*(3), 277–296. doi:10.1080/09652540050110011

Davenport, C., Gillis, J., Chan, S., & Eddy, M. (2015). Inside the Paris Climate Deal. *The New York Times*. Retrieved from http://www.nytimes.com/interactive/2015/12/12/world/paris-climate-change-deal-explainer.html?action=click&contentCollection=earth&region=rank&module=package&version=highlights&contentPlacement=1&pgtype=collection&_r=0

De Boer, J. (2003). Sustainability labelling schemes: The logic of their claims and their functions for stakeholders. *Business Strategy and the Environment*, *12*(4), 254–264. doi:10.1002/bse.362

Dobni, D., & Zinkhan, G. M. (1990). In search of brand image: A foundation analysis. *Advances in Consumer Research. Association for Consumer Research (U. S.)*, *17*(1), 110–119.

Elliott, R. (1994). Exploring the symbolic meaning of brands. *British Journal of Management*, *5*(s1), S13–S19. doi:10.1111/j.1467-8551.1994.tb00126.x

Fuller, D. A. (1999). *Sustainable marketing: Managerial-ecological issues*. Sage Publications.

Gbadamosi. (2016). *Handbook of Research on Consumerism and Buying Behavior in Developing Nations*. IGI Global.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

GBES. (2015). Starbucks: The World's Greenest Retailer. *Green Building Education Services(GBES)*. Retrieved from http://www.gbes.com/blog/starbucks-the-worlds-greenest-retailer/

Geuens, M., Weijters, B., & De Wulf, K. (2009). A new measure of brand personality. *International Journal of Research in Marketing*, *26*(2), 97–107. doi:10.1016/j.ijresmar.2008.12.002

Global. (2015). Green generation: Millennials say sustainability is a shopping priority. *Nielsen*. Retrieved from http://www.nielsen.com/in/en/insights/news/2015/green-generation-millennials-say-sustainability-is-a-shopping-priority.html

Goh, Y. N., & Wahid, N. A. (2015). A Review on Green Purchase Behaviour Trend of Malaysian Consumers. *Asian Social Science*, *11*(2), 103–110.

Grant, J. (2007). *Green is a principle, not a proposition: a review of the green marketing manifesto*. Academic Press.

Herrera, T. (2010). 10 Green NGOs Businesses Should Know About. *GreenBiz*. Retrieved from https://www.greenbiz.com/blog/2010/06/14/10-green-ngos-businesses-know-about

Hong, J. W., & Zinkhan, G. M. (1995). Self-concept and advertising effectiveness: The influence of congruency, conspicuousness, and response mode. *Psychology and Marketing*, *12*(1), 53–77. doi:10.1002/mar.4220120105

Kapferer, J. N. (1998). *The role of branding in medical prescription: An empirical investigation*. HEC working paper. Jouy en Josas, France.

Kapferer, J. N. (2012). *The new strategic brand management: Advanced insights and strategic thinking*. Kogan Page Publishers.

Kärnä, J., Hansen, E., & Juslin, H. (2003). Social responsibility in environmental marketing planning. *European Journal of Marketing*, *37*(5/6), 848–871. doi:10.1108/03090560310465170

Keller, K. L., Apéria, T., & Georgson, M. (2008). *Strategic brand management: A European perspective*. Pearson Education.

Kim, H. S. (2000). Examination of brand personality and brand attitude within the apparel product category. *Journal of Fashion Marketing and Management: An International Journal*, *4*(3), 243–252. doi:10.1108/eb022593

King, S. (1970). *What is a Brand?*. London: Walter Thompson Company Limited.

Kleindorfer, P. R., Singhal, K., & Wassenhove, L. N. (2005). Sustainable operations management. *Production and Operations Management*, *14*(4), 482–492. doi:10.1111/j.1937-5956.2005.tb00235.x

Levy, S. J. (1959). Symbols for sales. *Harvard Business Review*, *37*(Summer).

Makower. (2014). *State of Green Business: Collaboration becomes an accelerator*. Retrieved from https://www.greenbiz.com/blog/2014/01/27/state-green-business-collaboration-becomes-accelerator

Martineau, P. (1958). The personality of a retail store. *Harvard Business Review*, *36*(Nov–Dec).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

McAlexander, J. H., Schouten, J. W., & Koenig, H. F. (2002). Building brand community. *Journal of Marketing*, *66*(1), 38–54. doi:10.1509/jmkg.66.1.38.18451

Müller, B., & Chandon, J. L. (2003). The impact of visiting a brand website on brand personality. *Electronic Markets*, *13*(3), 210–221. doi:10.1080/1019678032000108301

Muntean, A., & Stremtan, F. (2010). Green marketing: A new challenge for Romanian organisations. *Journal of Environmental Protection and Ecology*, *11*(4), 1472–1474.

Natural Resources Canada. (2016). Funding Programs. *Natural Resources Canada*. Retrieved from http://www.nrcan.gc.ca/energy/funding/programs-funding/12400

Needle, D. (2010). *Business in context: An introduction to business and its environment*. Cengage Learning EMEA.

Ottman, J., & Books, N. B. (1998). Green marketing: opportunity for innovation. *The Journal of Sustainable Product Design, 60*.

Ottman, J. A., Stafford, E. R., & Hartman, C. L. (2006). Avoiding green marketing myopia: Ways to improve consumer appeal for environmentally preferable products. *Environment: Science and Policy for Sustainable Development*, *48*(5), 22–36.

Peattie, K. (1995). *Environmental marketing management: Meeting the green challenge*. Financial Times Management.

Peattie, K. (1999). Trappings versus substance in the greening of marketing planning. *Journal of Strategic Marketing*, *7*(2), 131–148. doi:10.1080/096525499346486

Penn. (2016). Collaborative Efforts. *Penn*. Retrieved from http://www.facilities.upenn.edu/sustainability/collaborative-efforts

Phelan, H. (2012). 10 Eco-friendly fashion brands we can get behind. *Fashionista*. Retrieved from http://fashionista.com/2012/04/10-eco-friendly-fashion-brands-we-can-get-behind

Polonsky, M. J. (1994). Green marketing regulation in the US and Australia: The Australian checklist. *Greener Management International*, *5*(January), 44–52.

Rao, P. K., & Bhargav, V. R. (2016). A Study on Green Packaging-A Case Study Approach With Reference To Dell Inc. *International Educational Scientific Research Journal*, *2*(7), 83–84.

Reinhardt, F. (1999). Market failure and the environmental policies of firms: Economic rationales for beyond compliance behavior. *Journal of Industrial Ecology*, *3*(1), 9–21. doi:10.1162/108819899569368

Sharma, A., Iyer, G. R., Mehrotra, A., & Krishnan, R. (2010). Sustainability and business-to-business marketing: A framework and implications. *Industrial Marketing Management*, *39*(2), 330–341. doi:10.1016/j.indmarman.2008.11.005

Sheth, J., & Parvatiyar, A. (1995). Ecological imperatives and the role of marketing. *Environmental marketing: Strategies, practice, theory and research*, 3-20.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Siguaw, J. A., Mattila, A., & Austin, J. R. (1999). The brand-personality scale. *The Cornell Hotel and Restaurant Administration Quarterly*, *40*(3), 48–55.

Sirgy, M. J. (1982). Self-concept in consumer behavior: A critical review. *The Journal of Consumer Research*, *9*(3), 287–300. doi:10.1086/208924

Sirgy, M. J., Grewal, D., Mangleburg, T. F., Park, J. O., Chon, K. S., Claiborne, C. B., ... Berkman, H. (1997). Assessing the predictive validity of two methods of measuring self-image congruence. *Journal of the Academy of Marketing Science*, *25*(3), 229–241. doi:10.1177/0092070397253004

Smith, A. C., Graetz, B. R., & Westerbeek, H. M. (2006). Brand personality in a membership--based organisation. *International Journal of Nonprofit and Voluntary Sector Marketing*, *11*(3), 251–266. doi:10.1002/nvsm.51

Sparks, P., & Guthrie, C. A. (1998). Self--Identity and the theory of planned behavior: A useful addition or an unhelpful artifice? *Journal of Applied Social Psychology*, *28*(15), 1393–1410. doi:10.1111/j.1559-1816.1998.tb01683.x

Tureac, C. E., Turtureanu, A. G., Bordean, I., Grigore, A., Modiga, G., & Pripoie, R. (2010). Ecological food products-general considerations on green marketing. *10th International Multidisciplinary Scientific GeoConference SGEM2010, 2*, 529-537.

Violeta, S., & Gheorghe, I. G. (2009). The green strategy mix–a new marketing approach. *Knowledge Management and Innovation in Advancing Economics–Analysis and Solutions*, *1*, 1344–1347.

Walker, L. (2013). 71% of Consumers Think Green When Purchasing. *Environmental Leader.* Retrieved from http://www.environmentalleader.com/2013/04/03/71-of-consumers-think-green-when-purchasing/

Wasik, J. F. (1996). *Green marketing and management: A global perspective*. Wiley.

Zhu, Q., & Sarkis, J. (2016). Green marketing and consumerism as social change in china: Analyzing the literature. *International Journal of Production Economics*, *181*, 289–302. doi:10.1016/j.ijpe.2016.06.006

This research was previously published in Driving Green Consumerism Through Strategic Sustainability Marketing edited by Farzana Quoquab, Ramayah Thurasamy, and Jihad Mohammad, pages 155-168, copyright year 2018 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 47
A Temporal Case Study of Green Business Initiatives of a Leading Firm in the Indian Hydrocarbon Industry

Kamalika Chakraborty
Indian Institute of Management Calcutta, India

Nishant K. Verma
Indian Institute of Management Bangalore, India

ABSTRACT

The effective functioning of modern business in the current day and age is incomplete without taking into consideration its extended impact on society and environment. In this respect companies need to continuously revisit and analyse their green initiatives to keep them relevant and contribute positively to the global cause. This book chapter provides a capable framework for organizations to conduct temporal analysis of their green initiatives and enable them to reflect on their current positions and strategize their future course of actions. Further, we analyse the green initiatives of the Indian Hydrocarbon Industry leader: Indian Oil Corporation Limited (IOCL) and trace its green journey across defined time periods thereby depicting the use of the developed framework in addressing the gap of temporal analysis in the literature.

INTRODUCTION

The consideration of society and environment in the world of business is becoming an integral part of the wholesome picture. We can trace the roots of the same in 1930s when Theodore Kreps realised the need of considering business activities and public welfare together. Then came the book 'Social responsibilities of the Businessman' in 1953 by H.R. Bowen, which stressed upon the obligation and responsibility on the part of the businessman to think for the society while doing the business. However, Friedman in 1970 opposed the notion by saying that the only social responsibility a company has, is to make money

DOI: 10.4018/978-1-5225-7915-1.ch047

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

which is in its shareholders' interest. Around the same time, the concept of corporate social responsibility had emerged. It was placed on the notion that a company is responsible towards all their 'stakeholders', rather than just the shareholders. With time, a broader concept, 'Sustainability' has emerged which also encompasses the consideration of future generations. The definition of sustainability given by World Commission on Environment and Development (WCED) in 1987 is still very apt:

Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

It talks about considering "the ability of future generations to meet their own needs". In this respect maintaining a healthy natural environment is one of the most important factors for future generations to come. In this light, businesses around the world need to constantly revisit their operations and devise strategic green initiatives to help maintain the natural environment around them. The present work is focused on the "green thinking" in businesses.

"Green thinking" has gone through a major shift in the recent decades. While the decade of 60s and 70s saw firms dealing with huge environmental crises, the 80s was characterized by taking steps towards meeting environmental compliances set by the regulatory bodies and minimizing compliance costs (also called reactive approach). The decade of 90s saw firms taking a proactive approach towards the environment by "anticipating the environmental impacts of their operations, take measures to reduce waste and pollution in advance of regulation," (Rondinelli, 1998, p. 39) and also identifying business opportunities through adoption of green initiatives (Rondinelli, 1998).

The motivation behind this book chapter was to develop a conceptual framework of green initiative by a firm. The second objective of the book chapter was to analyze the leading firm Indian Oil Corporation limited (IOCL), in the Indian hydrocarbon industry (an under-researched field) in the purview of the developed framework. In doing so the authors address the absence of temporal analysis of green initiatives in the extant literature. The authors specifically analyze the green initiatives of IOCL across three time periods- a) pre-2000, b) 2000-2007 and c) 2007-2015. Based on the analysis of the initiatives taken during this period along with the changes in the regulatory environment in the Indian Hydrocarbon Industry, the authors find that IndianOil was following a fit approach in the early pre-2000 era by complying with the necessary regulations. However, due to changes in practices in the business practices in the hydrocarbon industry post 2000 era, the organization redefined itself to adopt efficient practices across its core value chain which were internally driven and pro-environment and hence showed signs of stretch. This move was consolidated further in the 2007-2015 phase when the intensity of such initiatives increased further. Being responsible and ethical market leaders, coupled with increasing presence in the global market and being an integral player in the global hydrocarbon industry, they stretched themselves and adopted sustainability initiatives in non-core areas as well thereby making pro-environment operations an integral part of their corporate identity.

The case study therefore serves as example to other firms to reflect their current positions and strategize their future course of action with the help of the suggested framework. By addressing the stated objectives, the authors contribute to a greater understanding of practitioners in their greening actions.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

LITERATURE REVIEW

The literature on green business initiatives can be broadly divided into two major categories viz., the drivers behind such initiatives and the actions taken by a firm towards its set environmental objectives.

The authors briefly discuss the literature related to the drivers below and refer readers to Dhull and Narwal (2016) for the detailed literature review of the same.

The drivers behind the green initiatives are primarily classified into external and internal. External drivers result from the fact that firms are always embedded in a network of various social and institutional relationships. Therefore, any action taken by a firm cannot be delinked from the various institutional forces it is subjected to. It is these external pressures that make a firm adopt certain practices or resist other (Powell & Dimaggio, 1991). Various external drivers have been identified in the green business literature over time and one may refer to Walker et al. (2008) for an exhaustive list of external drivers in the extant literature. Although, the drivers may vary according to the context considered, most commonly cited external drivers can be put as follows:

1. **Regulatory Pressure:** Government plays an important role in shaping a firm's business practices by providing the necessary technical and financial support (Porter, 1990). It is also true in case of green business practices where government plays an important role in terms of providing a regulatory push to the companies. Studies have found government regulations as one of the major external drivers that can force a firm to adopt a compliance or a proactive approach. Unlike a compliance approach, proactiveness in responding to regulatory pressure is found to result into successful green initiatives (Carter and Dresner, 2001).
2. **Customers and Competitors Pressure:** Customers and competitors pressure also play a major role in realizing firms to adopt green practices. Firms may put efforts in going green if either its customers provide the necessary encouragement (New, 2000) or they are conscious of their customer's country context. For example, Rao (2007) finds that Asian firms put extra effort towards their green initiative when their customers are from Europe. Similar observation is also made by Zhu et al. (2005) for the Chinese fabric firms when their customers belong to Europe or Japan. Competitors might also set industry norms which forces everybody to start green initiatives (Henriques and Sadorsky, 1999).
3. **Public Pressure:** Consumer awareness of the relevance of green initiatives in today's world also put extra pressure on the firms to adopt such initiatives. Lau (2001) finds in this regard that the American consumers are more aware than their Chinese counterparts, creating extra pressure on the American firms to adopt green practices. However, in their recent study on the green initiatives by Chinese SME firms, authors Huang et al. (2015) find public pressure to be one of the significant external pressures.
4. **Supplier Pressure:** The research over considering suppliers as a potential external driver has documented contradictory observations over time. On one hand suppliers are not found to influence a firm's green initiatives positively (Carter & Dresner 2001). However, focused collaboration with supplier has been found to positively impact a firm's green initiatives (Theyel, 2001; Vachon and Klassen, 2006). Recent research by Large and Thomsen (2011) in the context of Germany also seems to support the positive role of focused supplier collaboration.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Other external drivers include society, suppliers and global competiveness or multinational pressure (Ben Brik et al. (2013) and Walker et al. (2008)).

Internal drivers can be broadly divided into three categories i.e. a) individual commitment: Commitment shown towards environment by the leaders/ top management (New et al., 2000), investors of a firm (Walker et al., 2008) and employee involvement (Hanna et al., 2000), b) Environmental friendly image and c) Value creation through green initiatives.

Among the above three categories of internal drive, the possibility of value creation serves as a strong motivation for firms to invest in green thinking. Value creation can be in many forms including cost reduction, new revenue opportunities, etc.

There are studies that show the economic benefits of going green (such as cost reduction). Porter and van der Linde (1995) pointed that curbing on the pollution related activities while going green can lead to noticeable reduction in cost and waste which was hidden. However, not all firms have been able to generate cost advantage while implementing green practices. In this regard, Christmann (2000) has found that unless there are complementary assets present in the company to give helping hand to the green practices, it is difficult to realize the full economic potential of such practices.

Lanoie and Tanguay (2000) discuss some industry cases where green initiatives have been implemented while increasing the profitability at the same time. They try to find out some common factors among the various cases to better present the picture to the managers who have the idea of going green in their mind. Stefan and Paul (2008) specifically list down the opportunities for revenue growth and cost reductions while going green. They also mention the suitable circumstances under which such opportunities really pay for going green.

Another economic incentive of integrating such practices to the core business strategy can be for gaining competitive advantage in the arena of sustainable business (Brik et al., 2013).

The value creation associated with going green in your business can also be measured by how much the green initiatives create shareholder value. In their research, Klassen and McLaughlin (1996) find that there is a significant positive impact on the share prices of the firms that have taken strong environmental management initiatives. Moreover, they find that there is a negative impact on the share prices for the firms that have faced environmental crises due to weak environmental management at their workplaces.

Other market value indexes, such as Tobin's q have also been used to understand the relation between sustainable initiatives and their capability to generate value for the firms. Lo and Sheu (2007) in this regard find significantly positive relation between corporate sustainability and market value. It indicates that firms that are committed to find sustainable ways of doing business are valued higher in the financial markets by the potential investors.

Researchers have also tried to develop various frameworks liking sustainability with value creation to help businesses to develop new strategies for going green and become sustainable. Hart and Milstein (2003) develop a framework to link the sustainable development to the shareholder value creation through various business lenses. The framework works as a tool to develop appropriate sustainability strategies while simultaneously driving shareholder value. Another framework is suggested by York (2009), that tries to incorporate environmental ethics in business decisions through the help of the notion of classical American pragmatism. Other major studies in this regard include Russo and Fouts (1997), etc.

One may refer to Jain and Sharma (2014) for the complete literature review on the drivers of green supply chain management. For the recent studies related to the drivers of green initiatives in the Indian context, one may refer to Qadri et al. (2011) and Bhool and Narwal (2013).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The next set of literature deals with actions taken by firms in relation to environmental issues. Handfield et al. (1997) summarize the key responses by organizations to environmental issues. These responses have been time variant since the pressure from regulatory groups and the gravity of environmental issues have become more prominent with time. Hence in the early years, i.e., from1970- 90s the response by firms had been to merely comply with the standards in the cheapest and quickest way possible without internalizing them. Such responses have been described as "resistant adaptation, embracing without innovation" and "reactive". In these responses, the nature of initiatives is mostly end of pipe in nature without making any change to the internal technology or system.

In the next set of responses, there appears to be a major shift in the basic approach toward dealing with environmental issues from being merely compliance oriented towards embarking on taking responsible initiatives for the environment. These responses could be receptive, constructive or proactive.

In the receptive phase, firms start looking at the potential of adopting environmental issues and developing competitive advantage out of these initiatives. Often adoption of such initiatives is dependent on the interest of the "policy entrepreneur" who is willing to invest in skills needed to leverage the issues into competitive potential. In the other two responses, the degree of internalization of these issues is greater. In case of the constructive approach, a shift is observed in adopting approaches other than end of pipe initiatives and integrating current systems and technologies keeping in mind environmental concerns. In the proactive stage, green thinking is embedded at the very early stages in planning or designing a product. Such firms integrate the environment as a key variable in their decision making and implementing processes.

Kolk and Mauser (2002) review different typologies and continuum models derived conceptually or based on empirical case studies. In this case, the continuum models usually focus on responses by firms to environmental issues over time while typologies indicate the various ideal strategies based on some key defining criteria available to organizations to deal with the environment. While these models offer some ideal types for organizations, yet most of these models are unidimensional in nature and indicate development over time. Also in case of typologies, the time element appears to be missing in such a case. Most of these models also remain at the conceptual level only with few being tested by data to prove the validity of the model proposed. In this regard, Orsato (2006) explains "when does it pay to be green" by providing a framework of a set of environmental strategies which corporations can adopt based on their position in the industry in which they operate. These environmental strategies can be used to achieve competitive advantage. The two key defining criteria are competitive advantage on one hand and competitive focus is the other.

While the above set of literature discusses the varied responses by firms, Sharma (2000) emphasizes that it is the interpretation of the manager who sees environmental issues as opportunities rather than threats in order to develop them into environmental strategy. Also, managerial interpretations are influenced by several factors such as the legitimization of certain issues within the organization, the slack resources (time and resources) for enabling creative solving and incorporating environmental performance criteria in the employee evaluation systems. When the environment is seen as an integral aspect of corporate identity, environmental issues become legitimate concerns which cannot be easily disowned. Secondly, the availability of time and resources also enables managers further to engage in problem solving once these issues are framed as legitimate concerns to be addressed by the organization. Also, the ambiguity and uncertainty associated with looking for environmental solutions can be offset by incorporating defining criteria in the employee evaluation criteria which would encourage managers to view environmental issues as opportunities rather than as threats.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Also, Sharma (2000) talks about the perceived benefits of adopting environmental strategies by proactive firms while reactive firms perceive such responsiveness to environment as moving away from their overall objective. Proactive firms perceived the benefits as competitive strengths that they developed as a result of their engagement with the environmental issues. The capabilities that the firms developed were found to be "stakeholder integration", "capability for higher order learning" and "capability for continuous innovation". These capabilities were found to be aspects associated with proactive firms who saw these capabilities as essential and advantageous to providing them with competitive edge over other competitors.

Fineman (2003) documents some case studies on corporate greening in case of water and electricity utilities. The author traces the changes at the individual, organizational and the wider social and economic contextual level. At the individual level, the drivers of adopting environmental systems were mostly from top management. Significant greening can take place with the commitment of the top management team. Also, the role of environmental champions was stressed whose ability to persuade and influence was seen as more important than the formal role processes in the firm. Also, at the organizational level, it was the implementation of tangible systems in place along with the development of an organizational culture where all the members felt associated and involved in greening the organizations. While policies themselves may not bring about much change but it is the implementation of these policies along with the environmental management system which can help in achieving set targets which can reduce incidents of environmental damage. Also environmental reporting alerted organizations to collect data in a more organized way to find out and focus on issues which they had not considered earlier.

The author also reports an important finding related to the trigger for adopting environmental systems in the organization. The trigger for bringing about change within the organization was external. This was more evident in the water industry where higher degree of environmental legislation along with public awareness drove the organizations to adopt compliance measures. In the case of electricity companies, the increased awareness of public acted as a strong pressure for the firms to take action in relation to the external drivers in order to avoid the backlash in case the company fell short of environmental expectations. The authors conclude that irrespective of the drivers, the higher degree of environmental management system operating in the companies reflects a growing awareness among companies to take environmental issues seriously.

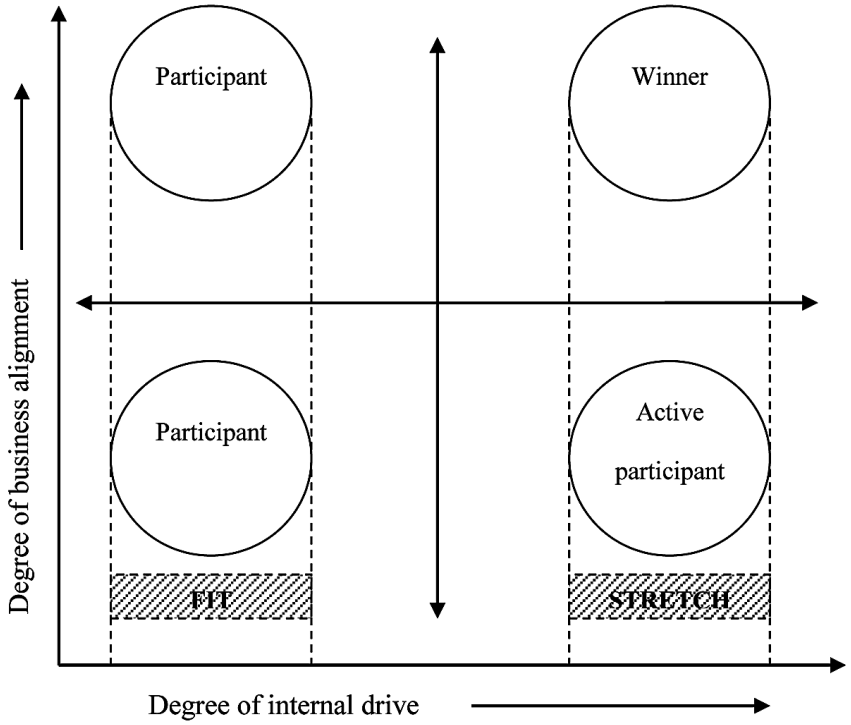
CONCEPTUAL FRAMEWORK

A reading of the literature shows the absence of temporal studies on the gradual transformation of a firm's green initiatives. Out of the limited evolutionary studies in the literature most of such papers remain only at the conceptual level and are unidimensional i.e., they only incorporate the type of actions taken by a firm towards greening their business. However, drivers of green initiatives play an equally important role in determining the firm's possible future course of action. In this respect, the authors bring in the two major dimensions of green business studies (as discussed above) to develop the framework. The same is shown in Figure 1.

One of the dimensions taken is the degree of business alignment (DBA). It is indicative of the degree of alignment of green initiatives with the core business value chain of the firm. The greater the proportion of total green initiatives (at any given point of time) incorporated in the value chain, the greater is the DBA of a firm. The other dimension is the degree of internal drive (DID). At one extreme, a low

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 1. Conceptual framework



DID means that the firm is taking green initiatives solely because of the external drivers. On the other extreme, a high DID indicates that a greater motivation for firms to take green initiatives comes from a strong internal drive along with the external drivers. In such a two-dimensional setting, a participant is a firm which is only complying to the external pressures and in doing so all its green initiatives are completely unaligned to the core business strategy of the company. Most of the firms can be thought of as a participant when they start their green journey. A winner is a firm which has reached a stage where its green initiatives are driven by internal factors (along with constantly present external factors) and all those initiatives are aligned with the core value chain of the firm. A winner is the expected destination status for a firm in its green journey. A firm might be a smart participant (intermediary stage) which denotes that the firm is aligning its green initiatives with their core value chain under the presence of external pressures. Similarly, a firm might be an active participant (intermediary stage) which denotes that the firm is more internally driven in its adoption of green initiatives which may be not aligned with the core value chain of the firm.

With regard to the framework discussed above, the authors use the analogy of strategic fit and stretch to comment on the kind of strategic approach a firm is taking while adopting green initiatives. A firm is said to be in a strategic fit when it configures its resources to merely respond to the external forces in its business environment. On the other hand, under strategic stretch a firm leverages its resources in such a way so that it is able to create new opportunities and in turn gain competitive advantage (Hamel and Prahalad (1992), Hamel and Prahalad (1994)). In this respect, firms which are either participant or smart participant follow a strategic fit approach and those which are active participant or winner follow a strategic stretch approach.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

As stated earlier the literature lacks a proper temporal case study of the green initiatives taken by a firm and the above two dimensional framework is an attempt towards the same. In this regard a case study on the green journey of Indian Oil Corporation Limited (IOCL) in the purview of the framework suggested above is presented in this chapter. Hydrocarbon industry has a major impact on the environment and therefore has a greater responsibility towards the greening of their operations. Moreover, studies on green initiatives within the hydrocarbon industry in the context of developing countries are very few which only list the myriad initiatives taken by firms. Such studies do not analyze the trajectory of the firms in greening the value chain and thereby are devoid of the scope to enable theorization from such temporal analysis. In this respect, IOCL being the market leader in the Indian refinery sector (IBEF India Oil and Gas industry report) with a long history therefore serves as an exemplar for the case study.

In the next section the authors discuss the hydrocarbon industry briefly which serves as a contextual background for the study.

Hydrocarbon Industry

Hydrocarbon industry in India plays an important role in the national economy. It contributes to around 15% to the GDP of the nation. The activities of the hydrocarbon industry can be broadly divided into two parts. The upstream part is focused on exploration and recovery of crude oil and gas. The downstream part is based on refining the crude oil, manufacturing other products from oil, selling and distributing through a huge network of retail outlets to the customers. A brief history of the Indian Hydrocarbon industry is given below.

The industry has gone through many changes while meeting the burgeoning demands of a growing nation. In post-independence era with the growing focus on industrialisation, modernisation, self-reliance, the hydrocarbon industry started growing through the establishment of public sector companies such as Oil and Natural Gas Commission (ONGC) in upstream, Indian Refineries Limited (IRL) and Indian Oil Company Limited (IOC) for marketing. Also, India's first efforts for research and development for the hydrocarbon industry were paid off with the formation of the Indian Institute of Petroleum (IIP) at Dehra Dun.

With the onset of the first Five-Year Plan on April 1st 1951, there was some investment in the petroleum sector during that period. Further, the new Industrial policy was confirmed on April 30th 1956. As per the new resolution industries were divided into three categories. Schedule – A, consisted of 17 core industries of basic & strategic importance which included oil and these were considered to be the responsibility of the Government Schedule – B companies consisted of 12 categories including aluminium, road, sea transport etc. which would be Government owned but private enterprise participation was also expected. The remaining would be expected to be taken up by private enterprises.

Over the years, the Indian petroleum industry has seen huge growth with the growth of public sector refineries and private sector enterprises also with the onset of deregulation and liberalization. With very little in house expertise at the time of independence, the petroleum sector has grown by leaps and bounds with skills and knowledge at par with global standards.

In the last 65 years, the petroleum product consumption has increased by around 59 times from 3 million tonnes during 1948-49 to about 176.9 million tonnes during 2015-16.

Also, several bodies with specialized knowledge have come up to support the development of the sector such as such as the Indian Institute of Petroleum, Petroleum Conservation Research Association, Oil Industry Safety Directorate, Centre for High Technology and Directorate General of Hydrocarbons.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

In addition, oil companies have also set up their own research and development centres. In this regard, the R&D centre of Indian Oil Corporation Limited in Faridabad finds worth mention which has done pioneering work in formulation of lubricants and greases. It is also considered to be the best in Asia. Refer to the Appendix for the list of refineries in India with their respective capacities.

INDIAN OIL CORPORATION: THE CASE

Indian Oil today is the flagship national petroleum company of India. It has the largest refining capacity in India with 35% refining market share. Also, the petroleum product market share corresponds to 46% and is the highest in India. Indian Oil is ranked 161st among all the world companies in the fortune 500 list as on the year 2016.

History

In 1958, the Government of India established its own refinery company named as "Indian Refineries Ltd" and with assistance of Soviet and Romanian groups, the company built its own refineries at Noonmati, Barauni and Koyali. In 1959, "Indian Oil Company" a statutory body was started for supplying oil products to state enterprises and selling products of the refineries. Post 1961, Indian Oil company became the major marketing organization for exporting and importing oil and gas. In September 1964, Indian Oil Corporation Limited was formed through the merger of Indian Refineries Ltd. and the Indian Oil Company.

The broad businesses of Indian Oil Corporation include:

Refining

Indian Oil processes crude oil in its refineries with the help of advanced technologies to produce products like gasoline, diesel, naphtha, lubricants and many others which enable the smooth running of the economy. It controls 11 out of 23 refineries. They are briefly described below.

- **Digboi Refinery, Assam:** The oldest refinery in India is Digboi Refinery in north-east India which was commissioned in 1901. The capacity of the refinery was increased to 0.65 MMTPA after necessary revamping.
- **Guwahati Refinery, Assam:** Guwahati Refinery was commissioned in 1962 with a present capacity of 1.0 MMTPA.
- **Barauni Refinery, Bihar:** Barauni Refinery was commissioned in 1964 and presently it's capacity today is 6 MMTPA.
- **Gujarat Refinery, Gujarat:** The Gujarat Refinery at Koyali in Western India has a capacity of 13.70 MMTPA. The refinery was commissioned in 1965-1966.
- **Haldia Refinery, West Bengal:** Haldia Refinery was commissioned in January 1975 and is now operating at a capacity of 7.5 MMTPA.
- **Mathura Refinery, Uttar Pradesh:** Mathura Refinery was commissioned in 1982 to satisfy the requirement of petroleum products in north western part of the country including National Capital Region. The present capacity has been increased to 8.0 MMTPA.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- **Panipat Refinery, Haryana:** Panipat Refinery is presently operating at a capacity of 15 MMT/yr.
- **Bongaigaon Refinery, Assam:** The Bongaigaon Refinery processes crude with a capacity of 2.35 MMTPA.
- **Paradip Refinery, Odisha:** Paradip refinery has been built with a capacity of 15 MMTPA and is touted to be Indian Oil Corporation's most ambitious project till date.
- **Chennai Petroleum Corporation Limited (CPCL):** CPCL has two refineries with a combined refining capacity of 11.5 Million Tonnes Per Annum (MMTPA).

Pipelines

A network of crude oil and product and gas pipelines runs across the country with a capacity of 80.490 million metric tonnes of oil and 10 million metric standard cubic meter per day of gas.

Marketing

Indian Oil has around 43000 marketing touchpoints with its distribution networks stretching across the length and breadth of the country. Also, based on Readers digest-AC Nielsen survey, Indian Oil was adjudged as the "most trusted brand" in the gasoline category.

Indian Oil R&D Centre

R&D centre is one of the best research centres in Asia with currently around 384 patents in different areas, of which 270 are international patents. The centre has developed several in house technologies which are made available for licensing. The centre works on several areas such as lubricants, engine testing, refinery technologies, environmental sciences and a host of different other topics.

Apart from the above, Indian oil has also successful ventured into both upstream and downstream activities. Through backward integration Indian Oil has ventured into exploration and production of crude oil as well. IOCL has also forward integrated into petrochemicals business given the huge demand for petrochemicals in India and other countries as well.

Data

For the purpose of the above study, the authors resorted to data available in the public domain, i.e., company sustainability reports, newsletters, government policy reports, business magazines, hydrocarbon industry reports as key sources of data. Overall, we referred to more than 35 reports which included the above. One of the authors had a prior working experience in the organisation giving the authors an advantage in terms of understanding the organisational structure and technical aspects of the various initiatives in general and green initiatives in particular.

GREEN INITIATIVES BY IOCL

In this section, the authors discuss various pro-environment initiatives taken by IOCL over the last 15 years.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Initiatives Under Fuel Production

Fuel policy norms in India came in a big way after 2000 in the form of Auto fuel policy in 2003. These were based on European regulations. Initially, in the year 2000, Bharat Stage (BS) - I norms which were based on Euro I norms were introduced in entire India. At the same time, National Capital Region (NCR) was introduced with Bharat Stage - II norms which were loosely based on EURO II. After the Auto fuel policy came in 2003, BS-I was slowly phased out with BS-II taking its place, which got implemented in entire India. Simultaneously, BS-III norms were introduced in 13 major cities in India. From September 2010 onwards BS-III norms were implemented throughout India and BS-II was phased out. BS-IV norms were implemented in the 13 major cities from April 2010. Currently, BS-IV norms are being implemented throughout India and this process is expected to be completed by April 2017. In 2016, the Indian government decided to skip BS-V norms altogether. Instead it was decided to implement more stringent BS-VI norms from 2020 onwards.

In this regard, Indian Oil has undergone major changes in its existing process through installation of relevant technologies in the refineries to comply with the standards set by the Auto Fuel Policy of India while producing petrol (Gasoline) and diesel. This initially began with removal of lead content in gasoline since lead was a harmful component and was associated with health issues. Lead content was removed in phases and finally brought down from 0.56 g/l to 0.013 g/l. Secondly benzene content was also drastically reduced since benzene is carcinogenic. Benzene in gasoline has been kept in line with BS III/IV norms. Also, sulphur, an important pollutant besides causing damage to the exhaust systems in vehicles, has been subsequently brought down to very lower levels, i.e., 500 ppm (BS-III) and 50 ppm (BS- IV) through installation of state of the art technologies by Indian oil refineries to comply with the norms. With 35% in national refining capacity of Indian Oil, the organization has played a proactive role in implementing the BS norms successfully over time and ensuring a cleaner environment to the citizens of the country.

Energy Conservation Initiatives

Post 2002, over the time IOCL has taken various initiatives in making their operations more efficient by consuming less fuel for the same output through process modification. Operational efficiency and improvements in the existing processes were already a part of Indian Oil's philosophy. Such measures/actions gained more attention after the dismantling of the three decade old Administered Pricing Mechanism (APM). Under APM, oil marketing companies were compensated at the rate of 12% irrespective of their successful/unsuccessful investments. Dismantling of the same meant that IOCL had to become more efficient in their operations in order to face the market competition and forces. All this led to IOCL taking a focused approach towards saving cost in various ways, one of them being energy conservation. Energy conservation initiatives meant lesser fuel consumption which in turn would lead to lesser environmental pollution. Therefore, energy conservation initiatives have become one of the important parts of sustainability strategy of IOCL.

In this regard, energy conservation schemes have increased from 20 in 2007-08 to 126 in 2013-14. MBN which is an energy performance indicator, has also decreased from 77 in 2003-04 to 56 in 2012-13. Lower value of MBN signifies the better performance as far as energy conservation is concerned.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Water Conservation Initiatives

Water is an essential component in refinery process. There is a specific demand of water in all refinery operations. However, IOCL has taken specific measures to reduce their dependence on regular water sources. In this regard, IOCL initiatives can be divided into two categories viz., refinery specific and non-refinery specific. Refinery specific initiatives consist of reusing/recycling the treated effluent for purposes like fire water, cooling water towers, etc. 75% of the treated effluent was reused in the refinery in 2013-14. The treated effluents comply with the MINAS standards set by MoEF (Ministry of Environment and Forests). Non-refinery specific initiative consists of rain water harvesting. Rain water harvesting has been adopted in R&D centres and the marketing and pipeline installations as well.

Waste Management

Indian oil has been prompt in its dealing with solid waste management by operating on the principle of prevent, reduce, reuse and recover. The organization treats it waste and complies with the regulations set by Hazardous Waste Act and Biomedical Waste Act. The main types of waste generated are oily sludge at the crude oil and product tanks at pipelines and marketing sites, used catalyst in the refineries and bio-sludge. In the refineries, strategies to minimize waste have been reduction of waste generation at the source, tank cleaning methods, safe disposal methods, bio-treatment of sludge. The sludge after being treated is used as manure in the green belts and the used catalyst is sold to cement industry for use as a filler material. Also, in the marketing division any kind of hazardous waste is treated as per the pollution control norms.

Emission Reduction

Emissions by Indian oil can be broadly be classified into two categories. The first category caters to reduction of gaseous emissions emitted from the core operations like handling, transporting of crude, products, leakages of hydrocarbons refinery operations etc. Several strategies have been developed to ensure that the emission standards are met in line with the Air pollution control norms. These include monitoring tail end emissions through the installation of analyzers, installation of necessary technologies to treat the gases before discharging them to the atmosphere, development of technologies through the involvement of research and development wing of Indian Oil Corporation.

Also, in addition to that above, there has been a renewed focus on reducing greenhouse gas emissions under the Kyoto Protocol which came into force in 2005 to protect the environment from the harmful effects of CO_2, CH_4 etc. In this regard, the Government of India had also proposed the "National Action Plan for Climate change" in 2008 to develop country specific strategy to mitigate climatic changes. The Government has therefore emphasized companies to reduce their carbon footprint.

In this regard, Indian Oil has also developed projects to reduce carbon footprint in its core operations. One such process is through the implementation of clean development projects in refinery installations. Clean Development projects are those projects which are designed to reduce the emission of greenhouse gas emissions through appropriate process modifications in their existing setup. Till now around four such projects in the refineries have been registered under UNFCCC, United Nations Framework Convention on Climate Change by Indian Oil Corporation. Once these projects are operational then the reduction in emissions is quantified by a type of emission unit called certified emission reduction unit

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

or carbon credits based on the approval of the CDM Board members. These carbon credits can be traded with countries listed under the scheme as provided to earn benefits from the investments made in such sustainability initiatives.

Alternative Energy Initiatives

In complying with its environmental objective, Indian Oil has taken steps in investing in alternative renewable energy initiatives. In this regard, Indian Oil successfully installed a 5MW solar power project at Rajasthan under the Jawaharlal Nehru National Solar Mission Phase – 1, Batch - 1. Indian Oil won the competitive bid among 350 participants to install the solar power project at Rajasthan. Also, a 21 MW wind power plant has been installed in Gujarat in 2009 and has been registered as a CDM project in May 2011. A second wind power plant is under implementation at Andhra Pradesh. Indian Oil has been instrumental in setting up a joint venture company with Nuclear Power Corporation of India to establish a nuclear power plant at Rawatbhata, Rajasthan. Among these, Indian Oil has also ventured into Bio-fuels with Jatropha cultivation of around 6000 hectares in association with Chattisgarh Renewable Energy Development Authority (CREDA) at Chattisgarh. This project has also created more than 3.5 lakh man days of rural employment. With a view to providing electricity to the rural populace, Indian Oil has distributed solar lanterns through its retail network and Kisan Seva Kendras to provide the rural masses from a smoke free environment and other health related issues. Around 115.66 crore worth of investment has been spent on renewable initiatives in the year 2012-13 which demonstrates their commitment to invest in such sources for future generation and consumption.

Biological Park Initiatives

Indian oil has also been committed to developing green belts in all its refineries not only for aesthetic purposes but also to act towards controlling pollution. The number of tree plantations has also increased manifold (19-20 times) from 2010-11 to 2015-2016. Over 10 lakh trees have been planted around refinery locations such as Mathura, Koyali, Digboi, Bongaigaon and Barauni. These green belts also serve as a natural habitat for various bird species.

Green Buildings

Indian Oil has also taken measures to ensure that its buildings are green and energy efficient. Presently, one such administration building has been awarded the “green building certification” and the “gold rating” award under LEED (Leadership in Energy and Environmental Design) system, which stands for leadership in energy and environmental drive, which is an international green building rating system providing green rating status.

Organizational Structure

While the organization has taken several initiatives towards greening, what appears striking is also the internal commitment of the organization by dedicating specific roles and responsibilities at various levels. At the corporate level, a board committee exists for CSR (Corporate Social Responsibility) and sustainable development followed by a department for renewable energy and sustainable development.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

There are also nodal officers appointed at the various divisions to look after the initiatives to suggest ideas and proposals for taking sustainability drive of Indian Oil ahead.

ISO 140001

ISO refers to a series of environmental management standards that have been developed by the International Organization for Standardization (ISO). The framework provided by ISO 140001 also called the Environmental Management System is a series of guidelines to enable a company to manage their environmental efforts and also run their operations more efficiently keeping the environment in mind. In this regard, Indian Oil has been certified as an ISO 140001 company which means that the organization has adopted a systematic approach towards managing its initiatives. ISO certification is not mandatory in nature and is a voluntary endeavour.

Data Analysis

In this section, we explain the rationale behind the classification of the various green initiatives based on the driver and the degree of alignment.

THE FUEL INITIATIVES

The fuel initiatives adopted by Indian Oil were based on meeting the stringent Auto fuel policy commissioned since early 2000s. As discussed in the literature review we see that one of the external drivers is the regulatory pressure which plays a major role in shaping a firm's actions. Such kind of pressure serves as a key push factor to take necessary actions. In this case also the Auto fuel Policy can be seen to act as a mandatory push factor for Indian Oil to take necessary actions to comply with the norms.

Given the external push, Indian oil adopted major technological changes to meet all the necessary norms for gasoline and diesel. In this regard, Indian Oil had to undergo major revamp of its existing

Table 1. Classification of the various green initiatives based on the driver and the degree of alignment

S No.	Initiative	Internal/External	Aligned/Not-Aligned
1	Fuel initiatives	External	Aligned
2	Energy conservation initiative	Internal	Aligned
3	Water conservation	Both	Non-aligned
4	Waste management	External	Non-aligned
5	Emission reduction	Both	Aligned
6	Alternative energy initiatives	Internal	Non aligned
7	Biological Park initiatives	Internal	Non aligned
8	Green buildings	Internal	Non aligned
9	Organizational structure	Internal	Aligned
10	Implementation of 140001	Internal	Aligned

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

process technologies to produce the acceptable quality fuels such as the installation of diesel hydrotreating units. These changes were made to the core operating process in the refinery installations which forms a key part of their business space. Hence all the necessary changes made were aligned with the core value chain of the firm

Energy Conservation Initiative

As discussed earlier, Indian oil has always focussed on improving its operational efficiency. However, with changes in the regulatory environment post 2002 in the form of dismantling of APM, the organization had to start looking for opportunities to become more efficient and more competitive. Since the Government was no longer compensating the oil companies through subsidies, therefore the companies had to look for ways to save costs. According to our literature review, reduction in costs which lie hidden in the pollution related activities of the firm form one kind of internal drivers. Hence the energy conservation initiatives taken by Indian Oil were voluntary and driven internally to generate savings. Consequently, implementation of these schemes involved process modifications in the core processes in the refineries and other core activities which indicate that changes made were aligned with the core value chain of the firm

Water Conservation

Water conservation efforts can be broadly divided into two parts as discussed in the previous section. Treatment of effluent water follows specifications provided under the Water Act for the quality of effluent water to be discharged. Such Acts are push factors which the organization has to comply thereby making such actions externally driven. However, complying with the standards does not require making any changes to the core processes or technologies. Secondly, water is mainly used as an ancillary agent to the core processes. The effluent is basically treated with relevant equipment before discharging and reuse purposes. Hence, we argue that changes made in this case are not aligned with the core value chain of the firm.

The next set of initiatives is rain water harvesting which has been installed in refinery, marketing and pipeline installations to collect rainwater to recharge the groundwater. Such activities are therefore internally driven based on the commitment of the organization to conserve water and infiltrate the groundwater level.

In light of the above two broad kinds of initiatives, therefore it is found that both kinds of drivers exist i.e. external and internal

Waste Management

Such initiatives are again based on regulatory acts which require Indian Oil to comply with. Hence, the driver is this case is external. Also, the actions taken also are based on such external drivers. In this case also, the treatments conducted do not bring about any alteration in the core processes of the organization. The organization however, responsibly deals with waste management to comply with Hazardous Waste Act and take necessary measures. However, those actions do not require any change in the core operation of the organization. Therefore, these set of initiatives are non-aligned.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Emission Reduction

There are broadly two kinds of emission reduction initiatives. The first set of initiatives refers to the controlling of those gases which are emitted during the processes in the refineries. Since, there are again mandatory regulations, the driver is definitely external. In this case the actions require making changes to the key technologies of the firm. Hence the initiatives are linked to the core value chain of the firm.

In the second set of initiatives, Indian Oil has taken up efforts at reducing greenhouse gas emissions through reduction in CO_2 (Carbon dioxide) Levels. The organization sensed an opportunity in the clean development process of Kyoto Protocol. This could enable the organization to reduce carbon dioxide emissions as well as earn some carbon credits. Hence the approval of four refinery projects as CDM project show the internal driver of "cost saving through identifying hidden costs in pollution related activities of the firm" and also conducting pollution free operations. In this case, Indian Oil's efforts at reducing carbon dioxide made them see the benefits of adopting CDM projects and derive economic benefits as well. Also, implementation of these projects involve making changes to the core processes making the initiatives aligned with the core value chain of the firm.

Alternate Energy Initiatives

Alternative energy initiatives were started by Indian Oil as a response to the conducive environment provided by the Government of India through the National Action Plan on Climate change in 2007-08. In the initial years, the Government had provided several incentives and subsidies for engaging in renewable initiatives. Hence Indian Oil entered this domain with great energy and enthusiasm and plunged into the renewable energy initiatives. An indication of such internal drive is indicated in Indian Oil competing with 350 other project participants in bidding to set up a Solar Plant in Rajasthan. Indian Oil has also developed solar lanterns and used its vast retail network to distribute to the rural population.

However, in the last two years the regulatory environment with respect to renewable energy sources has taken a mandatory path, i.e., 0.25% has to be solar power and 6.75% has to comprise other renewable sources of energy of the total energy generated and consumed by the refinery. However, Indian oil had already plunged into renewable energy much before the Government had made it mandatory for firms to adopt renewable energy initiatives. Since implementation of these activities do not alter the core value chain, these activities are therefore non-aligned.

Biological Park Initiatives

Tree plantations have been conducted in and around refineries to reduce greenhouse gases and also provide a natural habitat for flora and fauna. Such kind of activities also give visibility to the organization in terms of maintaining a rich bio-diversity by maintaining such ecological parks. Although these initiatives do not form a part of their core value chain, they occupy a huge place of pride among other initiatives as well.

Green Buildings

Indian Oil has also started to adopt green thinking in their design of building architecture as well and have been awarded the "Gold Rating" under the LEED system of rating (Leadership in Energy and

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Environmental Design) indicating their early efforts at greening their habitats. Hence this shows that even though these initiatives do not for a part of their core value chain, yet Indian Oil is leaving no stone unturned in becoming environmental friendly.

Organizational Structure

Successful implantation of the various initiatives is only possible through the dedicated efforts of a team comprising of top management and various other appointed officers to plan and implement the initiatives. In this regard, it can be seen in the reports, that the organization has a dedicated department to handle sustainable initiatives along with nodal officers appointed across the various aspects of the core value chain. This indicates a high degree of internal drive by the organization which has its own implementing and monitoring body (i.e., at the corporate level) to ensure the successful completion of its initiatives. The organization sees sustainability as a key part of their corporate identity and that perception itself is visible in the dedicated administrative positions.

ISO-140001

ISO-140001 indicates the organization's efforts at streamlining their environmental efforts by adopting the guidelines under ISO 140001. ISO adoption is a voluntary initiative and is not mandatory. Hence by adopting the framework under ISO 140001 Indian Oil has systematized their efforts in managing, calculating the losses in hydrocarbon, energy etc. to ensure better operations and focus on those issues that have been left unattended. Therefore, this initiative is definitely aligned with the core value chain of the organization.

TIME PHASE ANALYSIS

The awareness around conducting sustainable business operations in India has increased tremendously over the last 10-15 years. This period has been marked by some of the major policy changes to build a conducive environment to engage in sustainable business operations along with firms also evolving in their responses to the changes in the regulatory environment. In this regard, the present study focuses on the green initiatives taken by IOCL for the following three time periods Pre-2000, 2000-2007, and 2007-2015. We specifically chose year 2000 as it marked the onset of key regulatory fuel policy initiatives by the government around that time. The rationale behind choosing the year 2007 was due to the fact that the authors see an increase in the number of initiatives post 2007 which therefore becomes a key point in setting the time period for our analysis.

Pre-2000

Pre-2000, Indian Oil complied with mostly environmental regulations in the areas of fuel emission standards, water effluent quality, waste disposal. In these areas, the regulatory acts by the several monitoring bodies called for taking measures to adhere to the emissions. The driver was mostly external and the actions taken were both aligned and non-aligned, therefore the organization was following a fit strategy. In this case, the organization was mainly complying with the norms, i.e., the emission norms and other

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

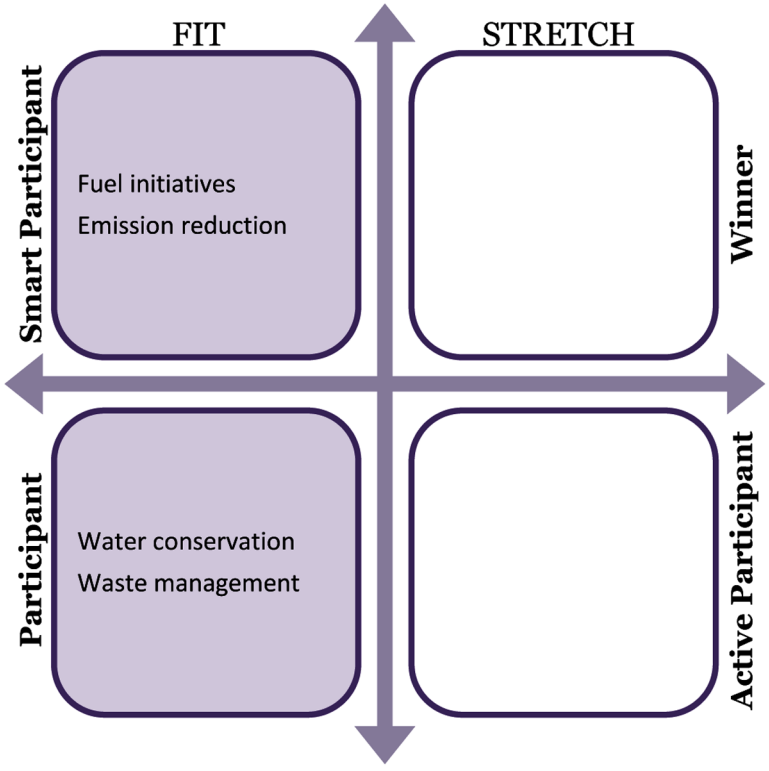
water and waste related norms. Hence the organization was mostly a "smart participant" in areas of alignment and a "participant" in areas of non-alignment as can be seen in Figure 2.

2000-2007

Beginning of 2000, some key changes took place in the regulatory environment. The authors now explain these changes and Indian Oil's corresponding actions in this regard. From early 2003, fuel policy norms became even more stringent with the commissioning of the Auto Fuel Policy. In this period (2000-2007), Indian Oil's position as a "smart participant" solidified further. Moreover, the company was still in the strategic fit approach. This meant that the IOCL's green initiatives that were aligned with their core value chain were externally driven. However, as compared to the pre 2000 era, this period saw some signs of strategic stretch by IOCL. This is clear in Figure 3, where IOCL had two initiatives in the winner quadrant, i.e., such initiatives were not only aligned with the core value chain but also were internally driven. The internal drive behind such "winner" initiatives was motivated by changes in some of the key hydrocarbon industry practices such as dismantling of Administered Pricing Mechanism (APM).

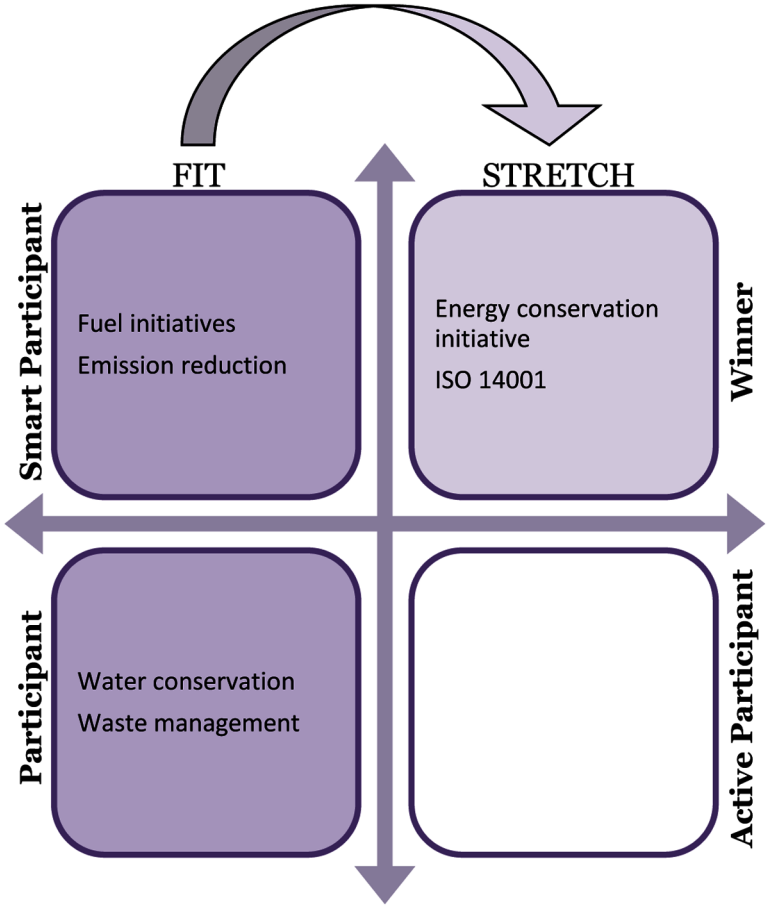
As mentioned earlier, dismantling of APM meant that Oil companies had to face new challenge of making their operations more efficient in order to reduce cost and be able to compete in the open market and make profit. The two "winner initiatives" in this period emerged as a consequence of making necessary changes to adapt to the changed scenario. Hence this shows the organization's pro-activeness in responding to the changed scenario. By the end of the period 2000-2007, IOCL no longer just restricted

Figure 2. Conceptual framework depicting Pre-2000 era



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 3. Conceptual framework depicting 2002-2007 era



themselves to only the fit approach but also started to stretch themselves as far as green initiatives were concerned. In this regard, the ISO 14001 certifications for IOCL refineries also increased substantially.

2007-2015

During this period, Indian Oil now started stretching in green initiatives in other non-aligned areas. As we can see from Figure 3, the initiatives can be seen concentrated in the active participant quadrant.

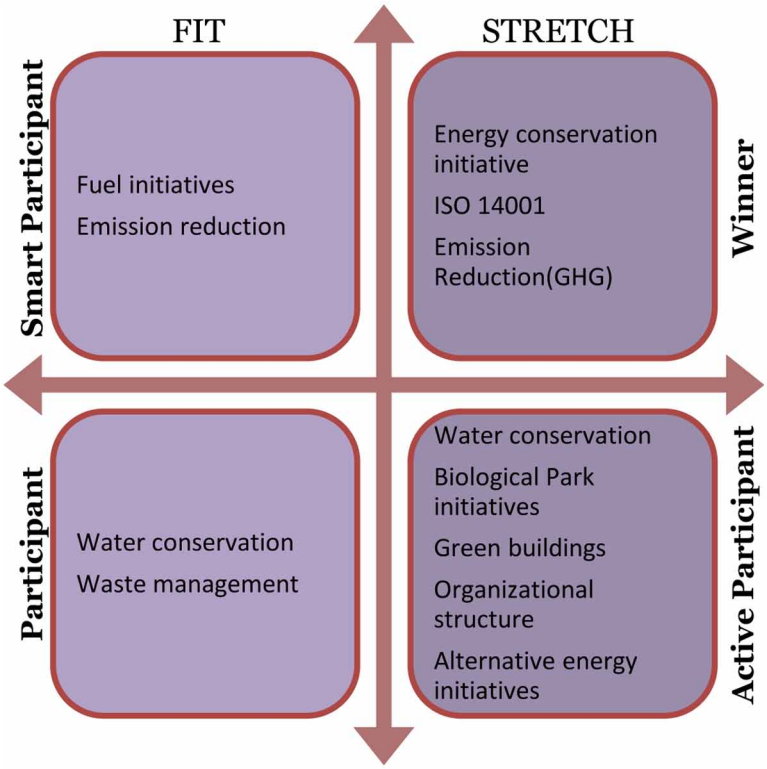
By the end of the last time phase, Indian Oil had already taken started to take green initiatives by stretching themselves. With Indian Oil operations spreading across business spaces, and increasing global reach, this led them to consider green initiatives on a larger scale and make it an indispensable part of their future journey. The organization was now more focused on making the environmental initiatives an integral part of its identity. It can be observed in the way Indian Oil has expanded their organizational structure to include additional specific departments and appoint nodal officers across various divisions to plan and implement green initiatives. Specifically in this space one of the major set of initiatives were the renewable/alternative energy. In their reports the authors see that the organization considers renewable energy as one of their potential future business space.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Also, as seen in the last phase (refer Figure 3) they made their presence felt in the winner quadrant with the onset of ENCON initiatives and engaging in ISO initiatives. Further in the present phase, it can be seen that the number of initiatives have further increased in case of energy conservation initiatives. The number of schemes went up from a mere 20 in 2007-08 to 126 in 2013-14. Therefore, the momentum continued to build in case of taking green initiatives. Hence by taking an internally driven pro-environment approach in the last era, the organization capitalized on its green ventures and started building on its capabilities at saving costs through energy efficient operations leading to a further solidification in their position in the "winner" quadrant. Also, after successful adoption of ISO 140001, the organization also went for ISO 14064 which was meant for greenhouse inventorization and reporting by the refineries. All the refineries got the certification in and around 2010. All the above figures as found in the reports indicate their drive to conduct green and sustainable operations. All of the above reflects the increased intensity of the winner quadrant.

Being a market leader in the country, also serves as a key internal drive to motivate the organization in adopting green initiatives whole-heartedly and setting an example to other organizations. This factor explains their efforts at embracing the sustainable business practices in all spheres of their activity and making their presence felt both in the active participant and winner quadrant.

Figure 4. Conceptual framework depicting 2007-2015 era



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

CONCLUSION

The need for addressing environmental concerns is more than ever before. In this regard, literature on green initiatives is also growing at a fast pace. Academicians are also trying to understand various aspects of such initiatives. Various authors have tried to understand the key drivers behind green initiatives and the nature of such initiatives. Very few studies provide a conceptual framework to assess a firm's approach regarding green initiatives over time. The current work is an attempt towards proposing a framework to study a firm's approach in taking green initiatives in different phases of time. Authors choose IOCL as the exemplar for studying its green journey over time through the lens of the conceptual framework suggested in this work.

The three phases show the journey of Indian Oil in their efforts towards green initiatives. IOCL was initially in the fit mode with compliance of set regulatory standards in the pre-2000 era. Based on the regulatory standards Indian Oil ensured their commitment to the standards. However, with changes in the business practices in the industry, Indian Oil had had to go that extra mile to incorporate fuel efficient practices to save costs which consequently led them to undertake more environmental friendly initiatives related to their core value chain. Being a market leader and with an increasing global reach, the organization started venturing in other non-core areas as well with regard to green initiatives while intensifying their presence in the core activities. Hence in the latter part, the organization became an active participant and also mobilized its efforts in the winner quadrant as well.

The above case study demonstrates how an organization has moved over time with respect its green initiatives. The framework helps to understand the position of the organization at different phases. Hence it serves as an example for other organizations to learn and understand the trajectory of Indian Oil in order to reflect upon their own position and how they can improve in greening their operations.

REFERENCES

Ben Brik, A., Mellahi, K., & Rettab, B. (2013). Drivers of green supply chain in emerging economies. Thunderbird International Business Review, 55(2), 123–136. doi:10.1002/tie.21531 doi:10.1002/tie.21531

Berns, M., Townend, A., Khayat, Z., Balagopal, B., Reeves, M., Hopkins, M., & Kruschwitz, N. (2009). The Business of Sustainability: Imperatives, Advantages, and Actions. Boston, MA: The Boston Consulting Group.

Berry, M. A., & Rondinelli, D. A. (1998). Proactive corporate environmental management: A new industrial revolution. The Academy of Management Executive, 12(2), 38–50.

Bhool, R., & Narwal, M. S. (2013). An analysis of drivers affecting the implementation of green supply chain management for the Indian manufacturing industries. International Journal of Research in Engineering and Technology, 2(11), 2319–1163.

Bowen, H. R. (2013). Social responsibilities of the businessman. University of Iowa Press.

Carter, C.R. & Dresner, M. (2001). Purchasing's role in environmental management: cross-functional development of grounded theory. *Supply Chain Management*, 37.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chan, R. Y. K., & Lau, L. B. Y. (2001). Explaining green purchasing behavior: A cross-cultural study on American and Chinese consumers. Journal of International Consumer Marketing, 14(2/3), 9–41.

Christmann, P. (2000). Effects of best practices of environmental management on cost advantage: The role of complementary assets. Academy of Management Journal, 43(4), 663–680. doi:10.2307/1556360 doi:10.2307/1556360

Dhull, S., & Narwal, M. (2016). Drivers and barriers in green supply chain management adaptation: A state-of-art review. Uncertain Supply Chain Management, 4(1), 61–76. doi:10.5267/j.uscm.2015.7.003 doi:10.5267/j.uscm.2015.7.003

DiMaggio, P., & Powell, W. W. (1983). The iron cage revisited: Collective rationality and institutional isomorphism in organizational fields. American Sociological Review, 48(2), 147–160. doi:10.2307/2095101 doi:10.2307/2095101

Fineman, S. (Ed.). (2002). The business of greening. Routledge.

Friedman, M. (1970). The social responsibility of business is to increase its profits. New York.

Handfield, R. B., Walton, S. V., Seegers, L. K., & Melnyk, S. A. (1997). Green value chain practices in the furniture industry. Journal of Operations Management, 15(4), 293–315. doi:10.1016/S0272-6963(97)00004-1 doi:10.1016/S0272-6963(97)00004-1

Hanna, M. D., Newman, W. R., & Johnson, P. (2000). Linking operational and environmental improvement through employee involvement. International Journal of Operations & Production Management, 20(2), 148–165. doi:10.1108/01443570010304233 doi:10.1108/01443570010304233

Hart, S. L., & Milstein, M. B. (2003). Creating sustainable value. The Academy of Management Executive, 17(2), 56–67. doi:10.5465/AME.2003.10025194 doi:10.5465/AME.2003.10025194

Henriques, I., & Sadorsky, P. (1996). The determinants of an environmentally responsive firm: An empirical approach. Journal of Environmental Economics and Management, 30(3), 381–395. doi:10.1006/jeem.1996.0026 doi:10.1006/jeem.1996.0026

Jain, V.K., & Sharma, S. (2014). Drivers Affecting the Green Supply Chain Management Adaptation: A Review. IUP Journal of Operations Management, 13(1), 54.

Klassen, R.D., & McLaughlin, C.P. (1996). The impact of environmental management on firm performance. Management Science, 42(8), 1199–1214. doi:10.1287/mnsc.42.8.1199 doi:10.1287/mnsc.42.8.1199

Kolk, A., & Mauser, A. (2002). The evolution of environmental management: From stage models to performance evaluation. Business Strategy and the Environment, 11(1), 14–31. doi:10.1002/bse.316 doi:10.1002/bse.316

Lanoie, P., & Tanguay, G. A. (2000). Factors leading to green profitability. In *Greener Management International* (pp. 39-39).

Large, R. O., & Thomsen, C. G. (2011). Drivers of green supply management performance: Evidence from Germany. Journal of Purchasing and Supply Management, 17(3), 176–184. doi:10.1016/j.pursup.2011.04.006 doi:10.1016/j.pursup.2011.04.006

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Lo, S. F., & Sheu, H. J. (2007). Is Corporate Sustainability a Value-Increasing Strategy for Business? Corporate Governance: An International Review, 15(2), 345–358. doi:10.1111/j.1467-8683.2007.00565.x doi:10.1111/j.1467-8683.2007.00565.x

New, S., Green, K., & Morton, B. (2000). Buying the environment: the multiple meanings of green supply. In S. Fineman (Ed.), The Business of Greening (pp. 33-53). London: Routledge.

Orsato, R.J. (2006). Competitive environmental strategies: When does it pay to be green? California Management Review, 48(2), 127–143. doi:10.2307/41166341 doi:10.2307/41166341

Porter, M., & van der Linde, C. (1995). Green and competitive: Ending the stalemate. Harvard Business Review, 73(5), 120–133.

Qadri, M. A., Haleem, A., & Arif, M. (2011). Identification of drivers for greening of supply chain in India. International Journal of Construction Project Management, 3(3), 213.

Rao, P. (2007). Greening of the supply chain: An empirical study for SMEs in the Philippine context. Journal of Asia Business Studies, 1(2), 55–66. doi:10.1108/15587890780001296 doi:10.1108/15587890780001296

Russo, M. V., & Fouts, P. A. (1997). A resource-based perspective on corporate environmental performance and profitability. Academy of Management Journal, 40(3), 534–559. doi:10.2307/257052 doi:10.2307/257052

Sharma, S. (2000). Managerial interpretations and organizational context as predictors of corporate choice of environmental strategy. Academy of Management Journal, 43(4), 681–697. doi:10.2307/1556361 doi:10.2307/1556361

Stefan, A., & Paul, L. (2008). Does it pay to be green? A systematic overview. The Academy of Management Perspectives, 22(4), 45–62. doi:10.5465/AMP.2008.35590353 doi:10.5465/AMP.2008.35590353

Theyel, G. (2001). Customer and supplier relations for environmental performance. Greener Management International (Vol. 35, pp. 166–186).

Vachon, S., & Klassen, R. D. (2006). Extending green practices across the supply chain: Impacts of upstream and downstream integration. International Journal of Operations & Production Management, 26(7), 795–821. doi:10.1108/01443570610672248 doi:10.1108/01443570610672248

Vachon, S., & Klassen, R.D. (2006). Extending green practices across the supply chain: Impacts of upstream and downstream integration. International Journal of Operations & Production Management, 26(7), 795–821. doi:10.1108/01443570610672248 doi:10.1108/01443570610672248

Walker, H., Di Sisto, L., & McBain, D. (2008). Drivers and barriers to environmental supply chain management practices: Lessons from the public and private sectors. Journal of Purchasing and Supply Management, 14(1), 69–85. doi:10.1016/j.pursup.2008.01.007 doi:10.1016/j.pursup.2008.01.007

WCED, World Commission on Environment and Development. (1987). Our Common Future. Oxford: Oxford University Press.

York, J. G. (2009). Pragmatic sustainability: Translating environmental ethics into competitive advantage. Journal of Business Ethics, 85(1), 97–109. doi:10.1007/s10551-008-9950-6 doi:10.100710551-008-9950-6

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Zhu, Q., Sarkis, J. & Geng, Y. (2005). Green supply chain management in China: pressures, practices, and performance. *International Journal of Operations and Production.*

ADDITIONAL READING

Government of India. (2008). National Action Plan on Climate Change. GOI Report. Retrieved from (http://www.moef.nic.in/sites/default/files/Pg01-52_2.pdf

Government of India. (2014). Auto Fuel Vision and Policy 2025. GOI Report. Retrieved from http://petroleum.nic.in/docs/autopol.pdf

Indian Oil Corporation Limited. (n. d.). About Us. Retrieved from https://iocl.com/AboutUs/Business.aspx

Indian Oil Corporation Limited. (2009). Environment. Sustainability Report. Retrieved from (https://www.iocl.com/Aboutus/Environment2303.pdf

Indian Oil Corporation Limited. (2011). Indian Oil: The Energy of India. Sustainability Report. Retrieved from https://www.iocl.com/Aboutus/sustainbility/Indian_oil_the_energy_of_india.pdf

Indian Oil Corporation Limited. (2011). Investor Presentation. Company Report. Retrieved from https://www.iocl.com/downloads/Investor_Presentation_June_2011.pdf

Indian Oil Corporation Limited. (2012). Fuelling a Billion Aspirations. Sustainability Report. Retrieved from https://www.iocl.com/download/Sustainability_Report_2011-12.pdf

Indian Oil Corporation Limited. (2013). Widening Horizons. Sustainability Report. Retrieved from https://www.iocl.com/download/Sustainability_Report_2012-13.pdf

Indian Oil Corporation Limited. (2014). Leading the change. Sustainability Report. Retrieved from https://www.iocl.com/download/IOCL_SR_Oct_2013-14.pdf

Indian Oil Corporation Limited. (2015). Transformational Leadership. Sustainability Report. Retrieved from https://www.iocl.com/download/Sustainability_Report_2014-15.pdf

Nishith Desai Associates. (2014). Oil and Gas Industry in India. Legal, Regulatory & Tax Report. Retrieved from http://www.nishithdesai.com/fileadmin/user_upload/pdfs/Research%20Papers/Oil_and_Gas_Industry_in_India.pdf

This research was previously published in Green Initiatives for Business Sustainability and Value Creation edited by Arun Kumar Paul, Dipak Kumar Bhattacharyya, and Sandip Anand, pages 45-69, copyright year 2018 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

APPENDIX

Table 2. List of refineries with their capacities in India

SN	Organisation	Location	Capacity (MMTPA)
01	Indian Oil Corporation Limited (IOCL)	Barauni	6.00
02		Koyali	13.70
03		Haldia	7.50
04		Mathura	8.00
05		Panipat	15.00
06		Guwahati	1.00
07		Digboi	0.65
08		Bongaigaon	2.35
09		Paradip	15.00
10	IOCL – CPCL (Chennai Petroleum Corporation Limited)	Chennai	10.50
11		Nagapatinnam	1.00
	Refining capacity of IOCL including subsidiary	Sub-Total	80.70
12	Hindustan Petroleum Corporation Limited	Mumbai	6.50
13		Visakhapatnam	8.30
14	HPCL - Mittal Energy Ltd (HMEL)	Bhatinda	9.00
	Refining capacity of HPCL including Joint Venture	Sub-Total	23.80
15	BPCL	Mumbai	12.00
16		Kochi	9.50
17		Numaligarh	3.00
18	Bharat Oman Refinery Limited (BORL)	Bina	6.00
	Refining capacity of BPCL including Joint Venture	Sub-Total	30.50
19	Oil and Natural Gas Commission	Tatipaka	0.10
20	Mangalore Refinery and Petrochemicals Limited (MRPL)	Mangalore	15.00
	Refining capacity of ONGC	Sub-Total	15.10
21	Reliance Industries Limited (RIL)	Jamnagar (DTA)	33.00
		Jamnagar (SEZ)	27.00
	Refining capacity of RIL	Sub-Total	60.00
22	Essar Oil Limited	Vadinar	20.00
	Refining Capacity in India	Gross Total	230.10

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 48
Environmental Sustainability Practices for SMEs

Gurudas Nulkar
HRD, India

ABSTRACT

The rate and scale of environmental degradation, through economic activities, has triggered widespread awakening among businesses, governments and civil society. The world over, corporations have responded by adopting sustainability practices and reporting. However, much of these happen within the premises of the corporations. As larger organizations outsource their manufacturing and service operations to small and medium enterprises (SMEs), they effectively shift their environmental burden on their vendors. In most developing countries, poor regulations and weak enforcement of environment laws leave the SMEs on their own, to improve their environmental practices. However, their limited resources and managerial capabilities are often inadequate to undertake sustainability practices. This chapter presents the findings of a research conducted among engineering SMEs in India. It proposes a lifecycle approach towards environmental practices and discusses potential business benefits and value creation from this. The chapter gives a roadmap for green business strategies, which SMEs can implement within their organization.

1. INTRODUCTION: WHY SMEs?

In our lifetime, we have witnessed some of the worst natural calamities. Warnings of polar ice melt, tsunamis, hurricanes and snowstorms are increasingly frequent. Death and destruction from such causes are steadily on the rise. Are these the vagaries of the planet or is this a response to human activities? This question has been extensively debated in the last few years, but has ended up creating more questions than answers. Should the environment be prioritized over industrial growth? Does the planet come ahead of people? Is technology leading to faster depletion of natural resources? Many such uncomfortable questions are now challenging the very structure of free markets.

However, the argument that unbridled consumption on a planet with finite resources, will inevitably lead to collapse, is gaining momentum. History offers ample proof of civilizations collapsing because

DOI: 10.4018/978-1-5225-7915-1.ch048

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

they had overlooked resource overuse (Diamond, 2000). Over the last decade, many corporations have come to terms with this prognosis and have taken up the path of sustainability. Many global corporations now have sophisticated sustainability programs indicating a level of acceptance to the environmental imperative. However, even as the awareness grows within society and governments, small enterprises seem to be spared. Their small size is effective in warding off attention and on the other hand their sheer number poses an enforcement challenge for authorities. Although their scale of operations renders a proportionately small environmental impact, it is estimated that their collective impact may be as much, if not more, as that of large industry. Moreover, many SMEs are part of global supply chains of large corporations and undertake manufacturing activities for them. As key suppliers to the large corporations, a significant portion of their environmental burden is thus transferred to the SMEs. They contribute significantly to a nation's economy and its GDP and from a precautionary principle then, it is imperative that SMEs be encouraged to improve their environmental performance within their own operations. The potential benefit from this is far too large to be neglected.

SMEs generally adopt reactive strategies which focus on compliance rather than sustainability (Hobbs, 2000). Recent studies show that the firm size is one of the major determinants of a firm's green strategy – environmental actions undertaken are inversely proportional to the company size (Bianchi & Noci, 1996). In the 2011 survey on Sustainability and Innovation, the MIT Sloan Business School too had similar findings (MIT Sloan Sustainability Dashboard). SMEs generally follow business instincts to reduce resource use and waste and are keen to save costs through efficient resource usage. But those practices which need investments or inflict costs are not popular among them. Employing clean technologies and life-cycle analysis often does not find favor among small firms. When faced with the prospect of no business gains, SMEs tend to disregard environmental improvement as a non-priority expense (Esty & Winston, 2009). In most developing countries, the potential contribution of SMEs to a cleaner environment may not have been realized yet. Taking the case of India, current policy and legal frameworks do little to encourage or support SMEs in this direction. As the adoption of sustainable practices by SMEs is critical for national environmental goals, they must be encouraged to go beyond the usual eco-efficiency practices. While the magnitude of impact on the environment of an individual SME will depend on the technologies employed, packaging used, energy consumption patterns and distribution and supply chain usage, there is no doubt on the necessity of them improving their environmental performance.

The author's research with SMEs shows that green business practices offer distinctive business benefits for SMEs. Large corporations increasingly demand environmental management systems from their suppliers since greening their supply chains contributes directly in their own sustainability efforts. Similarly, environmental management certifications are integral part of vendor qualification criteria for many companies. Moreover, in many developed economies, bankers and financial lending institutions require environmental risk assessment from their loan applicants. Similarly, many insurers charge higher premium from SMEs who are exposed to environmental risks. In the European Union, extended producer responsibility (EPR) requires corporations to be responsible for their products, no matter where they are produced. This has prompted large companies to disqualify SME suppliers who do not meet the environmental standards. On the other hand, SMEs in consumer businesses have witnessed growth in green consumerism not just in developed economies but also countries like India. To serve this market, SMEs must go beyond green manufacturing. This requires technical and managerial skills, but will extend the first mover advantages to those early in the game. These are just some of the obvious business benefits accrued through green practices.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The objective of this chapter is to help SMEs understand the benefits of green business practices and offer them a simple framework for greening their businesses. The chapter is draws upon the results of a three-year study undertaken by the author with engineering SMEs in India. The research examined green business practices of over 70 SMEs from the product lifecycle perspective. Additionally, in depth interviews with large corporations, who have SMEs in their supply chains, helped gain deep insights into environmental practices. The study has been published in international journals and has received a positive response from policy makers, industry associations and SMEs themselves. This chapter builds on the findings and discussions in the research and intends to help SMEs realize how green business strategies can result in competitive advantage for them. Consequently, this would help transform what are today cost burdens into strategic investments for tomorrow. The central argument of the chapter is that businesses must recognize the value arising out of the firm's environmental impact and strategically position itself to gain competitive advantages.

2. COMPETITIVE OPPORTUNITIES POSSIBLE WITH GREEN BUSINESS PRACTICES FOR SMES

The ability of SMEs to create, access and commercialize new knowledge in their own markets is fundamental to their sustained competitiveness. The formation of strategy and its implementation are at the core a competitive business. Competitiveness is a comparative concept of the ability and performance of a firm to sell and supply goods and or services in each market. In almost all literature on strategy, the leading hypothesis is that sustained superior performance of firms arises from sustained competitive advantages (Powell, 2001). Competitive advantage implies that firms can satisfy customer needs more effectively than their competitors. This can be achieved through lower costs or differentiated advantages which customers value and are willing to pay for. Both these situations were evident in the author's research on SMEs adopting green business practices. Thus, green strategies can potentially lead to the traditional generic outcomes of business strategy - cost leadership and differentiation. Responses in the research showed the presence of both forms of benefits in firms which practiced environmental management. It is important to note that these benefits were a result of green practices and could not have been achieved by other means. Porter and Linde (1995) have argued that the most competitive firms are not the ones with cheapest inputs or largest scales, but ones which have the capacity to innovate more. They discuss several examples where environmental regulation has caused firms to innovate for solutions thereby creating a cost advantage. Firms which proactively pursue green strategies stand to benefit in many ways than just profits. A green competitive advantage is the potential for environmental performance to improve long term profitability.

2.1 Benefits of Going Green

Based on research conducted in other countries and the author's own research with SMEs in India, it was found that SMEs enjoy several benefits from environmental management. These benefits vary with the extent of practices, nevertheless, they offer compelling reasons for small firms to undertake green business practices. The list of benefits arising from green practices is shown in Table 1.

Unique combinations of benefits were experienced by many SMEs. These covered the generic strategic positions which lead to competitive advantages for firms. Such advantages are gained because of an in-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 1. Business benefits of green practices

Business Benefits of Green Practices	Generic Advantage
Savings from reduced consumption of materials and resources	Lower Cost advantage
Savings from use of increased recycled content	Lower Cost advantage
Improved productivity of resources	Lower Cost advantage
Financial incentives from lending institutions	Lower Cost advantage
Lower premium from insurers	Lower Cost advantage
Lowering environmental risks in business	Lower Cost advantage
Improvement in quality of products	Differentiation advantage
Advantage with some current customers	Differentiation advantage
Advantage in acquiring new customers	Differentiation advantage
Export opportunities due to environmental management	Differentiation advantage
Improved image with customers	Differentiation advantage
Attracting better employees	Differentiation advantage
Better morale of employees	Differentiation advantage

novative and resourceful organization and are difficult to observe by competitors. The collective learning of the organization is hard to observe and imitate, effectively turning it into a competitive advantage. Our research shows that the benefits of lower costs are commonly observed in SMEs. These are a result of reduced usage of resources, lower waste, increased recycled content and lower environmental risks. Most of these benefits are realized in the short-run and are easiest to undertake, without much disruption in daily operations. As this is important for SME operations, the research showed cost saving benefits to be the most common within SMEs.

However, as each firm practices resource productivity, there is a limited scope for a competitive advantage from low costs. On the other hand, differentiated products or a differentiated firm image can be harder to imitate and is sought after through competitive strategy. However, the benefits of differentiation from green practices, were less evident in this research, than those of cost saving. At the current levels of green performance, cost benefits seem to be more than differentiation benefits.

2.2 Perils of Not Going Green

As a part of supply chains of global corporations, SMEs are obligated to meet the qualification criteria set by their customers. Increasingly, large corporations are demanding environmental management practices and in some cases certifications from their vendors. On the other hand, some companies value green performance but do not make it mandatory. In both the cases SMEs who have overlooked going green stand to lose. Many large corporations that the author interviewed during the research indicated a preference for green performance. Some companies set environmental standards which suppliers must meet, some demand environmental reporting while many are planning green qualification for their vendors in the near future. For example, companies like Walmart are keen to source from India but require a high degree of environmental management from their vendors. Those SMEs that already are on the job stand to gain a competitive advantage straight away.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The benefit of lower environmental risk is perhaps least understood among SMEs. Firms may find it challenging to invest in mitigating risks which cannot be quantified in many cases. While in developed economies firms would invest in compliance and in some cases beyond compliance, only to reduce environmental threats; this was not evident in India. SMEs may fall in either one of these situations: (i) environmental risks are not perceived at all due to poor environmental awareness (ii) environmental risks are not considered significant. 'Won't happen with me' is not a mitigation of environmental risks, as statistics from other countries shows.

Several studies conclude that SMEs lag in environmental practices when compared to large firms (Studer, Welford, & Hills, 2008). Most are agreed that SMEs are motivated more by compliance and cost saving than gaining a competitive advantage (Rowe & Hollingsworth, 1996) (Worthington & Patton, 2005). However, SMEs must realize the business case for going green and move in to gain early mover advantages.

3. BEYOND MANUFACTURING: GREENING THE PRODUCT LIFE CYCLE

Lean manufacturing, Six Sigma and a host of other such techniques help firms to improve resource utilization and reduce waste. These practices that help save costs are prevalent in SMEs already. However, these low hanging fruits are observable and imitable by competitors, and firms operating at high efficiencies hardly enjoy its benefits, since most competitors would do the same. Moreover, for the environment, these are generally located towards the end of the pipe. Most of these practices fall within the scope of manufacturing, are tangible, measurable, and offer something "to act on."

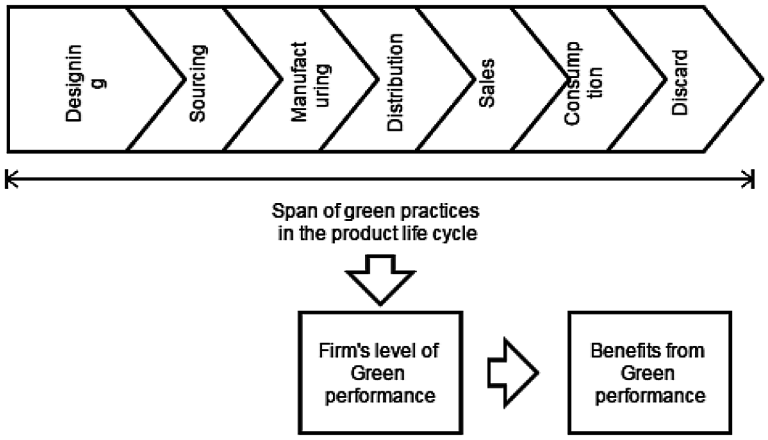
On the other hand, greening the other stages of the product life cycle is not always obvious and requires a certain degree of environmental awareness and knowledge. Moreover, as green practices in these stages may not lead to cost reductions, they are likely to be overlooked by SMEs. SMEs can gain significant benefits by greening not just the manufacturing stage, but the other parts of the life cycle. Designing for the environment and manufacturing with cleaner technologies has more beneficial impacts than end-of-pipe greening. Sourcing from suppliers who practice environmental management, distributing with green supply chains, designing the product for low resource use in its lifetime and finally designing the product for safe discard and making it suitable for reuse or recycle, are all ways in which the SME can stand to gain. The author's research examined the green practices of SMEs in all the generic stages of a product life cycle- planning, design, sourcing, manufacturing, and sales.

The research employed a conceptual framework developed based on the literature review and in-depth interviews (Figure 1). The framework proposes that the level of green performance of a firm depends of the green practices across the generic product life cycle and that the business benefits accrued are a result of the level of green performance that the firm practices. The research supported this proposition and showed firms with green practices in stages other than manufacturing enjoyed several benefits shown in table 1. On the other hand, firms which practiced green behavior mainly in the manufacturing benefited from cost savings, which is a necessary, but not a sufficient condition to enjoy a competitive advantage.

Figure 1 shows the generic stages in a product life cycle. This conceptual framework makes a proposition that the benefits a firm can expect from greening are related to the level of green performance it undertakes. This level is decided by the scope of green practices that the firm employs in the generic product life cycle. The author's research supported this proposition. The benefits are indeed correlated to the activities within the product life cycle. Firms which employ green practices in all the stages would

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 1. Green practices in the product life cycle



benefit the most. However, the research also showed that most SMEs are good at green practices in the manufacturing stage, but very few consider the other stages. SMEs keen to enjoy the benefits of going green then need to increase their scope of green activities in the product life cycle. This can be easily accomplished through the questions which the firm can ask itself at each stage. An easy to use Green Questionnaire is shown in Table 2.

A planned approach is recommended. The following steps will ease the process.

1. **Set Up Environmental Vision, Objectives and Targets:** The first step towards a greener organization starts with setting goals, objectives and targets. The establishment of quantitative goals provides a clear point of reference for developing and applying metrics. Unless management and employees have a clear understanding of exactly what is expected from the process and what will be evaluated for ascertaining this, attention to environmental issues will be unfocused and motivation will reduce over time. The old English adage works here - "What's measured, improves." Precise and measurable objectives are also set. A useful guide for setting objectives is the Coalition for Environmentally Responsible Economies (CERES) publication of "The Ceres Principles"1. This is a ten-point code of corporate environmental conduct. Similarly, the International Chamber of Commerce (ICC) has prepared the 'Business Charter for Sustainable Development'2 which sets out 16 principles for environmental management. These documents can be used as guiding principles.

Based on the research, the author suggests a simple three level approach to setting green targets for SMEs. This is shown in Table 3.

Another useful tool for SMEs is the Environmental Policy check-list which is available free at International Network for Environmental Management (INEM) website here http://www.inem.org/default.asp?Menue=94

2. **Make an Empowered Cross Functional Team:** This is an important step. Many SMEs have limited managerial and technical capabilities. These can be overcome by making a cross functional team. a team should be formed. This team will comprise personnel across departments and specializations. The team will be empowered to facilitate achieving targets. Their first task is to communicate the

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 2.

Product Life Cycle Stage	Questions on Green Activities Within Each Stage
Planning	Does the environment find a mention in the SME's Vision or Mission?
	Does the firm set environmental targets?
	Do any formal environmental management systems exist?
	Is there a designated officer for environmental activities?
	Are the strategic objectives and targets communicated within the organization?
	Do we need to modify any products to reduce their environmental impact at any stage?
Design	Can we design products to use lesser materials?
	Can we design our products to be able to use any clean technologies?
	Can we design products to use more recycled content?
	Can we design products to use lower consumables in their use?
	Can our products be recycled or reused at end of life? Whole or part?
	Can our products be discarded in an environmental safe manner?
Sourcing	Can we source from vendors with environmental management systems?
	Can we set environmental targets for our suppliers?
	Can we incorporate and input regulations - RoHS[26], REACH[27], etc.?
Manufacturing	Are any of the following tools and techniques employed in manufacturing? Lean management, Six Sigma, clean technologies, GreenCo Rating System, etc.
	How is environmental compliance and regulation dealt with?
	Do we monitor the following - Water consumption, Material use, Waste generated, Emissions, Effluent, Energy consumed?
Distribution	Can improve packaging for reducing transport load?
	Can we monitor fuel consumed in distribution and storage?
	Can we take back any packaging material for reuse/recycle?
Sales	Are our environmental efforts communicated to customers? How?
	Can our firm take a up a green competitive position?
	Is the firm's environmental performance used to influence buyers during the sale?
Consumption of my products	Does my product consume energy or other resources during use? Can we design the products for efficiency in its use?
	Is my product designed to last a lifetime of use?
Discard	Can my product be recycled? Whole or parts?
	Can my product be reused? Whole or parts?
	Can my product be discarded safely and within the laws of the land?

Table 3.

Level	Basis	What to Measure
First	Compliance and Control	Pollutants, emissions, energy
Second	Prevention and Reduction	Materials use, direct energy, indirect energy, water, non-product output
Third	Design for environment	Life cycle assessment

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

targets, efforts and benefits expected, across the organization. To reach the organizational goals, they will identify tools and technologies, disseminate best practices and measure the progress. This is an add-on duty for existing employees and the author recommends remunerating the efforts.

3. **Planning with the Green Questionnaire:** The team then takes up the Green Questionnaire. In many cases SMEs may not have all the stages of the product life cycle within their own firm. Some SMEs may be an outsourced manufacturing rather than a complete product design and manufacture partner. In this case the firm would have no control on the design stage and in some cases, may be even the sourcing stage. The important part here is to establish which of the stages can the firm work upon and then ask the suggested questions in those stages. Some questions may require support from environmental consulting firms. Especially decisions on product design, clean tech and discard. The firm will do a cost-benefit trade off when considering external help.

The Eco-design health check is a useful online tool available free at the International Network for Environmental Management (INEM) website here http://www.inem.org/Default.asp?Menue=190

4. **Prioritize the Stages:** Going green throughout the firm's activities, all at once, can be highly strenuous to small firms. This requires advanced technical capabilities and managerial band width. Such a large-scale intervention may result in operational disruption consequently leading to customer dissatisfaction. Prioritizing the firm's activities by stages is a less risky approach to greening. For example, in phase one, the firm may choose to spend the next six months in greening manufacturing and operations, followed by sourcing and distribution. In phase two, the firm may decide to work on its product design and clean tech solutions. In this manner, the risks of business disruption are lowered.
5. **Make an Implementation Plan:** This is not the same as the planning exercise. Some of the key reasons why project implementation fails with SMEs are ambiguity in communication, absence of empowerment to the member and lack of strategic will to complete the project. These risks must be mitigated to ensure an effective implementation. A key aspect of successful implementation is use of relevant and appropriate measures. If you wish to improve something, then you must measure it. Identifying key metrics is not a simple task, managers may be tempted to take up low hanging measures. However, it is important to spend time on identifying the right measures, some of which may not be obvious. For example, if water is the resource being worked upon, there could be various metrics:
    a. Water consumption at machine level;
    b. Water consumption at department level;
    c. Water consumption at aggregate plant level.

What you select will be specific to your business. Often, measuring water consumption at machine level may be too expensive and may not be required. On the other hand, if the firm makes ready to drink beverages, then measuring water consumed at each machine might be very important.

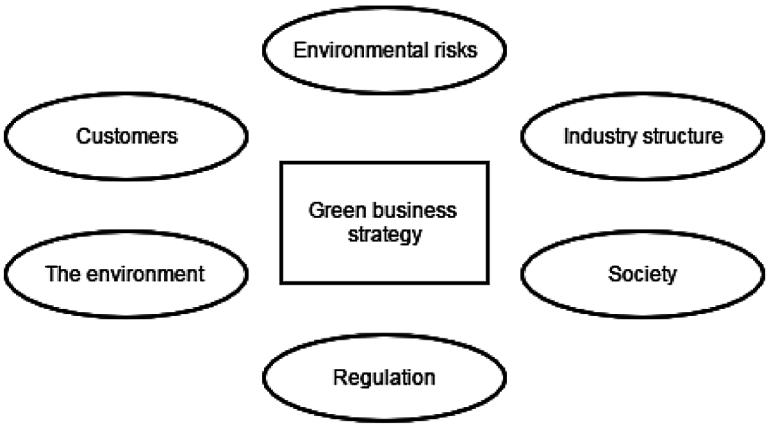
EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

4. FROM GREEN BUSINESS STRATEGIES TO A COMPETITIVE ADVANTAGE

For green strategies to work up a competitive advantage, they must take a holistic approach to integrate all the obligations towards the environment. The planning process must be able to address the following factors (Figure 2):

- **Regulation and Compliances:** Staying within rules is the primary responsibility of a firm. Governments have been increasingly pressing producers to improve their environmental performance. The REACH legislation (EUR, 2009) in the EU makes it mandatory for producers to register every chemical they make, is one such example. The Bharat Stage 4 emission norms force automobile manufacturers to design their products to meet the standards. Extended producer responsibility is on the horizon already. New 'take-back' laws may soon find their way in the Indian markets. They emphasize "producer responsibility" that holds manufacturers responsible for their packaging.
- **The Environment Itself:** The firm's green management process must focus on reducing its impact on the environment – in terms of consumption of natural resources and pollution of air, water and soil. A strategic focus will drive firms to redesign their products and processes for the environmental. As SMEs form a large segment of the Indian industry, it is imperative for them to indulge in sustainable practices.
- **The Customers:** SMEs have been facing pressures from their large buyers to improve environmental performance. In the automobile industry in India, car makers are increasingly pressurizing their vendors to align them to achieve their own green goals. Those SMEs which are proactive in green performance can offer the differentiated advantage. For example, when Toyota Kirloskar Motors in India wanted self-adhesive foam parts for the dashboard of Innova, the pre-qualification was meeting strict VOC norms in manufacturing. This led to automatic disqualification of most of the small firms making such components without considering these high standards. Only a few large ones who had invested in these technologies stood to benefit. Similarly, many cost leaders with excellent quality records, in the electro-plating industry are disqualified from supplying the

Figure 2. Factors which must be addressed by green strategies



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

airline industry, which is known to follow very high waste and pollution standards. Much research has shown that here is a growing class of customers who care for how the product they buy is made and what is let out in the process. Green strategies will help firms choose their customers, decide the products and manufacturing processes and invest in sustainable practices.

- **The Business Risks of Environmental Violations:** These can cripple a small firm. Risks of litigation can result in loss of man-hours in SMEs and penalties can be expensive. The social license allowed by the society to do business, can be taken away by them. A proactive strategic focus to the environment can help mitigate the environmental risks of businesses.
- **Industry Structure:** Large companies with strong research base can influence policy makers to strengthen or modify current industry standards. SMEs may find it challenging to respond in short times and often with large unbudgeted cash outflows which can potentially make them weaker. Competitive playoffs can change in an industry when competitors bring out changes in their product design which can drive down lower production. The EU made it mandatory for cell phone manufacturers to use the micro USB charging pin. This is done to produce and sell fewer chargers. Many SMEs make phone chargers for European markets. Those with low sunk costs will be more competitive.
- **Community Awareness and Social Initiatives:** Are much more visible. NGOs have been successful in creating customer awareness about environment. For example, the WWF "Check Your Paper" campaign is a a global database of eco-rated papers. It helps paper buyers find products with the lowest environmental impact. This campaign includes about 100 paper products with "good" or "excellent" environmental score. Customers can easily pick out green businesses by such awareness drives. Public opinion is increasingly being influenced by social initiatives. International public opinion also matters in issues with a high impact potential (Elkington, 1994 Winter).

5. SETTING YOUR GREEN STRATEGY

To make the transition from a compliant firm to a strategic environment managed one, may seem to be a herculean task for many SMEs. However, it can be simplified by following well defined paths which the firm can take. Orsato (2006) suggested that the generic competitive strategies can be superimposed on environmental framework and by cross tabulating the two generic strategic positions with internal processes or products the result is four generic green strategies (Figure 3). It is for each SME to decide its own course to reach the strategy 3 or strategy 4 quadrants. Some of the key aspects of each strategy are discussed below.

Strategy 1: Eco-Efficiency

This makes an easy starting point for SMEs. The intention is to lower costs while improving environmental performance within the firm's operations. Many of these practices are easy to observe, measure and improve. This strategy emphasizes regulatory compliance and industry compliance, but does not make product changes. This strategy places low demands on managerial capabilities and investments,

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 3. Generic green competitive strategies
Source: Competitive environmental strategies: When does it pay to be green? Renato Orsato, California Management Review; Vol 48, no. 8, Winter 2006.



while yielding cost benefits. This is the least disruptive step for an SME and many SMEs may already be at advanced stages in this step. Benchmarking your operations with industry leaders and continuous seeking of new opportunities to reduce environmental impacts is the hallmark of a good firm.

Strategy 2: Beyond Compliance

After setting the path of continuous process improvement, the firm can now seek out differentiation in their operations. This strategy may need investments in clean technologies or may need to discard age old practices making way for more efficient ones. This strategy needs clear understanding of technologies and their capabilities. In the author's research, some SMEs worked closely with their customers to differentiate their operations. This is an effective way of cooperating for mutual benefits. Your customer benefits from a cleaner supplier and the firm benefits from a differentiated image.

Strategy 3: Eco-Branding

Differentiating with green products is not the easiest strategy for many SMEs and hence this must be preceded by the first two strategies. This stage requires substantial work within the firm's products' life cycle. Green differentiation could be based on the design of the product, manufacturing or consumption of the product. Each requires different capabilities from the firm. Moreover, green products need a customer buy-in. The value brought on the table must be important to them. It is not unusual for customers to forgo green products for a cheaper one and therefore pulling off the eco branding in the market could be a bigger challenge, requiring strong marketing capabilities.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Strategy 4: Environmental Cost Leadership

This could be the last strategy which a small firm may want to explore. Most industry structures do little to support green businesses and hence firms in the green business may need to realign their value chains to suit their sourcing, production and distribution. There are many examples of green products which are cheaper than conventional or lowering costs of consumption. Environment friendly packaging using high recycled content can be cheaper than virgin materials. On the other hand, this strategy can be viewed as getting a higher price realization for environmentally designed and manufactured products.

6. NETWORKS ORGANIZATIONS FOR SMES

Several international organizations offer free and paid advice to SMEs for improving their environmental management systems. A small selection is given here.

- **International Network for Environmental Management (INEM):** Is the world federation of non-profit environmental management associations and cleaner production centers. Their network has over 30 members and affiliated environmental management associations and 10 cleaner production centers in more than 25 countries worldwide. The main goal is to minimize the environmental impacts of industrial operations, and to help business and industry reconcile the imperatives of development and the environment. www.inem.org
- **European Environment Agency (EEA) Sustainable Development Online (SDO):** This gives access to significant sustainable development sites. It provides descriptions of, and links to, many hundreds of sites covering the broad subject of sustainable development, including networks and tools for business. http://sd-online.ewindows.eu.org
- **The Environmental Management Navigator:** This is a capacity building package on environmental management tools. It is devised as a response to SMEs' need for assistance in selecting the most suitable environmental management tools per internal organizational and external market demands. Tools covered range from environmental management systems, cleaner production assessment and environmental cost accounting to environmental performance measuring and reporting. www.em-navigator.net
- **EMAS Tool Kit for SMEs:** This is a simple guide to assist small companies to implement an environmental management system that meets the requirements of EMAS. EMAS requirements are demanded by many EU clients, and Indian SMEs who wish to export will need to comply with EMAS. For such SMEs, this is an invaluable site. www.inem.org/emas-toolkit.
- **Environmental Management Tools for SMEs – A Handbook:** This Handbook discussed how SMEs can use environmental management to improve business performance. It focuses on three questions: What is environmental management? Why should SMEs use it? How is the tool used? http://reports.eea.eu.int/GH-14-98-065-EN-C/en
- **Environmental Good Housekeeping Guide for Small and Medium-Sized Enterprises:** This guide is specifically designed for SMEs to identify simple, practical, common sense good housekeeping measures that can reduce the costs of production, enhance the company's overall productivity and mitigate environmental impact. www.inem.org/htdocs/inem_tools.html#Anchor-Environmental-51548

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

7. FOSTERING GREEN BUSINESS STRATEGIES IN SMEs: RECOMMENDATIONS FOR OTHER STAKEHOLDERS

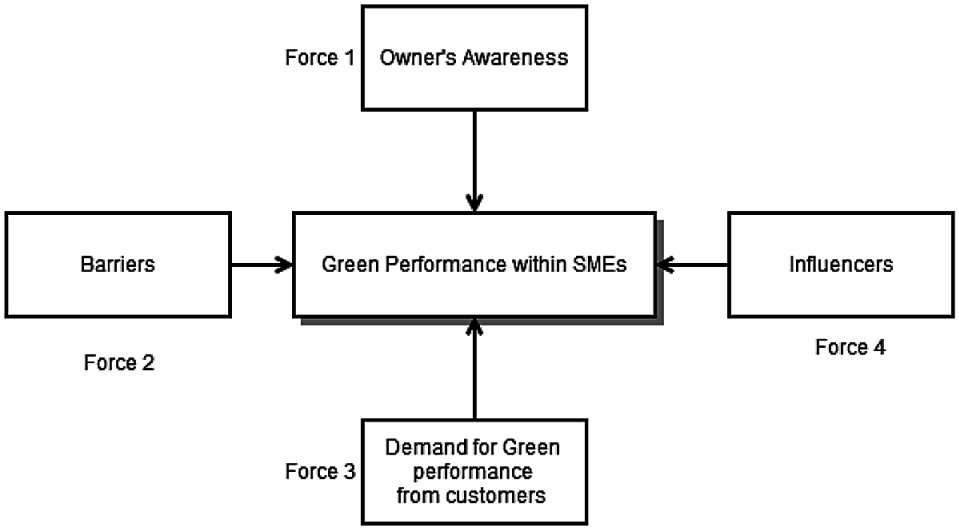
One of the objectives of the SME research undertaken by the author was to suggest a framework for policy makers to encourage the SME sector to go green. The era of enforcement is over. The new age must be fostering towards a greener economy. The policy makers and other stakeholders of the SME sector have a large and important role to play. The author proposes guidelines for policy makers. The recommendations are based on the Four-force Framework which the author had prepared from the research. This frame work is shown in the figure.

The framework shows that an SME's green performance depends on four forces namely – awareness, barriers, influencers and customer demand. Every firm is subjected to these four forces act in varying strengths depending on the sector. Force 1 can result in a proactive behavior, while the other three forces are likely to elicit a reactive behavior. Based on this framework, the recommendations are made to improve awareness, reduce barriers, strengthen influencers, and encourage customer demand. For this, not only the SME owners must participate, but also various other stakeholders too. The recommendations are specifically directed to be beneficial for SME owners and policy-makers.

Force 1: Awareness – The Backbone of the Dilemma

Throughout the analysis, various sections of this questionnaire have more than once revealed a singular aspect, which, the author feels, is the backbone of the problem. The environmental performance of an SME is highly dependent on the owner's environmental awareness. This seems to be the single most critical factor in improving SME green performances. The statistical analysis of responses shows a highly significant dependence among the two variables. And thus, the SME owner's awareness seems to be the

Figure 4. Four forces acting on green performance of firms



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

key to change. This is an importance discovery for policy makers, trade associations, environmentalists and chambers of commerce. Concerted efforts to improve environmental awareness among SMEs are not required. It is possible when all these stakeholders plan towards this goal.

Role of Government

A similar situation was successfully handled by the Indian government some decades ago. This was about creating safety awareness in industries. The Indian industries had a high accident rate compared to other countries and this was attributed to low awareness levels. The National Safety Council of India was set up in 1966 with the vision of creating a safety and preventive culture in organizations. NSC, along with local chambers of commerce, played a vital role in spreading awareness in industries and SMEs. This helped improve the safety standards over the next decade and today, Indian industries have vastly improved safety standards. The government can consider a similar organization which is aimed only at spreading awareness in industry. This council can work with local bodies, trade associations or chambers of commerce, to spread awareness within SMEs. This council will have a 3-point mission (i) Spread awareness of industry-environment linkage (ii) Highlight the current environmental situation, need for healthy environment and what is environmental degradation (iii) Communicate with workers, managers and owners in SMEs, through posters, slogans and case studies (iv) Engage the attention of SMEs with contests, events and activities.

Role of Industries

The local chambers of commerce and trade association can facilitate environmental awareness programs and training on environmental performance improvement. Within an SME cluster, these bodies have sizeable membership of local firms. For example, in Pune, the Mahratta Chamber of Commerce, Industries and Agriculture (MCCIA) is the largest chamber of commerce in Maharashtra. They have influential industrialists and politicians on their advisory boards and panels. This organization has, over the last few decades, helped local industries in several challenges – improving quality, competitiveness, knowledge of taxation, government schemes and subsidies etc. They are well suited to focus their efforts on helping create awareness among local industries as well as holding advanced environmental training programs.

Role of Bankers

Many SMEs build relations with their bankers. For some small firms, the bankers lend financial advice and may even sound an alarm on potential financial threats. Bankers are often accorded a high credibility by SME owners, who acknowledge the critical role of the financer in their firm's progress. This puts bankers in a unique position – one that can be leveraged to improve environmental awareness. The PCBs have not been effective in communicating environmental standards and norms. Banks can help spread awareness about compliance, since they stand to benefit from it. If their customers (loan beneficiaries) can lower their risks of environmental violation, then banks in turn lower their business risks. With this motive, they can diffuse environmental awareness and help in improving SMEs performance.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Force 2: Reducing Barriers

The barriers which came up in the research are unique to SMEs and their constraints. Finance has been the biggest barrier. Even in the other section, SME owners considered this barrier important in diffusing green practices. The following recommendations are proposed to reduce this barrier

Subsidize Green Certifications

During the 1980s, the government subsidized ISO 9000 certifications in within SMEs. Those who received a certification could claim Rs 75000 as a partial refund of expenses. This helped SMEs finance a certification which they did not consider a business priority. The TQM movement enhanced the competitiveness of many SMEs. While this is 'private profit' as opposed to 'public good' (Orsato, 2006) of environmental practices, nevertheless, this provides a compelling argument. The rate of diffusion of environmental practices within SMEs can be accelerated by incentivization. In one section of the questionnaire, 68% respondents strongly and 24% respondents somewhat agreed that such a financial incentive would benefit SMEs.

Preferential Financing of Green Activities

Costs associated with green strategies are significant for SMEs. The finance and other scare resources must be diverted from mainstream business activities to unproductive areas. Here, three stakeholders have a role to play. Government, Bankers (money lending institutions) who can offer lower interest rates for green capital expenditure and investing in clean tech and Insurers who can offer lower insurance premia for conditions of lower environmental risks.

Direct financial assistance programs for environmental equipment purchase can promote purchasing such equipment as well as stimulate a demand for environmental technologies. This has been successfully implemented in France, where Environment and Energy Management Agency (ADEME) provides direct financial assistance to projects going beyond compliance for an investment projects in air pollution reduction, waste management, soil remediation, renewable energy, energy efficiency, and cleaner transportation. Similarly, the German public bank "Kreditanstalt für Wiederaufbau" has a "Special Fund for Energy Efficiency in SMEs[3]" which covers up to 80% of costs for SMEs to receive professional advice on energy efficiency improvements. The Korean Ministry of Environment provides financial support to SMEs in the priority areas of air pollution reduction and increased recycling. SMEs that voluntarily install low-NOX (Nitrogen oxide) boilers can get a 90% subsidy from the Ministry, which also operates a Resource Recycling Promotion Fund to provide grants to eligible small businesses (Mazur, 2012).

Low-interest loans are granted in several countries in the European Union. The loan policy can be used to provide both positive and negative incentives to businesses. The Development Bank of Japan uses environmental screening to evaluate the level of corporate environmental management. India has SIDBI[4], a public financial institution whose objective is *"to be the principal financial institution for the promotion, financing and development of industry in the small-scale sector*". They are thus in a unique position to offer low interest loans for environmental technologies. The Energy Saving Trust[5] a non-profit organization in the UK, provides zero-interest small business loans of up to GBP 100,000 to help businesses install renewable energy technologies or measures that reduce energy consumption. The

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Green Deal[6], a UK government program, provides businesses with loans for energy efficient equipment without down-payment and with payback tied to cost savings obtained over the course of its operation.

Facilitation Centers to promote environmental awareness and green benefits.

Here again awareness shows up. This time as admitted by SME owners themselves. 98% agreed that owner's awareness needs to be improved while 95% agreed that green benefits are not easily understood by them. There is highly significant agreement among respondents on both these points. To add to this, the statistical testing showed a highly significant dependence of owner's awareness and level of green performance of the firms. This further strengthens the recommendations that there must be investment in promoting industrial awareness. CII has played a seminal role in Green building standards in India. Their stewardship is widely accepted across industries which this gives them a favorable position to promote environmental awareness too. State governments can open facilitation centers specific to SME clusters. Since SMEs in a region generally learn from each other, this characteristic can help diffuse practices of one firm within the cluster. These centers can facilitate sharing of best practices across industries. For example, in France, 21 Technical Industrial Centres[7] covering 32 SME dominated industry sectors, act as facilitation centers. They work with support from different business organizations and funded through fees paid by businesses. The National Industrial Symbiosis Programme (NISP)[8] was launched in the UK in 2005, and provides information, networking and matching service for firms. In this research, 93% respondents felt that green practices should be shared within SMEs, and this can be facilitated by the facilitation centers. A similar role was played by the National Productivity Council (NPC) in increasing awareness about productivity. This can be replicated on the environmental performance improvement.

Improve and Enlighten State Pollution Control Boards (PCBs)

The PCBs offices are understaffed and under skilled (Sahu, 2010). Increasing awareness should start with the enforcers. Improving the knowledge and awareness of its employees is the first step. Are they periodically trained for skills improvement? Are they evaluated and mentored? Are they sensitized towards the environment? These efforts would result in more credible officers visiting SMEs. The PCB should assume the role of a facilitator and shed its image of an inefficient and unaware enforcer. At the very least, there is an immediate need of simplifying regulations, making them more understandable in common language; establishing SME specific cells within the regulators to facilitate enforcement and increasing the number of staff.

The CPCB can learn a pick up some successful ideas from the US EPA. For example, the US EPA has substantial experience in measuring outcomes of environmental compliance assistance to demonstrate the effectiveness of preventing non-compliance. Direct compliance assistance is provided by the EPA through on-site visits, workshops, training programs, distribution of guidance documents and assistance provided through sector-specific, web-based Compliance Assistance Centers. Their Small Business Environmental website[9] is sectoral, user friendly and comprehensive. It is handy for small businessmen and is the single point gateway of most SME requirements.

Force 3: Strengthening Influencers

Merely reducing barriers is half the story. This research has established the role of influencers to green practices within SMEs. Each of these influencers can be strengthened with a view of promoting greener SMEs. The recommendations are:

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Personal Awareness, the Biggest Influencer

In this section, too, awareness comes up as the biggest influencers towards green practices. The earlier recommendations can be implemented to improve personal awareness.

Bankers and Insurers as Influencers

This research shows that banks and insurance firms have had the least influence on SMEs. Finance is the single factor agreed upon across various industries and SME size. Therefore, without support of financing institutions, the movement will lack 'teeth'.

SMEs rely on auditors, banks and insurance firms as credible sources of information. SMEs frequently interact with them and this provides an opportunity to have them influence their SME customers. These institutions can disseminate information and exert pressure on SMEs to pursue environmental improvements to achieve greater business success. Banks can ask for an environmental checklist during loan approval and insurers can ask for environmental risk identification and control plans. Banks and insurers can also offer favorable loan or insurance policy conditions to businesses with green credentials. At the international level, the United Nations Environment Program has published policy documents to promote sustainability in the banking and insurance sectors[10]. On the ground, the Royal Bank of Scotland follows the Equator Principles guidelines for assessing environmental and social risks of project finance transactions The Irish EPA has started discussions with the Irish Insurance Federation to try to make sure that insurance companies introduce environmental requirements for their clients, although this process is at an early stage. Similarly, insurance companies in Korea are considering the differentiation of insurance premiums depending on the level of environmental risk. In Netherlands, the ABN Amro bank played a key role in influencing new project financing to have an environmental report. Banks, lending institutions and insurance firms can have a positive influence on undertaking green practices.

The Influence of an Aware and Enlightened Society

Without human resources, it is inconceivable for firms to create products or services. The human resources firms employ are an integral part of the society. The same society which stands to gain from a better environment. From this position, they can influence SMEs to go beyond compliance. This requires environmental education at the school and college level. As children are the future of the nation, they must be aware how a healthy environment is the key to human health and happiness. For this, they must learn how industry can improve or degrade the environment. This researcher browsed the various school text books on environmental education. None of them had any direct mention of how industries have harmed the environment till today. They talk about consumption of natural resources, and about polluting industry. The pollution created by consumption is not dealt with in depth and undermines the impact on the environment. This needs a correction and teachers trained to teach these courses. Only then can we expect responsible citizen who have the power to influence industries into improved behavior.

Encourage Firms to Seek Greener Vendors

Large firms have been influential on SMEs on many occasions. They have demanded quality, productivity, safety and social good. It is imperative that they now influence environmental performance in SMEs. It

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

is possible for government to encourage large firms to do so. Here too, associations like CII and FICCI can play the lead role. They have the power to influence their members and the government, and have a history of commendable efforts which have benefitted Indian industry. This can promote emerging export opportunities for SMEs. ISO 14001certification is now an integral part of the European Union's Eco-Management and Audit Scheme (EMAS, 2013). Such requirements will increasingly be essential for exporting to developed countries and those who are prepared can secure such opportunities. In the European Union, there are several examples of government encouragement to diffuse green practices within the supply chain. In Ireland, a Business-to-Business (B2B) Green Mentor Programme[11] was launched in 2003 by Regional Waste Management Office. This program encourages large companies to provide guidance on waste prevention to their SME vendors. In Scotland, the Zero Waste Program promotes voluntary agreements with retail companies who then pass on the resource efficiency requirements down the supply chain.

Influencing Green Behavior Through Awards and Recognition

There is no dearth of awards for good business practices, quality and productivity achievements. This must be supplemented with recognition of environmental practices. Awards and social recognition promote a competitive atmosphere and one that leads to innovation. Instituting regional, sectoral and national awards can help spread innovative and competitive practices within SMEs. Recognition offers several benefits. Business leaders have an innate desire to be recognized as the best or at least better than the competition. This is possible with awards and therefore this recommendation finds credence.

Influencing Through Good Governance

What Indian industry lacks today is a system of uniform and strict enforcement. Currently, there is a limited liability of environmental violation. Many researchers feel that violators are not made to bear the full costs of environmental degradation liabilities. The perception of PCBs with SME owners has to be corrected. If they do not improve their own knowledge and awareness, their credibility is at stake. If they do not do their job of enforcement effectively then SMEs will believe that their competitors may not strictly follow norms. This can prompt them to follow suit, since not doing so will increase their costs. On the other hand, a just enforcement system can encourage SMEs to undertake green practices without the fear of a competitor getting away and reducing expenses.

Certification as an Influencer

There are numerous instances of unscrupulous firms taking advantage of green consumers. In absence of clear definitions, green labels and eco-branded products can be manipulated to the advantage of the seller. '*Greenwashing'* is the term given to such incidents. One way to avoid this is that policymakers can introduce green certifications which are specific to an industry. Electroplating industry certifications will be different from security services industry. To start with, the industries on the Red List[12] are suggested for introducing such certifications. The certifications will have levels to help buyers to make a choice.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Influencing Greener Firms Through Public Sector Demand

As a start, the governments itself can enforce green purchasing polices for its own companies. Introduction of green requirements as a condition for tendering for government contracts is feasible. The contractors can commit to maintaining specified environmental standards up and down the supply chain. Such green procurement can also increase market acceptance of green products by demonstrating their commercial feasibility. The Scottish Government's *"Public Procurement and Sustainable Development: Guidelines for Public Purchasers*[13]*"* dictates that those who fail to comply with environmental legislation may be excluded from selling to the Scottish Government. This guideline explicitly mentions that firms producing environmentally preferable goods and services and use of recycled/renewable materials are likely to offer a competitive advantage. The European Commission had proposed that 50% of all public tenders be "green", i.e. compliant with common core Green Public Procurement criteria.

8. CONCLUSION

The diversity and complexity of SMEs' activities within and across different sectors affect the nature and intensity of environmental problems. Moreover, the number of SMEs and their varied organizational capabilities pose a colossal challenge, one which cannot be addressed by voluntary strategy alone. A more effective approach would be one that is pulled by a firm's customers will be more effective for SMEs, than one which is based on external supervision and compliance. Given the size of the SME sector in any country, it is very challenging for external supervision and regulation to be an effective approach.

Although this author concludes that a competitive advantage can be gained by green performance, this alone is not enough encouragement for SMEs to improve green performance. Various barriers have been identified which act upon SMEs. The low awareness and indifferent attitudes of SME owner's also need to be dealt with. There are numerous reasons why SMEs do not or cannot improve their green performance. While each one can be justified from the SME's perspective, the loss from a degraded environment will be shared by all, including the SMEs. This will require more than good intentions to rectify.

REFERENCES

Bianchi, R., & Noci, G. (1996). *Le esperienze di alcune imprese operanti in Italia: gli studi di caso*. Politechnico di Milano.

Diamond, J. (2000). *Collapse.*

Esty, D. C., & Winston, A. S. (2009). *Green to Gold*. John Wiley & Sons.

Hobbs, J. (2000). Promoting Cleaner Production in SMEs. In R. Hilary (Ed.), *SMEs and the Environment* (pp. 149–157). Sheffield: Greenleaf Publishing.

Orsato, R. J. (2006). Competitive Environmental Strategies. *California Management Review*, *48*(2), 127–143. doi:10.2307/41166341

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Porter, M. E., & van der Linde, C. (1995). Toward a New Conception of the Environment-Competitiveness Relationship. *The Journal of Economic Perspectives*, *9*(4), 97–118. doi:10.1257/jep.9.4.97

Powell, T. C. (2001). Competitive Advantage: Logical and Philosophical considerations. *Strategic Management Journal*, *22*(9), 875–888. doi:10.1002mj.173

Rowe, J., & Hollingsworth, D. (1996). Improving environmental performance of SMEs: a study in Avon. In *Eco-management and Auditing* (pp. 97-107).

Studer, S., Welford, R., & Hills, P. (2008). SMEs and voluntary environmental initiatives: A study of stakeholders perspectives. *Journal of Environmental Planning and Management*, *51*(2), 285–301. doi:10.1080/09640560701865073

Worthington, I., & Patton, D. (2005). Strategic Intent in the management of Green Environment within SMES. *Long Range Planning*, *38*(2), 197–212. doi:10.1016/j.lrp.2005.01.001

ENDNOTES

1 http://www.iisd.org/business/tools/principles_ceres.aspx

2 http://www.iccwbo.org/Advocacy-Codes-and-Rules/Areas-of-work/Environment-and-Energy/Business-Charter-for-Sustainable-Development/

3 http://www.odyssee-indicators.org/publications/workshops/warsaw/Session-2-Industry/SME-program_Germany.pdf

4 http://www.sidbi.in/

5 http://www.energysavingtrust.org.uk/Organisations

6 http://www.greendealuk.co.uk/

7 www.reseau-cti.com

8 http://www.nispnetwork.com/

9 http://www.smallbiz-enviroweb.org/default.aspx

10 http://www.unepfi.org/fileadmin/documents/guide_banking_statements.pdf

11 http://www.envirocentre.ie/includes/documents/Limerick_Clare_Kerry_Regional_Waste_Management_Office.pdf

12 http://gpcb.gov.in/pdf/rog.pdf

13 www.sustainablescotland.com

This research was previously published in Green Initiatives for Business Sustainability and Value Creation edited by Arun Kumar Paul, Dipak Kumar Bhattacharyya, and Sandip Anand, pages 1-20, copyright year 2018 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 49
Institutional Perspective on the Drivers of Green Innovations in Firms

Wiboon Kittilaksanawong
Saitama University, Japan

ABSTRACT

In recent years, firms have increasingly engaged in green innovations in response to mounting pressures on environmental protection. Regulative and normative institutions are the main drivers of this response, while its strength is contingent upon a firm's deficiency gap and resource profile. The entry into this emergent industry of diversifying incumbents is usually determined by regulative and economic opportunity while the entry of entrepreneurial start-ups is more influenced by the sociocultural environment. Under the industry deregulation, most incumbents tend to become more focused on their core competencies developed during the regulated period unless they have prior experience in green innovations. Corporate governance plays an important role in implementing green innovations because these environmental initiatives go beyond compliance and require substantial long-term resource commitment that has significant strategic implications.

INTRODUCTION

In recent years, firms have increasingly experienced pressures from their stakeholders on environmental protection. Governments have introduced more regulative policies, adding costs to corporations that release environmentally unfriendly substances. Consumers have increasingly considered a company's environmental philosophy when deciding to purchase its products. Investors have largely discounted stock prices of environmentally irresponsible firms. In response to these mounting pressures, many companies have increasingly emphasized the implementation of environmental innovation projects such as green innovations. These projects are considered risky because they usually require large financial commitments that mostly accrue returns only in the long term (Ahuja, Lampert, & Tandon, 2008).

DOI: 10.4018/978-1-5225-7915-1.ch049

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Green innovations are associated with new designs, and novel products and processes (Berrone, Fosfuri, Gelabert, & Gomez-Mejia, 2013). These innovations are therefore a potential source of a firm's competitive advantage. The value of green innovations to the society at large is widely acknowledged, however it is less clear as to what drives firms to pursue these innovations. Building on the institutional- and resource-based perspective, and the corporate governance literature (Peng, Wang, & Jiang, 2008), we highlight conditions under which firms are likely to pursue green innovations and reasons why some firms engage in more or less green innovations than other firms.

From the institutional perspective, we discuss to what extent the regulatory pressures (e.g., from governments) and normative pressures (e.g., from non-governmental organizations, professional organizations, and societies) influence firms to engage in green innovations (Berrone et al., 2013; Chen, Kittilaksanawong, & Weng, 2015). Given that green innovations are an emergent market, its potential entrants comprises of both entrepreneurial start-ups and diversifying incumbents. We then discuss how these institutions in terms of economic, political, and socio-cultural environment differently influence these two types of firm to enter in this emergent market (York & Lenox, 2014).

As governments have increasingly introduced deregulation in many industries, firms are pushed to adapt to an unprecedented increase in the competitive, new operating environment to achieve cost leadership or differentiation to outperform their rivals (Porter, 1980). We further discuss how incumbent firms formerly in the less competitive, regulated institutional regime should strategically react to this changing competitive landscape by engaging green innovations in their products (Flammer, 2015; Kim, 2013). Particularly, it is important to explore whether and how these incumbents should use green innovations as a differentiation strategy to compete against new rivals that increasingly enter the industry as a result of the deregulation.

Institutional pressures from environmental concerns are also directed toward the governance of corporations. Corporate governance plays an important role in responding to these pressures because green innovations go beyond compliance and these innovations require substantial long-term resource commitment that has significant strategic implications on firms (Hart & Ahuja, 1996). In particular, corporate governance plays an important influential role in determining whether a firm should include such environmental responsibility as a part of its corporate missions or it should focus instead largely on maximizing shareholder returns (Margolis & Walsh, 2003). We therefore discuss how corporate governance structures can effectively influence green innovations of organizations (Walls, Berrone, & Phan, 2012).

In sum, the following sections discuss in order these four critical questions related to green innovations from the institutional perspective. In particular, first, whether and to what extent would firms pursue green innovations? Second, to what extent entrepreneurial start-ups and diversifying incumbents would differently pursue green innovations in their competitive strategy? Third, how does the industry deregulation affect competitive strategy of firms via green innovations? Fourth, how does corporate governance play role in decisions to pursue green innovations of firms?

INSTITUTIONAL PRESSURE AND GREEN INNOVATION

Institutional perspective emphasizes the social influence on conformity of organizational actions (Scott, 1995). To survive and prosper, organizations try to maintain or enhance legitimacy toward their stakeholders (Deephouse, 1999; Scott, 1995). Such institutional pressures are resulted from economic, regulatory,

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

and sociocultural factors (Shane, 2004). These pressures are broadly derived from regulative, normative, and cognitive institution (Scott, 1995). However, regulative and normative institutions deserve special attention as far as institutional pressures for conformity on organizations are concerned. Both regulatory agents (e.g., governmental agencies) and normative agents (e.g., professional and non-governmental organizations) are potential actors that importantly shape strategic choices of firms in industries that are environmentally sensitive (Kassinis & Vafeas, 2006).

When the environmentally offensive behaviors are involved with high social costs, firms that comply with governmental regulations could be sheltered from political risks and legal coercions (Deephouse, 1999). Such regulatory compliance is usually in the form of requirements for firms to rectify or improve pollution emissions to the environment. This regulatory pressure may drive firms to go beyond compliance to pursue green innovations. In particular, green innovations are a proactive initiative that requires long-term commitments, and thus potentially has large social benefits. Green innovations thus not only strengthen legitimacy of firms but also safeguard them from penalties for poor compliance with governmental environmental regulations. While green innovations are costly and with uncertain financial returns, firms are likely to have greater incentives to pursue these innovations when they are faced with a higher probability to be detected for illegal behaviors that are subject to severe sanctions (Berrone et al., 2013).

To achieve normative legitimacy, firms try to behave in accordance with prevalent practices among members in their professional organizations (Scott, 1995). The presence and activities of non-governmental organizations (NGOs) also push firms to go beyond meeting minimum regulatory requirements through their mobilization of resources and coordination of activist groups for such purpose. NGOs are likely to applaud green innovations because they signal a firm's long-term commitments to meet or exceed environmental performance standards (Berrone et al., 2013). NGOs can trigger internal tensions within the firm, thereby creating institutional environments for firms to pursue innovations and changes (King, 2008). When normative pressures for environmental responsibility increase, firms are therefore more likely to involve green innovations in their strategic decisions (Berrone et al., 2013).

DEFICIENCY GAP AND RESOURCE PROFILE

Because of concerns over legitimacy, firms are usually pressured to behave in similar ways that are socially acceptable (Scott, 1995). However, strong institutional pressures may not always force firms to become more alike. These deviant behaviors occur because firms are heterogeneous in terms of their deficiency gap with respect to environmental legitimacy and their available resources for achieving conformity. Although firms are subject to the same set of regulative and normative institutional pressures, they may differently exhibit responses to these pressures due to these heterogeneities. Such deficiency gap and available resources can differentiate behaviors of firms with respect to whether or not and the extent to which they will engage in risky green innovations.

Firms with a larger deficiency gap in terms of complying with prevalent environmental emission requirements are likely to be more active in engaging in green innovations (Berrone et al., 2013). In particular, firms that are perceived to cause more environmental damage than their industry peers are usually more visible to external regulative and normative institutional actors (e.g., the government and NGOs). Particularly, managers in these firms whose reputations have suffered from pollution emissions are likely to be more sensitive to environmental pressures. These firms tend to face higher risks of business

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

interruptions and legal costs because of their poor relationships with regulators and social actors. Such deficiency gap is therefore a critical driver for firms to pursue green innovations in the hope that these innovations will improve their relationships and thus legitimacy toward these external institutional actors.

Resources provide firms with the flexibility in choosing appropriate strategic choices in response to external requirements (Sharfman et al, 1988). A firm's strategic choices are thus constrained by its resource profile (Bourgeois, 1981). However, only organizational slack (i.e., uncommitted resources) allows an organization to adapt successfully to internal and external pressures, and to initiate strategic changes in response to the external environment (Bourgeois, 1981). This resource slack allows firms more latitude to experiment risky strategic initiatives. Firms with higher levels of resource slack, when faced with environmental pressures, are therefore more likely to engage in green innovation projects, which are a long-term initiative, going beyond minimum requirements but without clear economic benefits to them (Berrone et al., 2013). Firms without sufficient resource slack are however likely to be able to respond to these pressures only at the minimum required level in order to survive.

The likelihood for firms to engage in green innovations also depends on specificity of their resources. Resources with high levels of specificity are durable, specialized assets that are difficult to be redeployed from existing uses (Dierickx & Cool, 1989). Organizations that are heavily invested with this type of resources bear a greater risk from business failures. In particular, organizations with a larger share of firm-specific assets are exposed to a higher loss in their value in case of default and asset liquidation. These firms are therefore more vulnerable to risks of poor compliance with regulations and norms. Accordingly, firms holding a larger proportion of assets with higher specificity are more responsive to institutional environmental pressures and are more likely to invest in green innovations than those largely holding non-specific general assets (Berrone et al., 2013).

ENTREPRENEURIAL START-UP VS. DIVERSIFYING INCUMBENT

The regulatory actors such as the governments may issue regulatory policies that mandate or forbid firms to use specific environmental products, whereas the normative actors such as professional organizations and NGOs may also expect firms to behave in environmentally acceptable ways. Green innovations are an emergent market that has become increasingly legitimized. Therefore, there is an increasing number of both entrepreneurial start-ups and diversifying incumbents entering this emergent market (Scott, 1995). However, such regulative and normative institutions have different impacts on the likelihood that these two types of firms will enter this emergent market (York & Lenox, 2014).

In particular, regulatory actors such as the government can influence the entry of firms in emergent industries through economic incentive policies. Such policies can have a strong effect on the development of emergent industries. For diversifying incumbents, with incentive policies, diversifying into green innovations not only provides an economic opportunity for them, but also allows them to signal to stakeholders about their environmental commitments (York & Lenox, 2014). This signal can thus in turn reduce the likelihood for the government to impose stringent environmental regulations and other normative stakeholders to initiate activisms against them.

The identity of entrepreneurial start-ups pursuing green innovations is more closely tied to larger sociocultural norms (York & Lenox, 2014). Normative actors such as NGOs are more likely to applaud firms that voluntarily engage in environmentally responsible projects through non-economic incentives (Berrone et al., 2013). Because of the newness, entrepreneurial start-ups lack legitimacy toward their

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

stakeholders. They are more likely to invest in green innovations as a means to gain more normative legitimacy from their stakeholders (Hannan & Freeman, 1984). While economic incentives are a driver for both entrepreneurial start-ups and diversifying incumbents to enter in this emergent industry, social normative expectations are more likely to have a direct and strong influence on the entry of entrepreneurial start-ups in the green innovation markets (York & Lenox, 2014).

In particular, normative actors influence entrepreneurial start-ups to pursue green innovations through the entrepreneur's perception that normative legitimacy received from entry into this new field will assure the success of founding their venture even without clear evidence of economic opportunity or regulatory supports. For diversifying incumbents, however, their key decision makers are likely to be embedded within an economic logic rather than a sociocultural environment (Gladwin, Kennelly, & Krause, 1995). Social norms represent a normative, rather than economic or regulative incentives. Therefore, diversifying incumbents are less likely to be influenced by social norms to pursue green innovations.

Diversifying incumbents rely on their existing resources and capabilities to establish legitimacy to access to valuable resources (Hannan & Freeman, 1984). They possess legacy identities that are often related to economic profitability. When these incumbents involve in green innovations, their external and internal stakeholders including existing customers, investors, and employees may question legitimacy of making such decision. Diversifying incumbents are likely to struggle to position their multiple and even conflicting identities when diversifying into an industry that does not promise profitability in the short and long term. Unless targeted for activisms, these incumbents are likely to focus on satisfying their existing stakeholders or they may diversify into emergent green innovations only when there are sufficient economic promises (Hannan & Freeman, 1984).

Normative legitimacy in terms of social movements may also have a strong influence on entrepreneurial start-ups (York & Lenox, 2014). These collective actions are however less influential to diversifying incumbents because these incumbents are embedded in existing customers' needs. This embeddedness creates inertia in incumbent organizations to respond to social movements by engaging in green innovations. Such competency trap causes diversifying incumbents to disregard feedbacks from social movements (Levitt & March, 1988). Entrepreneurial start-ups however often more voluntarily respond to these movements as a means to promote their legitimacy. This legitimacy can in turn persuade stakeholders that their products are superior because they are delivering social benefits through green innovations (Carroll & Swaminathan, 2000).

INDUSTRY DEREGULATION

When the government introduces deregulation in an industry, firms operating in that industry are likely to experience an unprecedented increase in the competitive pressures. Industry deregulation opens up previously untapped opportunities in the regulated era by removing regulatory constraints, which increases competition among firms (Winston, 1998). In regulated industries, industry-specific regulatory bodies monitor behaviors of firms. These regulators can influence profitability of firms by constraining or enabling their certain actions. In the regulated regime, managing the relationships with such regulators is thus critical for a firm's strategic choices and performance. As the industry is increasingly deregulated, however, such relationships may not be as important as before. Firms are mostly required to deal more directly with competitors and customers rather than with regulators.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Industry deregulation increases pressure for price competition while decreasing incentives of firms to differentiate their products through investing in risky green innovations (Kim, 2013). Firm resources and capabilities are path-dependent (Dierickx & Cool, 1989; Levitt & March, 1988). Incumbents may therefore not perceive greater opportunities under such deregulation because their strategic choices are likely to be constrained by existing resources and capabilities, and past learning. Further, green innovations are usually more costly than other conventional environmental technologies. Incumbents may thus choose to focus on their existing competencies developed during the prior regulated period, which inherit economies of scale to achieve efficiency and cost leadership. In particular, incumbents capable of using brown technologies are less likely to enter into an unfamiliar emergent market for green innovations (Kim, 2013). However, by pursuing such cost-driven strategy, incumbents may also be vulnerable to leaner entrants who try to build up stakeholder relationships via differentiated green innovations.

In addition to the path dependency, strategic choices of incumbents between cost leadership and differentiation are also constrained by managerial discretion. Managerial discretion refers to the latitude of managerial actions (Hambrick & Finkelstein, 1987), which can be a driver for investment in green innovations (Andersson & Bateman, 2000; Sharma, 2000). Such discretion is influenced by managers' perceptions of their firm's external environment and internal resources. If managers interpret environmental issues as an opportunity while the company also has sufficient discretionary resources, they are likely to invest in green innovations as a source of their company's competitive advantage (Andersson & Bateman, 2000; Sharma, 2000). Such resource slack allows firms to more effectively deal with risks and uncertainties associated with investments in green innovations (Sharma, 2000).

The deregulation may also attract new entrants who are experienced in green innovations into the industry. If incumbents diversify into green innovations on their own, they are likely to compete directly with these experienced new rivals. Incumbents may thus choose to outsource green innovations to these rivals and resell innovative green products to their final customers. Instead of treating these new entrants as rivals, incumbents may therefore collaborate with them as the supply sources of green innovations. Investments in green innovations to successfully achieve firm-specific productivity gains are essentially path-dependent. Because of time compression diseconomies as the result of deregulation, incumbents may want to avoid direct competition with such experienced new entrants and instead choose to establish the supply chain by collaborating with them (Dierickx & Cool, 1989; Kim, 2013).

The deregulation not only increases competition among domestic companies, it also opens up the opportunity for foreign entrants to compete in the local market. Firms can sustain their competitive advantage by leveraging resources and capabilities in which they have a comparative advantage (Wernerfelt, 1984). In particular, faced with deregulation and increased competition from foreign entrants, domestic companies can exploit their comparative advantage over these foreign rivals through their closer relationship with local stakeholders. Local social responsibility and sustainability can become a critical element for competitiveness of domestic companies vis-à-vis foreign entrants (Flammer, 2015). Therefore, domestic companies can strengthen their relationship with local stakeholders through differentiation strategy by investing in green innovations. This environmental initiative can be an entry barrier against foreign competitors.

However, such stakeholder strategy would be more effective for companies operating in the business-to-consumer sector, where the purchasing decision is more sensitive to socially responsible behaviors of the company (Flammer, 2015). Firms should prioritize their stakeholders and direct their investments in green innovation projects toward core stakeholders rather than peripheral stakeholders. Because product

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

market competition fosters efficiency, companies are not likely to respond to higher competition by investing in any environmental projects that is value destroying (Stigler, 1958). Therefore, investments in green innovations in response to fiercer competition from foreign entrants should not reduce the firm's overall values.

CORPORATE GOVERNANCE

Institutional pressures from environmental concerns are also imposed on the governance of corporations. Corporate governance plays an important role in driving green innovations in firms because such environmental initiatives go beyond compliance to the regulative institution and require substantial long-term resource commitment that has significant strategic implications (Hart & Ahuja, 1996). Addressing such environmental initiatives requires that a firm extend coordination across organizational boundaries to include its supply chain actors and stakeholder groups (Marcus & Geffen, 1998). Corporate governance involves the mechanisms, processes, and relations by which corporations are controlled and directed. Therefore, corporate governance constituents including ownership, board of directors, and management can influence a firm's decision to invest in green innovations (Walls, Berrone, & Phan, 2012).

In terms of the ownership, firms that are more exposed to investors with long-term horizons are likely to be more involved in green innovations (Walls et al., 2012). The levels and frequency of shareholder activisms also affect such socially responsible behavior (Walls et al., 2012). Shareholder activisms are likely to occur when a firm's environmental performance is poor because firms with poor environmental performance are exposed to more risks including violations, fines, and remediation costs. Firms with concentrated ownership may have less managerial discretion and thus be less active in pursuing green innovations, which go beyond environmental compliance (Walls et al., 2012).

With respect to the board of directors, outside directors may strengthen people and product aspects of green innovations (Johnson & Greening, 1999) while reducing risks of firms from environmental litigations (Kassinis & Vafeas, 2006). When the board is more independent, larger, and less diverse, its ability to monitor environmental performance is worsened (Walls et al., 2012). Independency of the board is favorable for financial performance, but not for environmental performance (Walls et al., 2012). While a reduction of insider directors is an effort to increase governance independence, and thus to improve financial performance, it concurrently weakens expertise, experience, and reputation of insiders, which are a critical element to superior environmental outcomes.

Regarding the management, the duality of chief executive officer (CEO) may discourage firms from investing in green innovations (Webb, 2004). The proportion of shares held by top management team may be positively related to such corporate philanthropy (Coffey & Wang, 1998). The establishment of environmental committees not only strengthens environmental capability of firms by providing expertise and resources but also helps firms mitigate environmental problems (Walls et al., 2012). Firms with higher CEO salaries perhaps emphasize shorter-term financial goals at the expense of long-term environmental goals (Walls et al., 2012). When the fixed component of compensation is large, executives tend to be conservative and thus avoid risky investments in green innovations.

The combination of investors with long-term orientation and an independent board of directors therefore has both pros and cons for environmental performance. Powerful CEO duality works well with the board that consists of insiders. Therefore, the combination of CEO duality and insider directors may

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

be positive for environmental capability. However, when CEO duality is absent and the board has more outsiders, environmental performance may suffer. Since green innovations can be highly technical and industry-specific, insiders in the boards may possess relevant expertise to support the CEO in formulating and implementing environmental strategy.

DISCUSSION AND CONCLUSION

Regulative and normative institutions are two major drivers of the extent to which firms will respond to environmental issues. The strength of such response is contingent upon a firm's past environmental performance relative to its industry peers (i.e., deficiency gap), and the availability and specificity of its internal firm resources (i.e., resource profile) (Berrone et al., 2013). Instead of compelling conformity, institutions can therefore be a source of firms' strategic heterogeneity. This heterogeneity explains why some firms are more or less likely to pursue green innovations than other firms. In particular, institutional pressures can influence allocations of firms' internal resources toward investing in risky green innovations, which can be a source of their competitive advantage. With sufficient institutional pressures, and expected legitimacy gains, managers should consider pursuing such differentiation strategy in their firm's products.

Government regulators should be aware that their enforcing mechanisms and legitimacy sanctions may not be as effective as pressures generated by other normative institutions (Berrone et al., 2013). Firms may use resource slack to resist regulatory obligations while acquiescing social demands. In particular, firms with sufficient resource slack may choose to pay legal and economic sanctions rather than to voluntarily invest in risky green innovations. Such resource slack may be used as a buffer for the regulatory pressure rather than for investing in green innovations. Normative pressures however require that firms provide fundamental responses to knowledgeable people or organizations that exert these pressures.

Diversifying incumbents are more likely to be pushed by regulative and economic opportunity to enter in emergent industries such as green innovations while the entry of entrepreneurial start-ups tends to be more influenced by the sociocultural environment (York & Lenox, 2014). Entrepreneurs entering an emergent market that is culturally aligned with its venture may avoid direct competition with diversifying incumbents. However, if such entry is driven by regulatory and economic opportunity, they are more likely to compete with the diversifying incumbents. Therefore, entrepreneurs should try to understand social norms in a region and enter areas earlier before these norms are endorsed and become policies. Diversifying incumbents should always be aware of the sociocultural environment in a region to predict new entrants and to maintain their competitive edge. Government regulators should be aware that state-level policies might not be as effective as regional cultures and norms in promoting entrepreneurship in the region.

Under the industry deregulation and resulting higher price competition, incumbents are likely to focus more on their core competencies developed during the regulated period (Kim, 2013). In particular, incumbents that are more capable in brown technologies are likely to continue exploiting these technologies to strengthen economies of scale and efficiency rather than pursuing differentiation strategy by diversifying into unfamiliar green innovations. Due to strong inertial pressures, only those with prior experience in green innovations may increase their investments in green innovations to strengthen their products' competitiveness under the deregulated regime. By focusing on green innovations, mangers of these domestic companies can leverage comparative advantage in their relationships with local stakeholders to

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

compete more effectively with increasing foreign entrants (Flammer, 2015). However, managers should be aware that such differentiation strategy requires that there is a sufficient number of consumers, who demonstrate sufficiently high levels of environmental sensitivity and actually value the green attributes in their company's products (Kim, 2013).

Finally, executives should be aware that corporate governance system has a significant influence on environmental strategy and firm performance (Walls et al., 2012). Investors with long-term orientation may push firms to invest in green innovations. However, such a long-term horizon per se may not be sufficient to stimulate environmentally responsible behaviors. To realize the benefits of good environmental performance, firms also need an effective board monitoring, management, and control mechanism. Particularly, the board of directors has to prioritize the allocation of resources to particular core and peripheral stakeholders. Appropriate resource allocations with respect to investment in green innovations can safeguard firms from environmental violations and penalties.

ACKNOWLEDGMENT

This work was supported by JSPS KAKENHI Grant Number 15K03694.

REFERENCES

Ahuja, G., Lampert, C. M., & Tandon, V. (2008). Moving beyond Schumpeter: Management research on the determinants of technological innovation. *The Academy of Management Annals*, *2*(1), 1–98. doi:10.1080/19416520802211446

Andersson, L. M., & Bateman, T. S. (2000). Individual environmental initiative: Championing natural environmental issues in U.S. business organizations. *Academy of Management Journal*, *43*(4), 548–570. doi:10.2307/1556355

Berrone, P., Fosfuri, A., Gelabert, L., & Gomez-Mejia, L. R. (2013). Necessity as the mother of 'green' inventions: Institutional pressures and environmental innovations. *Strategic Management Journal*, *34*(8), 891–909. doi:10.1002mj.2041

Bourgeois, J. III. (1981). On the measurement of organizational slack. *Academy of Management Review*, *6*(1), 29–39.

Carroll, G., & Swaminathan, A. (2000). Why the microbrewery movement? Organizational dynamics of resource partitioning in the U.S. brewing industry. *American Journal of Sociology*, *106*(3), 715–762. doi:10.1086/318962

Chen, X. D., Kittilaksanawong, W., & Weng, P. P. (2015). Institutional Perspective on Corporate Social and Financial Performance: China versus the West. In R. Manos & I. Drori (Eds.), *Global Perspectives of Corporate Social Action and Social and Financial Performance* (pp. 73–92). New York: Palgrave Macmillan.

Coffey, B. S., & Wang, J. (1998). Board diversity and managerial control as predictors of corporate social performance. *Journal of Business Ethics*, *17*(14), 1595–1603. doi:10.1023/A:1005748230228

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Deephouse, D. L. (1999). To be different, or to be the same? It's a question (and theory) of strategic balance. *Strategic Management Journal*, *20*(2), 147–166. doi:10.1002/(SICI)1097-0266(199902)20:2<147::AID-SMJ11>3.0.CO;2-Q

Dierickx, I., & Cool, K. (1989). Asset stock accumulation and sustainability of competitive advantage. *Management Science*, *35*(12), 1504–1511. doi:10.1287/mnsc.35.12.1504

Flammer, C. (2015). Does product market competition foster corporate social responsibility? Evidence from trade liberalization. *Strategic Management Journal*, *36*(10), 1469–1485. doi:10.1002mj.2307

Gladwin, T. N., Kennelly, J. J., & Krause, T. S. (1995). Shifting paradigms for sustainable development: Implications for management theory and research. *Academy of Management Review*, *20*(4), 874–907.

Hambrick, D. C., & Finkelstein, S. (1987). Managerial discretion: A bridge between polar views of organizational outcomes. In L. L. Cummings & B. M. Staw (Eds.), *Research in Organizational Behavior* (pp. 369–406). Greenwich, CT: JAI Press.

Hannan, M. T., & Freeman, J. (1984). Structural inertia and organizational change. *American Sociological Review*, *49*(2), 149–164. doi:10.2307/2095567

Hart, S. L., & Ahuja, G. (1996). Does it pay to be green? An empirical examination of the relationship between pollution prevention and firm performance. *Business Strategy and the Environment*, *5*(1), 30–37. doi:10.1002/(SICI)1099-0836(199603)5:1<30::AID-BSE38>3.0.CO;2-Q

Johnson, R. A., & Greening, D. W. (1999). The effects of corporate governance and institutional ownership types on corporate social performance. *Academy of Management Journal*, *42*(5), 564–576. doi:10.2307/256977

Kassinis, G., & Vafeas, N. (2006). Stakeholder pressures and environmental performance. *Academy of Management Journal*, *49*(1), 145–159. doi:10.5465/AMJ.2006.20785799

Kim, E. H. (2013). Deregulation and differentiation: Incumbent investment in green technologies. *Strategic Management Journal*, *34*(10), 1162–1185. doi:10.1002mj.2067

King, B. G. (2008). A political mediation model of corporate response to social movement activism. *Administrative Science Quarterly*, *53*(3), 395–421. doi:10.2189/asqu.53.3.395

Levitt, B., & March, J. G. (1988). Organizational learning. *Annual Review of Sociology*, *14*(1), 319–338. doi:10.1146/annurev.so.14.080188.001535

Marcus, A., & Geffen, D. (1998). The dialectics of competency acquisition: Pollution prevention in electric generation. *Strategic Management Journal*, *19*(12), 1145–1168. doi:10.1002/(SICI)1097-0266(1998120)19:12<1145::AID-SMJ6>3.0.CO;2-B

Margolis, J. D., & Walsh, J. P. (2003). Misery loves companies: Rethinking social initiatives by business. *Administrative Science Quarterly*, *48*(2), 268–305. doi:10.2307/3556659

Peng, M. W., Wang, D. Y. L., & Jiang, Y. (2008). An institution-based view of international business strategy: A focus on emerging economies. *Journal of International Business Studies*, *39*(5), 920–936. doi:10.1057/palgrave.jibs.8400377

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Porter, M. E. (1980). *Competitive Strategy*. New York: Free Press.

Scott, W. R. (1995). *Institutions and Organizations*. Thousand Oak, CA: Sage.

Shane, S. (2004). *A General Theory of Entrepreneurship: The Individual-Opportunity Nexus*. Northampton, UK: Edward Elgar Publishing Incorporated.

Sharfman, M. P., Wolf, G., Chase, R. B., & Tansik, D. A. (1988). Antecedents of organizational slack. *Academy of Management Review*, *13*(4), 601–614.

Sharma, S. (2000). Managerial interpretations and organizational context as predictors of corporate choice of environmental strategy. *Academy of Management Journal*, *43*(4), 681–697. doi:10.2307/1556361

Stigler, G. J. (1958). The economics of scale. *The Journal of Law & Economics*, *1*(1), 54–71. doi:10.1086/466541

Walls, J. L., Berrone, P., & Phan, P. H. (2012). Corporate governance and environmental performance: Is there really a link? *Strategic Management Journal*, *33*(8), 885–913. doi:10.1002mj.1952

Walsh, J. P. (2005). Taking stock of shareholder management. *Academy of Management Review*, *30*(2), 426–438. doi:10.5465/AMR.2005.16387898

Webb, E. (2004). An examination of socially responsible board structure. *Journal of Management and Governance*, *8*(3), 255–277. doi:10.100710997-004-1107-0

Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal*, *5*(2), 171–180. doi:10.1002mj.4250050207

Winston, C. (1998). U.S. industry adjustment to economic deregulation. *The Journal of Economic Perspectives*, *12*(3), 89–110. doi:10.1257/jep.12.3.89

York, J. G., & Lenox, M. J. (2014). Exploring the sociocultural determinants of de novo versus de alio entry in emerging industries. *Strategic Management Journal*, *35*(13), 1930–1951. doi:10.1002mj.2187

This research was previously published in the Handbook of Research on Green Economic Development Initiatives and Strategies edited by M. Mustafa Erdoğdu, Thankom Arun, and Imran Habib Ahmad, pages 440-450, copyright year 2016 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 50
The Leading Practices of Green Mobile Telecommunication Base Station Design

Yazan Migdadi
Yarmouk University, Jordan

ABSTRACT

The aim of this study is to identify the green mobile telecommunication base station design practices as adopted by leading cases, four cases were analyzed; Ericsson, ZTE, Huawei, and Bharti. The data were collected from the published data. This study reveals that; the design attributes could be classified to; primary and secondary design attributes. A lot of relationships are reported between the design attributes. This study helps the academics in understanding the relationship between design attributes and actions, so they can use the reported model of this study for teaching purposes or for further extended survey study. The base stations developer and mobile communication services providers have a good insight about the sustainable design alternatives. The green operations practices are still new and the research contribution is limited, the research contribution of green mobile telecommunication base station deign is very limited.

1. INTRODUCTION

Mobile telecommunication base stations have been a crucial telecommunication technology spread everywhere as a result of wider use of mobile phone communication. The telecommunication industry consumes a large amount of energy as reported by some telecommunication social responsibility reports, further some operators are listed as the largest energy consumption in their countries, as more and more industries introduces more ICT the situation will get worse. More local and international pressure on the telecommunication operators and equipment vendors will increase in the future (Huawei 2011), accordingly, the developers of base stations have concerned about the green initiatives; the CO2 emissions over the product life cycle are traced and different actions have been made (Lu 2008; Jianguo et al., 2008). One of these important actions made is the green design of base stations; system developers have made

DOI: 10.4018/978-1-5225-7915-1.ch050

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

a lot of actions to reduce the energy consumptions, improve the using of green energy and reduce the need air conditioning of base stations. The concern about the green design of base stations is reasonable since the energy consumption of radio sites usually accounts for more than 75% of the energy consumed during the telecommunication process (Huawei 2011).

The majority of green product design previous studies have concerned about the process of green product development instead of reporting the attributes and actions (e.g. Wimmer et al., 2008; Bard et al., 2011; Lamore 2011; Cagno and Trucco 2013), further, the studies of green supply chain management practices have not reported in-depth the relationship between design attributes and between design attributes and actions (e.g. Zhu et al., 2005; Zhu et al., 2010; Green et al., 2012; Perotti et al., 2012; Shi, et al., 2012; Lee et al., 2012), accordingly, this study decided to report in –depth the green mobile telecommunication base stations design attributes and actions, to realize this aim the following objectives were realized.

1. Identifying the base stations design attributes.
2. Identifying the relationship between the base station design attributes.
3. Identifying the green design actions are made to realize the base station design attributes.

This paper is organized as follows; the second section discuss the literature and represents the research contributions, the third section represents and discusses the research methodology, the next section is data analysis and findings, the fifth section is the discussion and the last section is the conclusions applications and future researches.

2. LITERATURE REVIEW

The concept of design for environment is a new concept, according to this concept the product has not a negative impact on the ecological environment, whether the product is used by customers or when the product is used and disposed, according to this concept, the product could be made from ecological components, which are disposed in the ecological environment without negative consequences, or the hazardous materials are eliminated from the product, or the product is easy to disassembly for recycled or remanufactured, the product size and weight could be reduced; further, the product consumes less energy during usage, or the product emission less greenhouse gases (Zhu et al., 2005; Zhu et al., 2010; Green Jr. et al., 2012; Perotti et al., 2012; Shi et al., 2012; Lee et al., 2012), design for environment is a critical success factor in a green supply chain management strategy and can help firms realize economic benefits (Shi et al., 2012).

The studies have investigated the green product design focused mainly on the process of green product development; for example one of these studies decided to investigate how to develop eco-products using Eco-design approach (e.g. Wimmer et al., 2008), another study has developed a new design tool for green product development process which is called “Integrated Green and Quality Function Deployment” (IGQFD) (Cagno and Trucco 2013), moreover, another study focused on developing a methodology which guides the decision makers toward a superior balance between quality, cost, environmental issues in product design (Bard et al., 2011), also a new process of product development which combines both the market requirements and social responsibilities toward stakeholders have been developed, this

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

process is called "Green Ocean" (Lamore 2011), another study have developed an ecodesign product and the performance of this product is evaluated by using product life cycle assessment approach (Schneider et al., 2008).

Other studies decided to investigate the factors determine the process of product design development, for example one of these studies has investigated the willingness of designers to adopt the eco-innovation tools (O'Hare et al., 2010), another study examined the impact of market and customers on adopting more eco-designed product (Jeswiet and Hauschild 2008; Short and Harvey 2008).

The green product design attributes have been investigated by green supply chain management practices studies; these studies decided to report the relationship between the green intra-organization and inter-organization practices and green supply chain key performance indicators (operational performance, environmental performance and financial performance) (Zhu et al., 2005; Zhu et al., 2010; Green et al., 2012; Perotti et al., 2012; Shi et al., 2012; Lee et al., 2012). Green product design has been defined as inter-organizational environmental practices, these studies have not reported the relationship between green product design attributes in details, and the actions affected the green design attributes (e.g. Green et al., 2012).

Accordingly, it is required more sophisticated models and more in-depth analysis of green product design attributes of particular industries, since some industry requires different design requirements, for example the producers of mobile phone concerns about the size, weight, reducing hazard materials, easy to recycle product. These attributes are secondary for mobile telecommunication base station design. So this study bridges the gaps of limited studies regarding green product design in general and green mobile telecommunication base stations design in particular.

3. RESEARCH METHODOLOGY

The methodology adopted by this research was qualitative case study methodology, the practices of four cases were investigated; this methodology was adopted since the aim of this study is to identify the relationships between design attributes and actions, which requires in-depth analysis of particular cases. The quantitative survey methodology will be used if the relationship between design attributes and actions are well understood, further. In the following sections the phases of study are presented, under each phase a clear discussion is presented.

3.1. First Phase: Selecting the Cases

The cases investigated by this research are; Ericsson, Huawei, ZTE and Bharti, the cases were selected carefully to have more reliable conceptual model. The cases are leading cases in constructing the mobile telecommunication base stations, also, the cases are leading in green base stations design (for example ZTE Corporation has already developed into the fifth largest telecommunication equipment provider, ranking among one of the Top 5 in the world, and is the largest mobile phone terminal manufacturer of China), so some cases won international or local awards of green mobile telecommunication practices (for example Bharti won **"**Green Mobile Award' at the 2011 GSMA Global Mobile Awards of driving one of the largest green power initiatives for mobile towers, also, Huawei won InfoVision Award from the International Engineering Consortium (IEC) for its innovation and "Green Design"), other cases

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

are strongly involved in green mobile telecommunication research projects, or main contributed to the standards of mobile telecommunication green practices (for example Ericsson is strongly involved in the EU research project EARTH, also has been active in the ITU-T LCA standard, L.1410).

3.2. Second Phase: Collect the Data

The data used are collected from secondary sources; the published data via websites and data published data in the annual sustainability and social responsibility reports were collected.

3.3. Third Phase: How to Realize the First Objective: Identifying the Base Station Design Attributes

The reported practices of the selected cases were revised, the focus was on identifying the general classification categories of design attributes and the detailed attributes, then the attributes adopted by each case was summarized, then the general titles were identified and checklist was used to report and count the attributes adopted. Then the result was summarized on a table as presented in Table (1).

3.4. Fourth Phase: How to Realize the Second Objective: Identifying the Relationship Between Design Attributes

A model which combines the relationship between attributes was developed for each case, the content of summarized facts of each fact was analyzed and represented by using arrows and circles. Then, the models were combined to form a general model, over each arrow an abbreviation represents each case was written. The arrows colours and thickness were distinguished according to frequency of cases adopted the relationship (see Figure (1)).

3.5. Fifth Phase: How to Realize the Third Objective: Identifying the Green Design Actions Are Made to Realize the Base Station Design Attributes

The actions adopted by each case to realize a particular design attributed were identified by revising the summarized facts related to each case, the check list was used for this purpose, then, the actions adopted to realize each design attribute are summarized in separate tables (see Table (2) to Table (5)).

4. DATA ANALYSIS AND FINDINGS

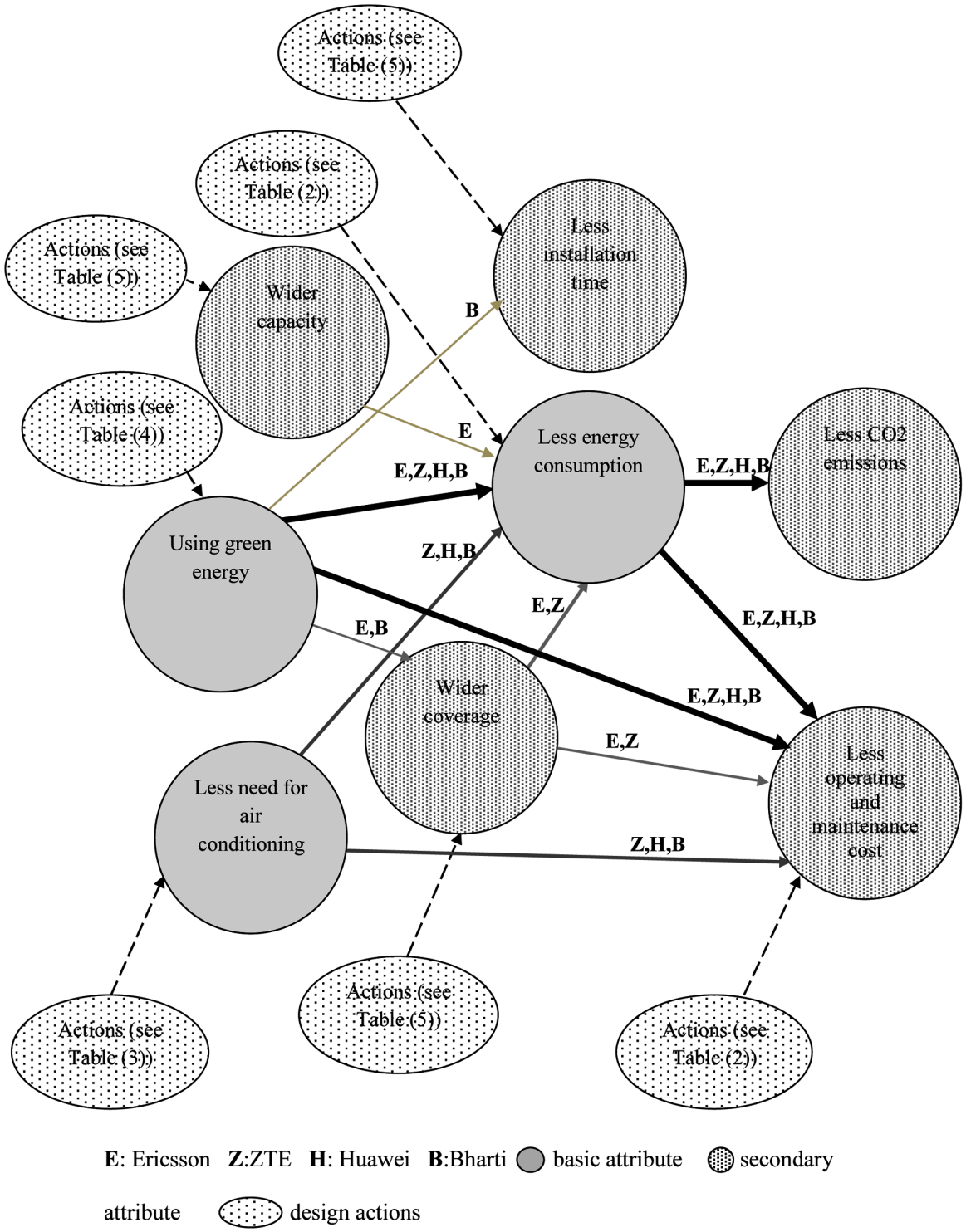
This section is classified to two main sections; the first one is identifying the base stations design attributes, and identifying the actions made to realize the design attributes.

4.1. Identifying the Base Stations Design Attributes

Table (1) show the design attributes as reported by the investigated cases, it can be seen that; the design attributes could be classified to two categories; the primary design attributed and the secondary design attributes. The primary design attributes are those mainly intended by the designers, so these are the

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 1. The relationship between green attributes as adopted by the surveyed cases



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 1. Base stations design attributes

Design Attributes	Ericsson	ZTE	Huawei	Bharti	Frequency of Attributes
Primary design attributes					
Less base station energy consumptions	X	X	X	X	4
less need for air conditioning		X	X	X	3
using green energy	X	X	X	X	4
Secondary design attributes					
Less CO2 emissions	X	X	X	X	4
Wider coverage	X		X	X	3
Less installation time	X			X	2
Wider capacity or less capacity per subscriber	X	X			2
Less maintenance and operating cost	X	X	X	X	4

X: Attribute is reported by the case

core attributes, however, the secondary attributes are those realized as a result of adopting the primary design attributes.

After revising the practices of selected cases it is found that; the base stations primary design attributes are; less base station energy consumptions, less need for air conditioning, using green energy. The most frequently primary attributes which adopted by all cases are; less base station energy consumption and using green energy.

The secondary deign attributes are; less CO2 emissions, wider coverage, less installation time, wider capacity or less capacity per subscriber, and less maintenance and operating cost. The most frequently attributes which adopted by all cases are; less CO2 emissions and less maintenance and operating costs. However, the least frequently attributes which adopted by two cases are; less installation time and wider capacity.

4.2. The Relationship Between Base Station Design Attributes

The saving of energy is affected by the using of air conditioning, using green energy and wider coverage. However, less energy consumption reduces CO2 emissions. The using of green energy improves the coverage of base stations, and reduces the base station installation time. On the other hand, the saving of operating or maintenance costs is affected by less energy consumption, less need for air conditioning, using green energy and wider coverage of base stations.

4.3. The Base Station Design Actions

4.3.1. Less Base Station Energy Consumption and Reduce the Operating and Maintenance Cost Actions

Table (2) shows the actions made to reduce the base station energy consumption and reduce the operating and maintenance cost, it can be seen that; the actions adopted to reduce the energy consumption are the same as the actions made to reduce operating cost. The most frequently actions are made by two cases

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 2. Less base station energy consumption and operating and maintenance cost actions

Action	Ericsson	ZTE	Huawei	Bharti	Frequency of Actions
Multi-standard radio base station (RBS), SDR based wireless solution	X	X			2
Eco-mode features for traffic use, traffic usage adopted stations	X	X			2
Remote site management	X				1
Intelligent management system			X		1
High sensitive receiving technology for wireless devices		X			1
High frequency digital power amplifier			X		1
Integrated system power management				X	1
Antenna integrated Radio	X				1

X: Action is adopted by the case

only, these actions are; multi-standard radio base station, and eco-mode features for traffic use. However, the remaining actions are made by one case, these actions are; remote site management, intelligent management system, high sensitive receiving technology for wireless devices, high frequently digital power amplifier, integrated system power management, and antenna integrated radio. The majority of actions made are not shared.

4.3.2. Less Need for Air Conditioning Actions

Table (3) shows the actions made to reduce the reliance on using air conditioning, it can be seen that; the actions adopted are; direct ventilation, intelligent ventilation, heat exchange for heat dissipation, wider operating temperature and free cooling unit. The first three actions are adopted by one case which is ZTE however the wider operating temperature is adopted by Hauwei, but the free cooling unit is adopted by Bharti, so no shared actions between cases.

4.3.3. Using Green Energy Actions

Table (4) shows the actions made to use green energy, it can be seen that; the actions adopted are; using solar energy, using solar-wind hybrid energy, using solar-diesel energy. The first actions which is using solar energy is made by all cases, however, the remaining actions are made by Huawei only.

Table 3. Less need for air conditioning actions

Actions	Ericsson	ZTE	Huawei	Bharti	Frequency of Actions
Direct ventilation		X			1
Intelligent ventilation		X			1
Heat exchange for heat dissipation		X			1
Wider operating temperature			X		1
Free cooling unit				X	1

X: Action is adopted by the case

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 4. Using green energy actions

Actions	Ericsson	ZTE	Huawei	Bharti	Frequency of Actions
Using solar energy	X	X	X	X	4
Using solar-wind hybrid energy			X		1
Using solar-diesel energy			X		1

X: Action is adopted by the case

4.3.4. Wider Coverage Actions

Table (5) shows the action made to expand the base site coverage, it can be seen that; the action adopted is high sensitive receiving technology for wireless devices; this action is made by one case which is ZTE.

4.3.5. Wider Capacity Actions

Table (5) shows the actions made to expand the capacity of base station, it can be seen that; the actions adopted is using heterogeneous network which is adopted by the Ericsson.

4.3.6. Less Installation Time Actions

Table (5) shows the action made to reduce the installation time, it can be seen that; the action adopted is using the antenna integrated radio; this action is made by one case which is Ericson.

5. DISCUSSION

The basic design attributes are the most important since the sources of CO2 emissions of base stations is the energy consumption; furthermore, more than 90% of the power consumption of the station comes from the communications equipment and air conditioning system (Qiang, 2008). These are two key fac-

Table 5. Actions made to realize secondary design attributes (wider coverage, wider capacity and less installation time)

Actions	Ericsson	ZTE	Huawei	Bharti	Frequency of Actions
Wider Coverage Action					
High sensitive receiving technology for wireless devices		X			1
Wider Capacity Action					
Heterogeneous network	X				1
Less Installation Time Action					
The antenna integrated radio	X				1

X: Action is adopted by the case

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

tors in optimizing energy conservation: lowering the power consumption of communications equipment and the air conditioning system, plus simultaneous use of new energy based on the situation at the site.

The using of green energy will improve the coverage especially for the rural areas since the energy sources are limited in the rural areas. Further, the operating cost will be reduced since the green sources are available for free. The using of base stations powered by green energy required less installation time since it is not required to be linked with electrical energy power by cables which consume significant time.

The investigated cases concerned about improving radio system to reduce energy consumption since the radio part is the largest energy-consuming entity of the base station, it is consuming more than 80% of the base stations energy demands. On the other hand, some cases concerned about intelligent management systems remote site systems, these actions reduce energy consumption since the intelligent system is able to monitor the power supplies, fire alarm systems, and temperature, also the intelligent system is able to capture every fault in site so reduce the operating and maintenance costs.

The using of Eco-mode features for traffic use or traffic usage adopted stations will reduce energy consumption since the systems will adjust the power required according to the used output power in the radio in the radio interface, so during low usage the energy used will be reduced and operating and maintenance cost will be reduced in accordance. The using of high sensitive receiving technology will improve the coverage so the number of base stations in a particular area will be reduced so the energy consumption will be reduced and the operating and maintenance cost will be reduced in accordance.

The majority of producers adopted solar power energy rather than hybrid sources, or wind energy, since the solar power equipment are easier for installation in comparison with wind and occupy smaller area. Heterogeneous network will improve the capacity of base stations since it is a powerful macro-radio base stations are complemented by smaller radio base stations (pico and micro) which provides extra capacity during the high demand, further, it is serving users with a nearby low power node, so it is possible to off-load the high power nodes, thus saving energy.

6. CONCLUSION

6.1. Contribution and Results

The majority of green product design previous studies have concerned about the process of green product development instead of reporting the attributes and actions, further, the available literature of green supply chain management practices have not concerned about reporting in-depth the relationship between green product design attributes and actions.

The main result of this study is the design attributes are classified to primary and secondary attributes; the primary design attributes are those mainly intended by the designers, so these are the core attributes, however, the secondary attributes are those realized as a result of adopting the primary design attributes. The primary design attributes are; less base station energy consumptions, less need for air conditioning, using green energy. The secondary deign attributes are; less CO2 emissions, wider coverage, less installation time, wider capacity or less capacity per subscriber, and less maintenance and operating cost.

There are relationships between design attributes; the saving of energy is affected by less using of air conditioning, using green energy and wider coverage. However, less energy consumption reduces CO2 emissions. The using of green energy improves the coverage of base stations, and reduces the base station installation time. On the other hand, the saving of operating or maintenance costs is affected by

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

less energy consumption, less need for air conditioning, using green energy and wider coverage of base stations. The realization of design attributes is affected by stream of actions which are reported by this study.

6.2. Implications and Future Research

This study helps the academics in understanding the relationship between design attributes and actions, so they can use the reported model of this study for teaching purposes or for further extended survey study. The base stations developer and mobile communication services providers have a good insight about the sustainable design alternatives.

This study developed a model of base stations design according to practices of four cases, the results of this study could not generalized, so it is recommended to conduct a survey study, this study reports the design attributes as reported by the producers of base stations, it is recommended to evaluate the effectiveness of green base stations by surveying the mobile telecommunication service providers, also, it is recommended to evaluate the effectiveness according to country context.

REFERENCES

Brad, S., Brad, E., & Mocan, B. (2011). Framework for eco-innovative design with application in low-voltage electric appliance industry. *International Journal of Environmental Technology and Management*, *14*(5), 379–396. doi:10.1504/IJETM.2011.043513

Cagno, E., & Trucco, P. (2007). Integrated green and quality function deployment. *International Journal of Product Lifecycle Management*, *2*(1), 64–83. doi:10.1504/IJPLM.2007.012875

Green, K. W. Jr, Zelbst, P. J., Meacham, J., & Bhadauria, V. S. (2012). Green supply chain management practices: Impact on performance. *Supply Chain Management: An International Journal*, *17*(3), 290–305. doi:10.1108/13598541211227126

Huawei Technologies Co., China. (2011). Huawei whitepaper on energy efficiency and carbon reduction.

Jeswiet, J., & Hauschild, M. (2008). Market forces and the need to design for the environment. *International Journal of Sustainable Manufacturing*, *1*(1), 41–57. doi:10.1504/IJSM.2008.019226

Jianguo, Z., Qiang, Z., Yu, G., & Yingwen, P. (2008). China mobile in Action. *Huawei Communication*, *45*, 31–35.

Lamore, P. R. (2011). Sustainable new product commercialisation: From Blue Oceans to Green Oceans. *International Journal of Social Entrepreneurship and Innovation*, *1*(2), 163–175. doi:10.1504/IJSEI.2011.043743

Lee, S. M., Kim, S. T., & Choi, D. (2012). Green supply chain management and organizational performance. *Industrial Management & Data Systems*, *112*(8), 1148–1180. doi:10.1108/02635571211264609

Lu, H. (2008). Making “green” telecom real. *Huawei Communicate*, *45*, 39–41.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

O'Hare, J., Dekoninck, E., McMahon, C., & Turnbull, A. (2010). Adapting innovation tools to the eco-innovation requirements of industry: Case study results. *International Journal of Design Engineering*, *3*(2), 172–194. doi:10.1504/IJDE.2010.034863

Perotti, S., Zorzini, M., Cagno, E., & Micheli, G. J. (2012). Green supply chain practices and company performance: The case of 3PLs in Italy. *International Journal of Physical Distribution & Logistics Management*, *42*(7), 640–672. doi:10.1108/09600031211258138

Qiang, Z. (2008). Creating green sites. *Huawei Communication*, *45*, 36–45.

Schneider, F., Salhofer, S., Schiffleitner, A., & Stachura, M. (2008). The development of an ecodesign product-the ecomouse case study. *Progress in Industrial Ecology, an International Journal, 5*(1), 102-123.

Shi, V. G., Koh, S. L., Baldwin, J., & Cucchiella, F. (2012). Natural resource based green supply chain management. *Supply Chain Management: An International Journal*, *17*(1), 54–67. doi:10.1108/13598541211212203

Short, T., & Harvey, J. (2008). Lightbulbs and nappies: Sustainable development and customer perceptions. *International Journal of Sustainable Design*, *1*(1), 13–28. doi:10.1504/IJSDES.2008.017054

Wimmer, W., Ostad-Ahmad-Ghorabi, H., Pamminger, R., & Huber, M. (2008). Product innovation through ecodesign. *International Journal of Sustainable Design*, *1*(1), 75–92. doi:10.1504/IJSDES.2008.017058

Zhu, Q., Geng, Y., Fujita, T., & Hashimoto, S. (2010). Green supply chain management in leading manufacturers: Case studies in Japanese large companies. *Management Research Review*, *33*(4), 380–392. doi:10.1108/01409171011030471

Zhu, Q., Sarkis, J., & Geng, Y. (2005). Green supply chain management in China: Pressures, practices and performance. *International Journal of Operations & Production Management*, *25*(5), 449–468. doi:10.1108/01443570510593148

This research was previously published in the International Journal of Green Computing (IJGC), 6(2); edited by Vicente Gonzalez-Prida, pages 43-52, copyright year 2015 by IGI Publishing (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Section 5

Organizational and Social Implications

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 51
Green Innovation and Ethical Responsibility: Do They Improve Customer's Green Purchase Intentions?

Harsh Tullani
SRM University-Delhi NCR, India

Raiswa Saha
SRM University-Delhi NCR, India

Richa Dahiya
SRM University-Delhi NCR, India

ABSTRACT

The article aims at finding whether it's green innovation or ethical consideration of the business that predominantly affects consumer's choice for green purchase intentions. Does it act as a precursor to green marketing practices, and how it can impact consumers green purchase intentions? This article contributes a conceptual model focusing on three main variables under study i.e., green innovation, ethical responsibility and green purchase intentions. The study employs qualitative literature review followed by a quantitative survey of 250 consumers through 7-point Likert scale. The study results support that ethical responsibility has a positive impact on green purchase intentions. Green innovation has also got a positive relationship with green purchase intentions. However, green innovation and ethical responsibility are also significantly associated with green purchase intention. In a nutshell, both factors conjointly affect consumer's green purchase intentions. The study has functional and social implications for policymakers, citizen action public, businesses, stakeholders and the public in general. Environmental awareness, sense of trust & corporate image can be studied as a mediator or moderator to get a holistic view of the phenomenon. As per the understanding of the researchers, this is a naive study that explores, tests and contributes an empirically tested conceptual model supporting the combined effect of ethical responsibility and green innovation on green purchase intentions.

DOI: 10.4018/978-1-5225-7915-1.ch051

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

INTRODUCTION

The Brand inclination is imperative for distribution of the innovative product as it offers a lot of profits for such a unique position in the market, strong competitive power, & market share. These interests constrain the companies to acknowledge the environmental accountability (Chen et al., 2006). In the ancient time, firms' only liability was to capitalize on their owners' welfare and profit, rather than giving regards to the social and environmental effects (Sinthupundaja, & Kohda, 2017). It has been observed currently that ecological issues are rising progressively owing to the enormous amount of environmental pollution which is caused by manufacturing units (Chen, 2008). This is also applicable to green innovation in provisions of consumer goods, industrial supplies and services (Polonsky, 1994; Ottman, 1998). In today's globalized, rapidly-changing world, innovation is becoming ever more important as changes in technology, skills and knowledge increasingly affecting countries' competitiveness externally as well as the well-being of their people internally. Spillovers in R&D means that private firms (and individual countries) are unable to capture the full value of their investments in the competitive market. Indeed, innovation studies suggest that the social returns to private R&D are often much larger than the (already large) private returns. This means in such cases firms will undervalue such investments and so be motivated to underinvest relative to what might be good for society as a whole. Fostering positive spillovers is a "primary justification for government R&D-support policies". Key externalities like congestion, environment and CO_2 emissions may not be properly priced or regulated in the market. Firms thus, undervalue innovations that would address such externalities. For this reason, energy innovation has been called "a tale of two market failures" — i.e. it is undervalued due to both spillovers and the lack of adequate CO_2 pricing. Imperfections in risk-sharing institutions and capital markets hamper the extent to which innovation and innovative approaches can diffuse. Therefore, the time-to-market of environmentally friendly products may be an intermediate outcome of effective green external integration, which ultimately leads to improved performance. Green innovation and ethical responsibility of businesses have seamlessly integrated towards the development of green purchase intention and green consumerism.

Green Purchase Intention

Green purchase intention is the intentional purchase of products and services with an idea of minimal harm to the natural environment. Some free market advocates claim that the market automatically gives people all the choices, want and all the information they need, but what consumers are demonstrating is that they are more environmentally acceptable choices than the market has been delivering, and more worthy information about the social and environmental impact of the products they might buy.

Need for the Study

Businesses use "green" as a symbol to sustain within the public relation opportunity. They use green as a brand positioning strategy such as energy efficient, organic and eco-friendly (Parker et al., 2009). Chen et al. (2006) found that the competitive advantage of the business depends upon the green product as well as green innovation. The sustainable businesses depend on the way how to tackle the environmental

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

problems (Baker, & Sinkula, 2005). Many business houses view their green activities as different, isolated and fragmented sets of activities such as energy conservation, recycling & reducing pollution. Therefore, businesses provide the economic and competitive opportunities after the environmental improvements take place; those improvements work as a value added instrument to both organization as well as the customers buying pattern (Porter, & Van der Linde, 1995). To achieve Green purchase intention organizations should be connected with the green supply chain in a sustainable manner.

Research Question and Problem Statement

Awareness about Green products is scattering day by day in India. Customers, companies as well Government is getting concerned about the environment which breeds Green purchase intention in India. Now, the question arises:

RQ1: Do green innovation influence green purchase intention of consumers?

Business firms have understood the vital roles of green marketing practices to strive in the market and gain a competitive position over rivals in the industry. Green marketing has received a tremendous increase with the revitalization of environmental awareness among customers. Green marketing, in fact, carries a paradigm move approach in many business firms since it has changed the manner in which a business goes about reaching out to the customers. These days, the supervision of green marketing and innovation is obligatory in influencing the consumers' decision of purchasing. This is due to the impact of consuming chemical-based products towards health. Consumers of organic farm products tend to pay attention on the products' characteristics which are environmentally-friendly and give benefit to their health as defined in terms of green purchasing by Lee. According to the research discussions, consumers within the age group of more than 50 years tend to pay more attention towards purchasing organic products. Recently, since organic products are not sold in many places and they have higher prices, these products seem to be affordable merely for middle to high-class communities. The label "Go Green" and physical appearance of organic products, which differs from those of non-organic ones, support in the promotion processes. In the coming years, organic products which are environmentally-friendly will be able to compete in the market with other nonorganic products. This will enable companies to gain their own specialty and ability in winning marketplace competition.

RQ2: Do ethical responsibility influence green purchase intention of consumers?

Consumers who are aware of environmental issues & interested in buying ecological products are called 'green consumers' (Soonthonsmai, 2007). Ottman (1992) reported that consumers acknowledge green products only when they are satisfied with their primary needs for quality, convenience, affordability & performance and when they are aware of the working of a green product that how it could solve their environmental problems. Krause (1993) reported that consumers were becoming more concerned about their routine and its impact on the environment, therefore, many of the consumers transformed as a Green consumer.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Green Innovation

While undergoing Green purchase intention-behavior exploration, numerous studies have depicted a "gap" between consumers' favorable attitudes and real purchasing habit (Vermeir, & Verbeke, 2006; Vermeir, & Verbeke, 2008; Tanner, & Kast, 2003). Hughner (2007) in a study have found that whereas, consumers irrespective of showing an optimistic outlook towards organic food purchases, just a limited number of consumers actually purchases. It is thus, evident from past researches being undertaken that there exist customer's thoughts and real actions gap (Wheale, & Hinton, 2007; Chen, & Chai, 2010) which is referred to as 'green attitude-behavior gap'. If green innovation is ignored or has given comparatively less importance it can affect the purchase decision of the customers and can lead to brand switching by the customers. Therefore, green innovation shows that consumers positive attitude towards green purchases does not always lead to buying behavior and is essential to examine why environmental attitudes have a weaker influence on consumer green purchase behavior; that leads to the discrepancy between consumer attitude and purchase behavior.

Previous research has not been capable of recognizing the consumer attitude towards the green purchase (Gupta, & Ogden, 2009) as no inclusive examination of environmentally responsible purchasing (Memery et al., 2005) has been studied vastly. Thus, the authors felt the necessity of conducting this study on consumer behavior towards the green purchase, and this encouraged the authors to evaluate the existing pertinent literature on consumers' green purchase behavior. An increased attention towards environmental damages (pollution, depletion of resources, etc.) has raised an increased level of concern and emphasis on sustainable products.

Green Innovation

H1: Green Innovation has a significant positive impact on Green Purchase Intention

The word 'green' has turned out to be a significant reflection of a company owing towards public concern in respect of ecological issues, which has enthused rising attention among researchers in investigating green marketing concepts. An assortment of environmental topics has been studied giving focus towards green market orientation (Hong et al., 2009), ecological social accountability (Siegel 2009), corporate social responsibility (Ambec, & Lanoie, 2008), and ecological administration (Florida, & Davison, 2001; Molina-Azorin et al., 2009). Therefore, green supervision will be possibly more to create radical innovation than incremental innovation.

Ethical Responsibility

H2: Ethical Responsibility has a significant positive impact on Green Purchase Intention.

Consumers generally express their apprehension about the company's ethical performances by means of ethical buying and ethical consumerism. Thus, an ethical consumer feels a true sense of socially responsible by means of his or her purchasing intentions. Green purchases and ethical responsibility

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

have received a positive relationship as it explains the ethical consumption and several dimensions of consumers' perceptions towards an ethical firm. There are various benefits that accrue to green purchases and ethical responsibility by benefitting the natural environment (environmentally friendly products, fair-trade products, etc.) Consumer perceptions and attitudes influence purchase behavior, which is tested in several ethical consumption models (Shaw, & Clarke, 1999; Vitell, Singhapakdi, & Thomas, 2001).

Green ethical consumption relates to an important consumers' responsibility with respect to their purchasing actions not only as individuals but, also on their social value systems (Uusitalo, & Oksanen, 2004). Thus, consumers' ethical behavior can also be reflected in their involvement pattern (Carrigan, & Attalla, 2001). Company's unethical behavior has an impact on consumer attitudes according to previous studies done by Folkes, & Kamins, 1999. It has been well established that customers do give due importance to ethical products (Carrigan, & Attala, 2001; De Pelsmacker et al., 2005) and are highly worried about the companies' ethical roles to pay off which leads to widespread purchasing behavior.

METHODOLOGY

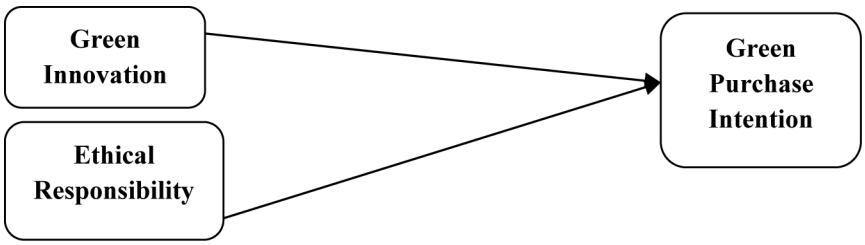
Research Objective

- *To analyze the relational impact of Green innovation on Green purchase intention.*
- *To analyze the relational impact of Ethical responsibility on Green purchase intention.*
- *To develop a comprehensive model encompassing all the developed constructs.*

Proposed Conceptual Model

This study has done the summarization of the literature on green innovations and ethical responsibility into an innovative and novel management outline leading towards Green purchase intention. Many past research studies have explored the construct of Green purchase intention and innovation, but no research has still found the dual effects of green innovation and ethical responsibility towards green purchase intentions or green consumption. This present study explored explicitly and found the constructs to be worth researching in order to fill the research gap and propose a novel model framework and design i.e., green innovation with ethical competencies of companies. This study, hence, explored the positive and significant effects of innovation and ethical perspectives of firms to build their consumer consumption study pattern (see Figure 1).

Figure 1. Conceptual framework. Source: Authors compilation



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Constructs, Participants and Procedure Measurement

The current research discusses the conception of Green purchase intention and its linkage with ethics and innovation. To meet the aims and objectives of the research, this study has employed a quantitative research technique to find out the interrelationships among Green innovation, ethical responsibility and Green purchase intention of consumers in India, thereby, formulating an all-inclusive representation for the purpose. Turker (2009) scale have been used for studying ethical responsibility. Steenkamp & Gielens (2003) scale was used for green innovation and for green purchase intentions or consumption, Maro & Oliver (1993) scale was used.

Field surveys of 250 consumers through 7-point Likert scale from strongly disagree to strongly agree (1 to 7) self-administered structured questionnaire is filled, to understand their attitude towards Green purchase intention and Green products. Non-probability sampling approach has been adopted by the researchers, whereas, convenience and judgment-based sampling methods have been employed in order to select the subjects representing both the genders, educational levels, diverse age groups, monthly income and marital status. Demographic categories such as income, gender, age and qualification have been taken into consideration along with urban classifications. Various published reports of Government of India, various rating agencies, Indian Chambers of Commerce and Industry, business publications and reports made available by various companies were selected for secondary data reviews. Exploratory factor analysis and Structural equation model (SEM) have been used with the help of software like Amos 20 and SPSS 21.0 for data analysis. Standard editing and coding techniques have been utilized to analyze the data.

Case Analysis

Coca-Cola

Coca-Cola is the leading retailer brand in the world with the purpose of creating economic, social, and environmental value. They are involved in packaging innovations, to make bottles lighter and friendlier with the environment by promoting recycling and make sure that their operating waste is managed adequately. There 2020 goal is that 25% of the materials they use in their pet packages include recycled or renewable components.

State Bank of India: Green IT@SBI

SBI entered into green service known as “Green channel counter”. SBI provides numerous services like paperless banking, no deposit slip, no withdrawal form, no checks, no money transactions form which can be done through SBI shopping & ATM cards. State Bank of India turns to wind energy to reduce emissions.

Philips

Philips’ innovation efforts are closely aligned with their business strategy. It does so through cooperation among research, design, marketing, strategy and business in interdisciplinary term along with the innovation chain, from front-end to first-of-a-kind product development. Philips LifeLight, the new

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

zero-energy, Solar powered LED lighting range designed for homes in off-grid rural and semi-urban communities are all part of Philips drive to deliver innovations (See Figure 2 Philips group Research and Development expenses).

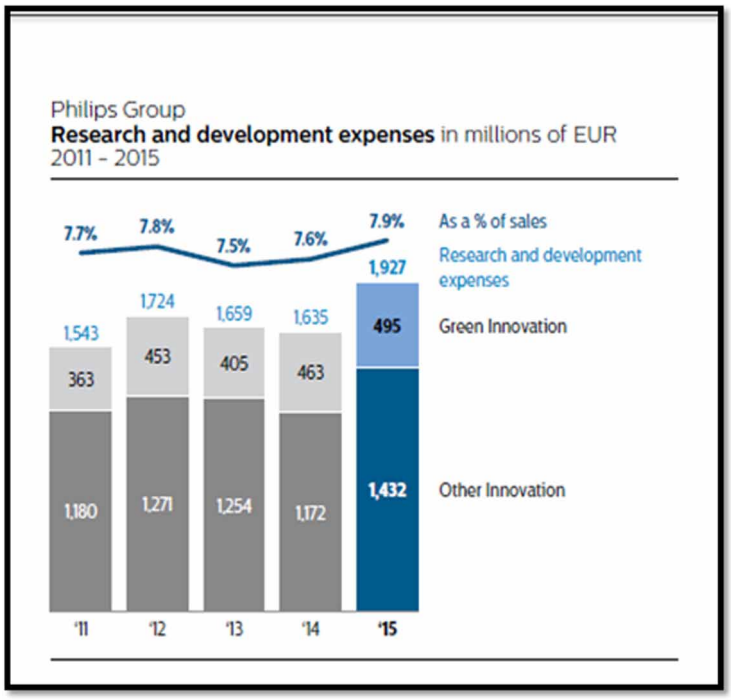
Samsung

Samsung commits to provide eco-friendly products & services based on green management to prevent world through business initiatives. Their vision is "providing a green experience, creating a sustainable future" with the slogan "Planet First". They have reduced 70% of GHG emissions. According to the EM2020 goal as compared to 2008 even they are continuously improving the energy efficiency level in the manufacturing process Samsung works for the safety of employees as well as customers by increasing their recycling & creating innovative products & services.

LG

South Korean consumer durable major LG Electronics recently introduced LG LED E60 and E90 series monitors in the Indian market. The LED E60 and E90 series monitors are packed with the eco-friendly features such as 40 percent less energy consumption than the traditional LCD monitors. Also, the use of hazardous materials such as halogen or mercury is kept to minimal in this range. Globally, LG has launched a range of eco-friendly products 'Eco-Chic' such as the platinum coated two-door refrigerator and washing machine with steam technology.

Figure 2. Philips group research and development expenses (Source: 2015 Annual Report of Philips)



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

HCL

Last year, HCL launched its range of eco-friendly notebooks, HCL ME 40. HCL claims that this was India's first PVC free and eco-friendly notebook. This notebook is completely free from polyvinyl chloride (PVC) material and other harmful chemicals. Further, the bureau of energy efficiency has given HCL eco-friendly products a five-star rating, and they also meet REACH (REACH is the European Community Regulation on chemicals and their safe use) standards and are 100 percent recyclable and toxin free.

DATA ANALYSIS

Empirical Results

The precursor of this research study and model framework are green innovation and ethical responsibility with the consequent effect on green purchase intention. Two levels of analysis - the measurement model and the structural model have been specified which covers basically the structural equation modeling.

SEM of this study has included:

Validation of Measurement Model

This research shows the standard deviations and means of the respective variables and also the correlations amongst them in Table 1. There exist significant positive correlations among the three variables: Green Innovation, Ethical Responsibility and Green Purchase Intention. The results of exploratory factor analysis are shown in Table 2. The three constructs in this study can be categorized into only one factor in Table 2. Next, the study has applied confirmatory factor analysis (CFA) to confirm the reliability and validity issues in the measurement model. The results of the Confirmatory Factor Analysis point toward that the measurement model depicts the satisfactory levels to attain model robustness (chi-square=151.8, DF= 97, chi-square /DF = 1.556, IFI = 0.934, CFI = 0.914, RMSEA = 0.071).

To substantiate the validity and reliability of the measurement model, there are several measures like examining the factor scores of individual items. The item loadings are shown in Table 3 which are found to be all significant. Table 3 also lists the Cronbach's alpha values which measure the reliability values. The minimum threshold value of Cronbach's alpha according to Hair et al. 1998 is 0.7. In our model, each and every Cronbach's alpha coefficient values are more than 0.7, which indicates acceptability in reliability issues. For checking the validity of the study, this research has applied Fornell and Larcker's measure of the average variance extracted (AVE) which measures the quantity of variance explained by a construct through its items. For meeting the threshold values of discriminant validity, the square root of a construct's AVE must be greater than the correlations between the construct and other constructs. For instance, the square root of the AVEs for the two variables, green innovation and ethical responsibility are 0.764 and 0.765 which are more than the correlation, 0.445, between them in Table 1. This result shows that there is enough discriminant validity between the two variables, i.e., green innovation and ethical responsibility. Next, the AVEs of the three constructs, i.e., green innovation, ethical responsibility and green purchase intentions are all more than 0.5 in Table 3. It is, therefore, proved that the convergent validity of the three constructs is acceptable.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 1. Descriptive Statistics [Means, standard deviations, and correlations of the constructs]

Constructs	Mean	Standard Deviation	A	B	C
Ethical responsibility	3.867	0.712			
Green Innovation	4.016	0.652	0.445 **	0.463 **	
Green Purchase Intention	3.613	0.689	0.500 **	0.537 **	0.324 **

Source: Authors compilation

Table 2. Factor analysis

Constructs	Number of items	Number of factors	Accumulation Percentage of explained variance (%)
Green Innovation	3	1	72.191
Ethical responsibility	4	1	72.484
Green Purchase Intention	5	1	65.935

Source: Authors compilation

Table 3. The items' loadings and the constructs Cronbach alpha coefficients and AVEs

Construct	ITEMS	Factor loadings	Cronbach alpha	AVE	Square root of AVE
Green Innovation	GI1	0.787	0.806	0.583	0.764
	GI2	0.775**			
	GI3	0.728**			
Ethical responsibility	ETHR1	0.734	0.872	0.585	0.765
	ETHR2	0.859**			
	ETHR3	0.699**			
	ETHR4	0.769**			
Green Purchase Intention	GPI1	0.800	0.901	0.588	0.769
	GPI2	0.798**			
	GPI3	0.737**			
	GPI4	0.790**			
	GPI5	0.756**			

Source: Authors compilation

The Results of the Structural Model

Structural model results are shown in Table 4 and Figure 3. The overall fit measures of the structural model is acceptable (chi-square = 93.615, DF = 90, chi-square/df. = 1.031, GFI = 0.905, NFI = 0.900, CFI = 0.996, RMSEA = 0.021). Table 4 presents the results of the two paths. Figure 3 shows the results of the full model. According to Table 4 and Figure 3, the results point to wide support for the two hypothesized effects in the research model. As a result, this study verifies that green innovation is positively related to green purchase intentions and ethical responsibility of firms is related to green purchase intentions.

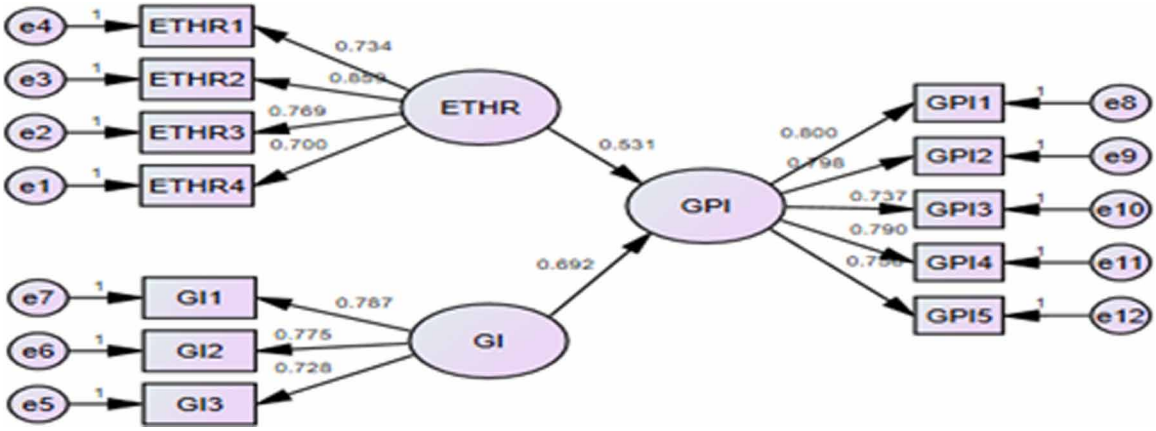
EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 4. The results of the structural model

Hypothesis	Proposed Effect	Path Coefficient	Results
H1	+	0.692**	H1 is supported
H2	+	0.531**	H2 is supported

* p < 0.05, **p < 0.01
Source: Authors compilation

Figure 3. Path coefficient source: authors compilation



DISCUSSION AND IMPLICATIONS

By undergoing a broad and descriptive literature study, several factors affecting consumer green purchase intentions were recognized. Consumers' concern towards the adoption of social and environmental issues was found to have a significant impact on green purchase intentions (Makatouni, 2002). It is clearly evident from our research that green innovation and ethical responsibility play a very important role in designing consumer-oriented strategies towards green products. Particularly, social and ethical perspectives of companies were established to stimulate the purchases of green products (Padel, & Foster, 2005). The existing research focuses on the factors which can impact the green purchase intentions of customers. If a product is lacking in any aspect of innovation it can lose the opportunity to gain market competitiveness. Therefore, consumers normally relate green product characteristics with environmentally responsive processes (Makatouni, 2002). It shapes the individual's ethical or moral responsibilities towards the society (Doran, 2009). Customers, who display constructive attitudes towards green purchases, feel a strong individual compulsion towards the environmental concerns in selecting green products, particularly when they have diverse product categories.

Ethical norms and values such as universalism, benevolence and altruism were found to have positive relationships with ethical obligations (Eze et al., 2013; Chen et al., 2012; Padel, & Foster, 2005). Hence, it can be also stated that strong social and environmental values guide consumers in their product and purchase involvement. Consumers high involvement leads to better and vigorous contribution in the course (Vermeir, & Verbeke, 2006; Agrawal, & Rahman, 2014. Future research is required to address

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

the issues that act as barriers between consumers' positive approach towards green purchase intentions. Green product prices seem to have a significant bearing on the purchasing of environmentally sustainable goods (Young et al., 2010). Consumers are frequently susceptible towards price which companies charge for green products (Eze et al., 2013), higher than their expectations, will result in an attitude-behavior gap in green purchase intentions.

Additionally, complexity in accessing innovative and environmentally sustainable products was found to be major reasons behind lower levels of purchases (Padel, & Foster, 2005; Lea, & Worsley, 2008). According to surveys, consumers usually access products which are in proximity and appreciable range (Young et al., 2010). When there is a gap in accessibility and price, consumers are found to resist their purchasing habit of such green products (Young et al., 2010; Connell, 2010).

Theoretical Implications

This kind of a research study explains the gap between green innovation strategies and sense of ethical responsibility. The key drivers of green purchase intentions of consumers in perspective of green purchasing alongside with a variety of attitudes and behaviors affecting green purchase behavior are important to consider. The research thus, identifies green innovation, marketing strategies as potential explanations for the discrepancy in green purchase intentions. Additionally, it provides an empirical analysis of the outcomes and independent variables in future studies to examine their influence on green purchases (dependent variable). Future researchers may also suggest various frameworks and models based on their own results, taking our findings and analysis as a model base.

Managerial Implications

It guides the corporate bodies to design the key predictors of consumers' green purchase intentions. Marketers can better devise their innovation strategies and take ethics as a core driver for understanding the consumer psychology of green purchase behavior as this understanding will equip them to frame their product contributions. The present study has functional as well as social implications for policymakers as well as considers the environmental values and concerns which can act as the prime factors for environmental education. Consumers generally remain unconvinced about environmental claims made by manufacturers and find it hard to recognize green products but, through ecological awareness of these products can generate a sense of trust and attachment with the companies.

CONCLUSION

This research contributes a view on the relationship of green innovation and ethical responsibility with green purchase intention. We have utilized Factor analysis & SEM to explore the positive effect of Green innovation and Ethical responsibility leading to Green purchase intention. Although various studies have been done to understand Green purchase intention, but no study has integrated Green innovation and Ethical responsibility by way of Green purchase intention. Many companies have transformed their businesses into a Green business model worldwide either by modifying their product or technology. Now, businesses are willing to promote the green attributes of products and customers are claiming about be-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

ing skeptical (Makower, 1995). Further studies need to tackle the problem of lack of awareness among customers about green products which is the crucial area of working in Green marketing discipline. This study will help the marketers to revamp their strategies and to draw consumer pattern and gain competitive advantage. This study can further be tested in different market segments and would be valuable to investigate the Green purchase intentions by adding more factors which influence the buying behavior or pattern of the customers for Green products.

REFERENCES

Ambec, S., & Lanoie, P. (2008). Does it pay to be green? A systematic overview. *The Academy of Management Perspectives*, *22*(4), 45–62. doi:10.5465/amp.2008.35590353

Baker, E. W., & Sinkula, M. J. (2005). Environmental marketing strategy and firm performance: Effects on new product performance and market share. *Journal of the Academy of Marketing Science*, *33*(4), 461–475. doi:10.1177/0092070305276119

Carrigan, M., & Attaila, A. (2001). The myth of the ethical consumer- do ethics matter in purchase behavior? *Journal of Consumer Marketing*, *18*(7), 560–577. doi:10.1108/07363760110410263

Chen, Y. S., Lai, S. B., & Wen, C. T. (2006). The influence of green innovation performance on corporate advantage in Taiwan. *Journal of Business Ethics*, *67*(4), 331–339. doi:10.100710551-006-9025-5

Chen, Y. S. (2008). The driver of green innovation and green image – green core competence. *Journal of Business Ethics*, *81*(3), 531–543. doi:10.100710551-007-9522-1

Chen, T. B., & Chai, L. T. (2010). Attitude towards the environment and green products: consumers' perspective. *Management Science and Engineering*, *4*(2), 27–39.

Connell, K. Y. H. (2010). Internal and external barriers to eco conscious apparel acquisition. *International Journal of Consumer Studies*, *34*(3), 279–286. doi:10.1111/j.1470-6431.2010.00865.x

De Pelsmacker, P., Driesen, L., & Rayp, G. (2005). Do consumers care about ethics? Willingness to pay for fair trade coffee. *The Journal of Consumer Affairs*, *39*(2), 363–385. doi:10.1111/j.1745-6606.2005.00019.x

Florida, R., & Davison, D. (2001). Gaining from green management: Environmental management system inside and outside the factory. *California Management Review*, *43*(3), 64–84. doi:10.2307/41166089

Folkes, V. S., & Kamins, M. A. (1999). Effects of information about firm's ethical and unethical actions on consumer attitudes. *Journal of Consumer Psychology*, *8*(3), 243–259. doi:10.120715327663jcp0803_03

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, *18*(1), 39–50. doi:10.2307/3151312

Eze, U. C., & Ndubisi, N. O. (2013). Green Buyer Behavior: Evidence from Asia Consumers. *Journal of Asian and African Studies*, *48*(4), 413–426. doi:10.1177/0021909613493602

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Gupta, S., & Ogden, D. T. (2009). To buy or not to buy? A social dilemma perspective on green buying. *Journal of Consumer Marketing*, *26*(6), 376–391. doi:10.1108/07363760910988201

Hair, J. F. Jr, Anderson, R. E., Tatham, R. L., & Black, W. C. (1998). *Multivariate Data Analysis* (5th ed.). Upper Saddle River, NJ: Prentice Hall.

Hong, P., Kwon, H. B., & Roh, J. J. (2009). Implementation of strategic green orientation in supply chain: An empirical study of manufacturing firms. *European Journal of Innovation Management*, *12*(4), 512–532. doi:10.1108/14601060910996945

Hughner, R. S., McDonagh, P., Prothero, A., Shultz, C. J., & Stanton, J. (2007). Who are organic food consumers? A compilation and review of why people purchase organic food. *Journal of Consumer Behaviour*, *6*(2-3), 94–110. doi:10.1002/cb.210

Krause, D. (1993). Environmental consciousness: an empirical study. *Environment and Behavior*, *25*(1), 126–142. doi:10.1177/0013916593251007

Lea, E., & Worsley, A. (2008). Australian consumers' food-related environmental beliefs and behaviours. *Appetite*, *50*(2), 207–214. doi:10.1016/j.appet.2005.07.012 PMID:17604876

Makatouni, A. (2002). What motivates consumers to buy organic food in the UK?: Results from a qualitative study. *British Food Journal, 104*(3/4/5), 345-352.

Makower, J. (1995). Beyond the bottom line: Putting social responsibility to work for your business and the world. *Touchstone, 25*, 126–142.

Mano, H., & Oliver, R. L. (1993). Assessing the dimensionality and structure of the consumption experience: evaluation, feeling, and satisfaction. *The Journal of Consumer Research*, *20*(3), 451–466. doi:10.1086/209361

Memery, J., Megicks, P., & Williams, J. (2005). Ethical and social responsibility issues in grocery shopping: A preliminary typology. *Qualitative Market Research*, *8*(4), 399–412. doi:10.1108/13522750510619760

Molina-Azorın, J. F., Claver-Cortes, E., Lopez-Gamero, M. D., & Tari, J. J. (2009). Green management and financial performance: A literature review. *Management Decision*, *47*(7), 1080–1100. doi:10.1108/00251740910978313

Ottman, J. (1992). Sometimes consumers will pay more to go green. *Marketing News*, *26*, 16–23.

Ottman, J. (1998). Innovative marketers give new products the green light. *Marketing News*, *32*(7), 10.

Padel, S., & Foster, C. (2005). Exploring the gap between attitudes and behaviour: Understanding why consumers buy or do not buy organic food. *British Food Journal*, *107*(8), 606–625. doi:10.1108/00070700510611002

Parker, B., Segev, S., & Pinto, J. (2009). *What it Means to Go Green: Consumer Perception of Green Brands and Dimensions of Greenness*. North Miami, FL: Florida International University.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Peng, Y. S., & Lin, S. S. (2008). Local responsiveness pressure, subsidiary resources, green management adoption and subsidiary's performance: Evidence from Taiwanese manufactures. *Journal of Business Ethics*, *79*(1/2), 199–212. doi:10.100710551-007-9382-8

Polonsky, M. J. (1994). An introduction to green marketing. *Electronic Green Journal*, *1*(2), 1–10.

Porter, M., & van der Linde, C. (1995). Green and competitive: Ending the stalemate. *Harvard Business Review*, (September-October): 120–133.

Reinhardt, F. (1999). Market failure and the environmental policies of firms: Economic rationales for 'beyond compliance' behavior. *Journal of Industrial Ecology*, *3*(1), 9–21. doi:10.1162/108819899569368

Shaw, D., & Clarke, I. (1999). Belief Formation in Ethical Consumer Groups: An Exploratory Study. *Marketing Intelligence & Planning*, *17*(2), 109–119. doi:10.1108/02634509910260968

Siegel, D. S. (2009). Green management matters only if it yields more green: An economic/strategic perspective. *The Academy of Management Perspectives*, *23*(3), 5–16. doi:10.5465/amp.2009.43479260

Sinthupundaja, J., & Kohda, Y. (2017). Effects of Corporate Social Responsibility and Creating Shared Value on Sustainability. *International Journal of Sustainable Entrepreneurship and Corporate Social Responsibility*, *2*(1), 27–38. doi:10.4018/IJSECSR.2017010103

Soonthonsmai, V. (2007). Environmental or green marketing as global competitive edge: Concept, synthesis, and implication. In *EABR (Business) and ETLC (Teaching) Conference Proceeding*, Venice, Italy.

Steenkamp, E. M., & Gielens, K. (2003). Consumer and market drivers of the trial probability of new consumer packaged goods. *The Journal of Consumer Research*, *30*(3), 368–384. doi:10.1086/378615

Tanner, C., & Wolfing Kast, S. (2003). Promoting sustainable consumption: Determinants of green purchases by Swiss consumers. *Psychology and Marketing*, *20*(10), 883–902. doi:10.1002/mar.10101

Turker, D. (2009). Measuring Corporate Social Responsibility: A Scale Development Study. *Journal of Business Ethics*, *85*(4), 411–427. doi:10.100710551-008-9780-6

Uusitalo, O., & Oksanen, R. M. (2004). Ethical consumerism: A view from Finland. *International Journal of Consumer Studies*, *28*(3), 214–212. doi:10.1111/j.1470-6431.2003.00339.x

Vermeir, I., & Verbeke, W. (2006). Sustainable food consumption: Exploring the consumer "attitude–behavioral intention gap. *Journal of Agricultural & Environmental Ethics*, *19*(2), 169–194. doi:10.100710806-005-5485-3

Vermeir, I., & Verbeke, W. (2008). Sustainable food consumption among young adults in Belgium: Theory of planned behaviour and the role of confidence and values. *Ecological Economics*, *64*(3), 542–553. doi:10.1016/j.ecolecon.2007.03.007

Vitell, S. J., Singhapakdi, A., & Thomas, J. (2001). Consumer ethics: an application and empirical testing of the Hunt-Vitell theory of ethics. *Journal of Consumer Marketing*, *18*(2), 153–178. doi:10.1108/07363760110386018

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Wheale, P., & Hinton, D. (2007). Ethical consumers in search of markets. *Business Strategy and the Environment*, *16*(4), 302–315. doi:10.1002/bse.484

Wegener, D. T., & Petty, R. E. (1994). Mood management across affective states: The hedonic contingency hypothesis. *Journal of Personality and Social Psychology*, *66*(6), 1034–1048. doi:10.1037/0022-3514.66.6.1034 PMID:8046576

Young, W., Hwang, K., McDonald, S., & Oates, C. J. (2010). Sustainable consumption: Green consumer behaviour when purchasing products. *Sustainable Development*, *18*(1), 20–31.

This research was previously published in the International Journal of Sustainable Entrepreneurship and Corporate Social Responsibility (IJSECSR), 3(1); edited by Amulya Gurtu, pages 35-52, copyright year 2018 by IGI Publishing (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

APPENDIX

Table 5. Scales and items

S.no.	Statement	1	2	3	4	5	6	7
1.	**Green Innovation (GI)**							
a.	I am usually among the first to try any new green product/ brand. (GI1)							
b.	I feel good about the company that launches innovative green products in the market. (GI2)							
c.	I feel that green product innovation doesn't make a company superior to other company. (GI3)							
2.	**Ethical responsibility(ETHR)**							
a.	I feel selling green products in market is the ethical responsibility of a business. (ETHR1)							
b.	Customer satisfaction should be highly imp for the companies/brands. (ETHR2)							
c.	I feel company should emphasis towards the social responsibilities to society. (ETHR3)							
d.	I feel companies should contribute more to campaigns and projects that promote the well-being of the society. (ETHR4)							
4.	**Green Purchase Intention(GPI)**							
a.	I like to purchase new and green products. (GPI1)							
b.	I probably choose green products to buy as their brand image is better. (GPI2)							
c.	I feel green products are healthier and safer. (GPI3)							
d.	I would describe myself as environmentally responsible. (GPI4)							
e.	My purchase habits are affected by my concern for our environment. (GPI5)							

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 52
Driving Green Marketing in a Developing Country:
Reducing the Attitude–Behaviour Gap

Shweta Pandey
International Management Institute, India

Deepak Chawla
International Management Institute, India

ABSTRACT

Despite having a pro-environment attitude, customers may not consistently reflect the same in their behaviour. This chapter explores the applicability of the social-normalisation theory to reduce the attitude-behaviour gap of customers for driving green behaviour in India. The theory argues that green behaviour can be driven by positioning green activities as normal. The chapter details the findings of an empirical study done across 496 customers pan India. Analysis done based on various techniques (Heat maps, factor analysis and regression) indicates that while a broader consensus existed among customers about what is green, the conceptions of normality of the activities vary thereby, corroborating the existence of an attitude-behaviour gap. Results shows that perceptions of what is normal have a significantly higher impact than perceptions of what is green and hence, social-normalisation theory can be applied to drive green marketing in developing countries like India.

INTRODUCTION

Rapid pace of growth and burgeoning population has bought unmindful and irresponsible consumerism leading to several environmental challenges for emerging economies in Asia (Zhao and Schroeder, 2010; Lee, 2009). Asian markets like India and China face growing challenges like resource scarcity, rising consumption levels and fast pace of urbanisation resulting in sustainability issues for both consumers and companies (Accenture and UN Global Compact, 2013). As per World Bank estimates, the cost of environmental degradation from various sources (urban air pollution; inadequate water supply, poor sanitation, hygiene; indoor air pollution, natural resource damage) in India was USD 80 billion or 5.7%

DOI: 10.4018/978-1-5225-7915-1.ch052

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

of GDP in 2009 (The World Bank, 2013). In a survey conducted across 178 countries by World Bank, India ranked 155th overall and almost last in the level of air pollution exposure (The World Bank, 2014). Greendex 2008 survey findings show that consumer choices have a big role in ensuring sustainable pro-environment practices (phys.org, 2008). For example, customer choices regarding lowering household energy consumption by using energy-efficient devices, reduction of fuel consumption by walking or using public transport instead of individual transport, use of organic or lesser polluting products can impact environment positively. Individuals need to accept pro-environmental products which may impact their lifestyles and beliefs. Thus, many of the environmental issues are embedded in human behaviour and therefore, need to be managed by changing the relevant behaviour (Vlek and Steg, 2009).

While there is an increase in environmental issues in emerging Asian markets like India, yet researchers find a higher proclivity towards the future purchase of sustainable products by customers of these emerging markets (Khare, 2015; Kumar and Ghodeswar, 2015; Accenture and UN Global Compact, 2013). Further, the rising economic and social costs of environmental pollution resulting in business sustenance issues, stricter enforcement of environmental regulations, higher awareness and penchant for customers to adopt pro-environmental practices and have led Indian firms to explore green marketing for sustainable growth (Saxena and Khandelwal, 2012; Mishra and Sharma, 2010; Jain and Kaur, 2004).

Green marketing is the marketing of pro-environment products or products that are presumed to be environmentally preferable (Barbarossa and Pastore, 2015). Green marketing can create value for corporates as it yields a triple bottom-line of social, environmental and financial performance for the firms (Elkington, 1997). It can help companies manage risk of operational disruptions like resource scarcity and climate-change. It can reduce operating costs through better internal resource management like minimisation of energy consumption and higher carbon credits, which can result in improved value propositions for products. Driving green appeal can further mitigate risks, capture opportunities from regulation (Barbarossa and Pastore, 2015) and can drive higher brand equity (Trott and Sople, 2016). Additionally, it can drive sustainable competitive advantage, for example; the 3Ps (polluting prevention pays) program of 3M has been recognised as a significant step in corporate environmental practices.

Indian companies have also been making progressive efforts towards green marketing. Tata Motors has taken steps for introducing alternate fuel based cars like hybrid-electric cars, CNG based Nano and the greener Indigo; ITC is promoting green hotels; Samsung India and LG are building eco-friendly and energy-efficient electronics, etc. (Trott and Sople, 2016; Mishra and Sharma, 2010). Similarly, durable, non-durable and service industries are pursuing green marketing in India to ensure sustainable growth (Saxena and Khandewal, 2012).

RESEARCH CONTEXT: THE ATTITUDE-BEHAVIOUR GAP

Numerous studies done across the world as well as in India indicate that despite having a pro-environment attitude, customers do not consistently reflect the same in their behaviour (Carrington, et al., 2014; Rettie et al., 2014; Black, 2010; Gupta and Ogden, 2009). Similarly, while several pro-environmental products have been introduced to the market by the Indian companies, green product's adoption has often met with more verbal appreciation from stakeholders and customers than actual purchase (Khare, 2015). Nittala (2014) finds that while educated university teachers in India are aware of impact of pro-environment consumption yet their beliefs do not necessarily result in purchase of green products. She states that product

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

recycling has a positive influence while comfort, eco-labelling, and lack of information has a negative influence on the willingness of teachers to purchase green products. Manaktola and Jauhari(2007) find that while Indian consumers show positive attitude towards hotels practising green marketing, they are not willing to pay additional money for the same. Jain and Kaur (2004) find that Indians (sample limited to Delhi) have high willingness towards pro-environment behaviour but feel that individual contribution may not do much towards the cause and therefore, their pro-environment behaviour is confined to themselves. Thus, the attitude-behaviour gap precludes adoption of green practices in India. Marketers need to understand how to bridge this attitude-behaviour gap to ensure sustainability of green marketing.

Several approaches have been explored to address the attitude-behaviour gap. Moser (2015) suggests that green marketing needs a complete blend of economic, technological and cultural adoption to manage the attitude-behaviour gap. Ottman et al. (2006) critique the myopic sense of green marketers and state that marketers focus on the positioning of green products as environmental friendly and do not focus on customer satisfaction resulting in consumers not purchasing green products. Other researcher's highlight issues like high pricing and scarce availability (Eckhardt et al., 2010; Finisterra do Paco and Raposo, 2010; Bhate, 2001), lack of consumer knowledge or information (Ottman et al., 2006) and improper communication (Barbarossa and Pastore, 2015) as reasons for customers not adopting green products. Researchers argue for the need to refocus on consumer value, enhancing consumer knowledge, environmental concern and ensuring credibility of product claims (Ottman et al., 2006; Finisterra do Paço and Raposo, 2010). Social norms i.e. complying with community beliefs and practices are stated to have a significant impact on green behaviour of customers across the world (Fiske and Taylor, 2013; Alcott, 2011; Nolan et al., 2008). However, consumption-practices change over time and are shaped by what is considered normal within a social group or a community or a reference group (Gupta and Ogden, 2009). Thus, an emerging area beyond customer attitudes, knowledge and product characteristics is the process of social-normalisation for driving sustainable green marketing in India (Rettie et al., 2014).

Social-normalisation relates to gradual acceptance of green activities as normal by the consumers leading to better adoption and sustainability of such practices (Rettie et al., 2014). However, conception of what constitutes normal practice changes over times and thus, there is a need to assess them continuously. Diverse cultures, regions and social classes have varied opinion about activities being green versus normal and consequently, the social-normalisation theory needs to be explored across different national and cultural contexts (Rettie et al., 2012). However, the social-normalisation process remains unexplored in the Indian context. Further, social norms may be driven by various factors like gender, marital status, income, region, education, etc. (Uddin and Khan, 2016; Kumar and Ghodeswar, 2015; Khare, 2015; Saxena and Khandelwal, 2012; Jain and Kaur, 2006). Diamantopoulos et al. (2003) suggest that factors like legislative norms, social norms and situational impact factors should be analysed along with socio-demographics to understand the green customer profile. Thus, there is also a need to understand the impact of socio-demographic factors on green behaviour to drive better marketing strategies (Lee, 2009).

Given the above research gaps, this chapter has two objectives:

1. Explore the impact of social-normalisation theory in the Indian green marketing context.
2. Understand the impact of socio-demographic factors on green marketing strategies in India.

This chapter explores the social-normalisation process and its impact on adoption of green practices in India based upon an empirical study.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

LITERATURE REVIEW

Social-normalisation is the process of green activities and products being gradually perceived as mainstream or normal over a period resulting in higher acceptance and sustainability of the practices by the customers (Rettie et al., 2014). Researchers argue that green practices, which are considered as normal, become a habit for consumers and are pursued more often than the ones which are positioned on just environment benefit and therefore, such normalisation of practices can lead to reduction in the attitude-behaviour gap in the green marketing context (Shove, 2003).

The impact of social norms on adoption of pro-environment behaviour has been observed in several studies. For example, Barr et al. (2001) state that "putting out recyclable material for collection" is a socially-visible activity and is replicated by others due to it being perceived as a social norm. Social norms are also known as subjective norms. Several studies show that such socially visible subjective norms impact pro-environmental behaviour (Wang et al., 2011; Park & Ha, 2012) like purchase of green products and recycling. Johnstone and Tan (2015) state that making green as the social norm can lead to bridging of the green attitude versus behaviour gap as it leads to the collective goals being prioritised over individual goals. Comparative feedback on energy consumption of oneself versus others in society has been stated to motivate people for energy consumption (Alcott, 2011). Adoption of ecology-friendly practices into the normal routines of consumers impacts their sustainability. For example, Shove (2003) highlights that patterns of consumption of energy and water (depicted through examples of laundering and showering) reflect people normal habits and routines. Some studies done in the Indian context also highlight the impact of social norms on adoption of green practices in India. Khare (2014) finds that normative influences, i.e. compliance to social norms to avoid negative consequences, impact green attitude of Indian consumers. Kumar and Ghodeswar (2015) find that social appeal, environment protection and responsibility, green product experience and environmental friendliness of companies drive green behaviour in India. Consumer conceptions of normality are driven more at a social level than individual (Shove, 2003) and therefore, sustainability of green consumption requires such green practices to be perceived as normal by the individual. These examples indicate that social-normalisation can be extended to pro-environmental behaviour.

However, green practices and their perceptions may vary across countries. For example, people in developed countries use household heating/cooling systems whereas the same is yet to be adopted across larger parts of India. Similarly, tumble drying is a normal practice in the US and UK households whereas Indians practice drying in sunlight as the norm, resulting in different energy consumption requirements. Hence, such changes in social norms needs continued focus and research (Khare, 2015; Varman and Costa, 2008).

Some researchers have explored the impact of socio-demographics on adoption of green practices in India. Saxena and Khandelwal (2010) find that compared to males, females have a higher positive attitude towards green marketing. They also find that married people, people living in metros and big cities, better educated and older people have a more positive attitude toward green marketing. Krishna and Qaim (2008) find that higher level of wealth and education impact sustainable acceptance and consumption of genetically modified crops. However, given the attitude-behaviour gap there is a need to further explore impact of socio-demographics on the actual green behaviour.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

RESEARCH METHODOLOGY

A study was conducted to explored customer conceptualisation for some common environment-related activities. These activities consisted of a mix of activities adapted from existing literature (Rettie et al., 2012) and new activities added based on the Indian context and expert opinion. The research steps are explained below.

Step 1: Visualising Consumer Perceptions of Green vs. Normal.

All respondents were asked to rate each pro-environmental activity across green and normal scales. The results were plotted graphically using heat maps to visualise consumer perceptions of activities as being green versus normal and draw insights based on the same.

Step 2: Exploring Perceived Green and Normal Dimensions.

The activities were grouped into green and normal dimensions using exploratory factor analysis to identify the key green and normal perceptions existing in the Indian context.

Step 3: Exploring Actual Green Behaviour Dimensions.

Exploratory factor analysis was done to identify green behaviour dimensions in the Indian context.

Step 4: Impact of Green and Normal Perception Factors on Actual Green Behaviour Dimensions.

Expert opinion was used to identify activities relevant to each of the green behaviour factors found in step 3. Then green and normal perception factors were formed using the average of ratings given on the normal and green scales respectively for the above identified activities. Each green behaviour dimension was regressed upon the green and normal perception factors to assess the impact of green and normal perceptions on the actual green behaviour.

Step 5: Impact of Socio-Demographics on Green Behaviour Dimensions

The detailed methodology and results are discussed ahead.

Survey Development

A quantitative survey was developed containing four key sections. Section I of the questionnaire had items related to socio-demographic data like age, gender, occupation, income, marital status, etc. Section II and III captured customer perceptions of 23 sustainability related activities being normal and being green respectively using a 5-point Likert scale (Strongly disagree = 1; Strongly agree = 5). Section IV captured the level of green behaviour exhibited by customers using 15 items drawn from previous research (Robert, 1996). The questionnaire was rolled out both online and offline across all four regions in India.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Selection of Activities

23 sustainability related activities were selected from a mix of previous studies on sustainability (Rettie et al., 2012) and post discussions with experts. Some activities like "drying clothes in a tumble dryer," "using patio heaters" and "eating meat or fish" (Rettie et al., 2012) were not considered. This was done in consultation with experts as use of tumble dryers or patio heaters is not prevalent across all regions in India due to varying climatic conditions and level of technological acceptance. Further, "eating meat or fish" may be driven by religious beliefs in India and hence, was removed from the list of activities. Some activities like "Showering/bathing on alternate days," "Monitoring electricity consumption," were modified to reflect the Indian context and reworded as "Using a bucket of water instead of a shower while bathing" and "Switching off lights and fans when not in use." In addition, new activities that were not included in the research by Rettie et al. (2012) were added to the study based on expert opinion. These were, "Use of cosmetics made from herbs and plant extracts," "Sometimes using a solar cooker for cooking," "Using both sides of paper and waste envelopes for rough work," "Purchasing lead-free petrol," "Switching-off vehicle ignition at red lights" and "Reusing plastic bags obtained at time of shopping for other purposes." These statements reflect some of the prevalent pro-environment practices, which may be the result of several communication campaigns done by pro-environmentalists in India. Furthermore, some statements depicting anti-green behaviour statements were added. For example, "Use of mosquito repellant liquids at night instead of mosquito nets," "Driving in a self-owned vehicle to the office every day," "Using disposable dishes for picnic/outings" and "Purchase of canned food." This was done to ensure inclusion of activities, which may have been adopted by people in certain regions or areas due to benefits like time-saving and personal convenience, but the level of adoption may differ across regions. These anti-green activities were reverse-coded for factor analysis.

ANALYSIS

Data Profile

Out of the 578 questionnaires collected, 514 were complete and usable. Post removal of outliers, 496 were retained. The data points showed varying levels of socio-demographic factors like age, occupation, income, region, education, etc. as given in Table 1.

Visualising Consumer Perception Gap Using Heat Maps

Heat maps are two-dimensional representation of data, which visually indicate the percentage of customers selecting a level of rating (green/normal) using a continuous range of symbols. Cells with hollow dots and light grey shaded background depict a lower percentage of customers selecting a rating and cells with full black dots and darker grey shade background indicate the highest percentage selecting a rating (Figure I). In addition, mean, standard deviation of each activity is also depicted (Figure I). The grid helps understand the distributional patterns of responses against each activity. A quick look overall shows that there are differences across many activities in terms of being green versus being normal, which points towards differences in the social-normalisation process across activities.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 1. Sample data socio-demographics

Gender	Male	58.20%
	Female	41.80%
Region	North	33.00%
	South	22.20%
	East	22.20%
	West	22.60%
Age Group (years)	18-25	18.55%
	26-35	49.25%
	36-45	22.10%
	46-55	7.50%
	56 and greater	2.60%
Occupation	Student	25.80%
	Professional	29.40%
	Service	30.90%
	Self-employed/Business	6.00%
	Homemaker/Retired/Others	7.90%
Income (INR)	less than or equal to 5 lacs	13.00%
	5 lacs and above but less than 10 lacs	24.10%
	10 lacs and above but less than 15 lacs	20.50%
	15 lacs and above but less than 20 lacs	9.60%
	equal to or greater than 20 lacs	32.80%
Marital Status	Married	53.50%
	Single	46.50%
No. of people staying in house	1	3.00%
	2	13.40%
	3	21.30%
	4	32.40%
	5	15.80%
	6 and greater	14.10%
No. of children	0	53.70%
	1	24.30%
	2	19.00%
	>2	3.00%

Note: The professional category denotes people who run their own business setup and Service denotes people who work for other organisations.

Green Perceptions

Several activities are perceived as green/very green (Figure 1) by a large percentage of respondent base. This is depicted by the similar dark grey shading with solid dots in the green/very green rating category. This consensus is also confirmed by the fact that these activities have a high mean (showing they are

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

green) and low standard deviation (showing agreement between customers). Such activities include "using public transport," "switching off the fans and lights when not in use," "using a bucket of water instead of shower for bathing," "using organic products," "using a solar cooker," "walking for short distances," "buying recycled products," "using energy-saving appliances," "planting a tree," "using both sides of paper" and "switching off vehicle at red lights."

There is another set of activities, which are not perceived as green by customers. These are depicted by the dark grey shading with solid dots in the "not green"/ "not at all green" scale ratings. These include, "using a self-owned vehicle to the office," "using plastic bags given by shopkeepers instead of taking your own" and "leaving TV on standby." The rating on the activity, "buying grocery online," shows that customers have no clarity on it being "green" or "not green." This is visually depicted by the dark grey shading with solid dots in the "neither" rating category. The activity has a mean close to 0 and standard deviation less than one showing that most customers do not know how to rate the activity- green or non-green.

There are some activities where the customers did not seem to have a consensus as a similar percentage of them marked the activity as "green" versus "not-green" (activities like buying milk in plastic pouches, buying canned food and using mosquito repellent liquids instead of nets at night). These activities have negative means close to 0 and high standard deviation. Similarly, another group of activities, like "using low phosphate detergent" and "buying lead-free petrol" has ratings between "neither" to "green," depicting the possibility of multiple groups. The activity "using disposable dishes for picnic/outings" has ratings spread across all categories showing dispersed opinion among customers. This may also indicate the presence of different groups of respondents having divergent views and needs further analysis.

Normal Perceptions

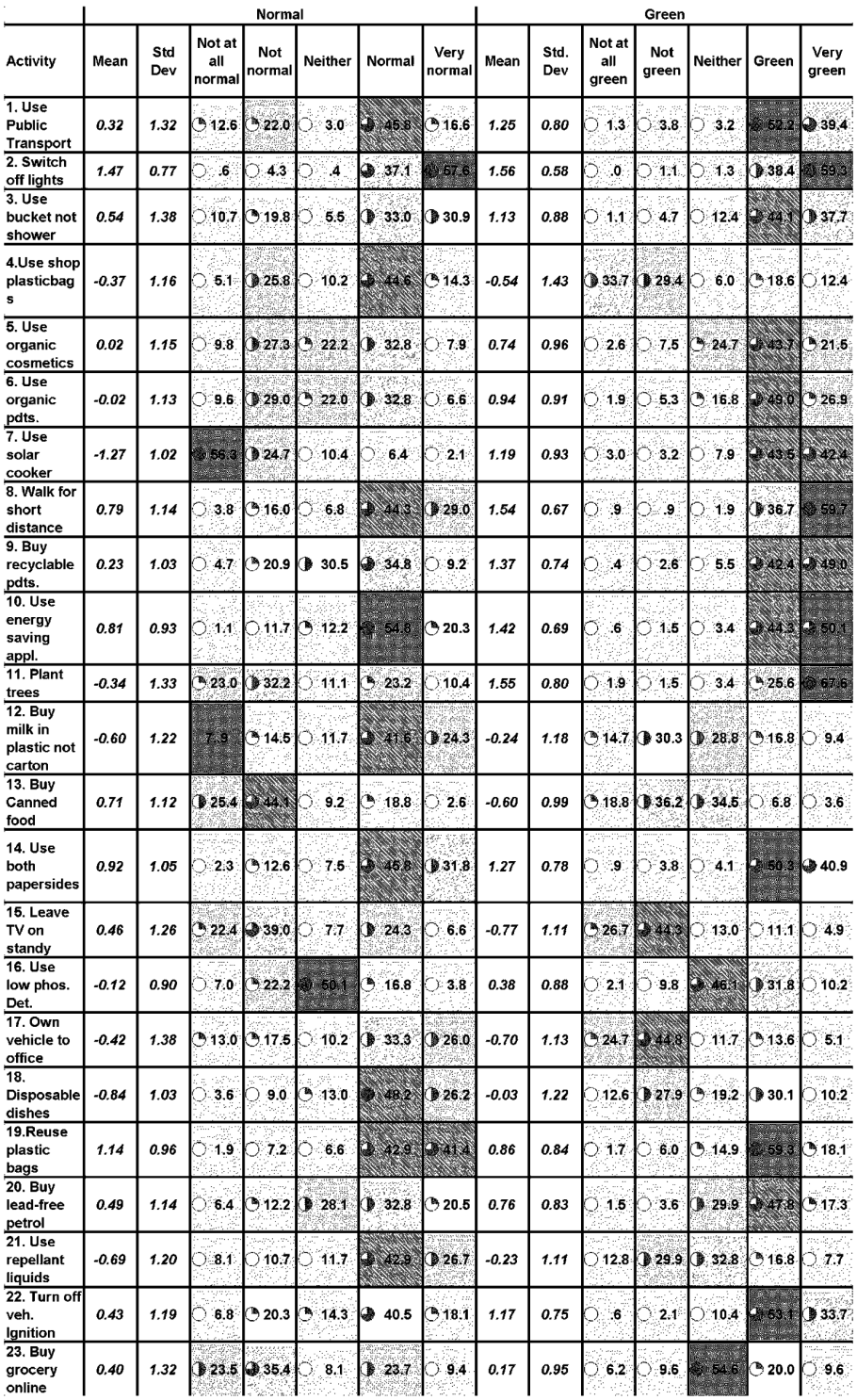
Analysis of the heat map for normal scale for all activities shows that opinion about the 23 activities being normal is dispersed. Only few activities like, "switching off lights and fans when not in use," "using a bucket of water for bathing instead of a shower," "walking short distances," "using both sides of paper," "using energy-saving appliances" and "reusing plastic bags for other purposes" are rated as normal by a high proportion of the customers. These activities are also clearly understood as green by customers indicating that they have gone through the social-normalisation process.

While there is a consensus among customers on the activity "using a solar cooker" being green; yet, it is not rated as normal. Further, "using a self-owned vehicle for office" is understood to be a non-green activity but is rated as normal. This attitude-behaviour difference indicates that perceptions about activities being pro-environment may not result in their being incorporated into the normal routines of consumers and vice versa.

Further, different levels of social-normalisation exist for a larger number of activities as depicted by the variation in customer perceptions of the activities being normal or non-normal. For example, activities like "using public transport," "using plastic bags given by shopkeeper instead of carrying own," "using organic ingredient based cosmetic products," "using organic products," "buying recyclable products," "planting a tree," "leaving TV on standby," "switching off vehicle at red lights" and "buying grocery online" have varying perceptions of normality. Similarly, "buying milk in plastic packets" is rated as a normal activity by most respondents whereas the opinion on it being green/non-green is divided. This is indicative of different levels of social-normalisation process for these activities across diverse groups and therefore, a need for understanding various segments associated with it.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 1. Heat Map showing normal versus green perceptions of consumers



	Normal							Green						
Activity	Mean	Std Dev	Not at all normal	Not normal	Neither	Normal	Very normal	Mean	Std. Dev	Not at all green	Not green	Neither	Green	Very green
1. Use Public Transport	0.32	1.32	12.6	22.0	3.0	45.8	16.6	1.25	0.80	1.3	3.8	3.2	52.2	39.4
2. Switch off lights	1.47	0.77	.6	4.3	.4	37.1	57.6	1.56	0.58	.0	1.1	1.3	38.4	59.3
3. Use bucket not shower	0.54	1.38	10.7	19.8	5.5	33.0	30.9	1.13	0.88	1.1	4.7	12.4	44.1	37.7
4.Use shop plasticbags	-0.37	1.16	5.1	25.8	10.2	44.6	14.3	-0.54	1.43	33.7	29.4	6.0	18.6	12.4
5. Use organic cosmetics	0.02	1.15	9.8	27.3	22.2	32.8	7.9	0.74	0.96	2.6	7.5	24.7	43.7	21.6
6. Use organic pdts.	-0.02	1.13	9.6	29.0	22.0	32.8	6.6	0.94	0.91	1.9	5.3	16.8	49.0	26.9
7. Use solar cooker	-1.27	1.02	55.3	24.7	10.4	6.4	2.1	1.19	0.93	3.0	3.2	7.9	43.5	42.4
8. Walk for short distance	0.79	1.14	3.8	16.0	6.8	44.3	29.0	1.54	0.67	.9	.9	1.9	36.7	59.7
9. Buy recyclable pdts.	0.23	1.03	4.7	20.9	30.5	34.8	9.2	1.37	0.74	.4	2.6	5.5	48.4	49.0
10. Use energy saving appl.	0.81	0.93	1.1	11.7	12.2	54.6	20.3	1.42	0.69	.6	1.5	3.4	44.2	50.1
11. Plant trees	-0.34	1.33	23.0	32.2	11.1	23.2	10.4	1.55	0.80	1.9	1.5	3.4	25.6	67.6
12. Buy milk in plastic not carton	-0.60	1.22	7.9	14.5	11.7	41.6	24.3	-0.24	1.18	14.7	30.3	28.8	16.8	9.4
13. Buy Canned food	0.71	1.12	25.4	44.1	9.2	18.8	2.6	-0.60	0.99	18.8	36.2	34.5	6.8	3.6
14. Use both papersides	0.92	1.05	2.3	12.6	7.5	46.9	31.8	1.27	0.78	.9	3.8	4.1	50.3	40.9
15. Leave TV on standy	0.46	1.26	22.4	39.0	7.7	24.3	6.6	-0.77	1.11	26.7	44.3	13.0	11.1	4.9
16. Use low phos. Det.	-0.12	0.90	7.0	22.2	50.1	16.8	3.8	0.38	0.88	2.1	9.8	46.1	31.8	10.2
17. Own vehicle to office	-0.42	1.38	13.0	17.5	10.2	33.3	26.0	-0.70	1.13	24.7	44.8	11.7	13.6	5.1
18. Disposable dishes	-0.84	1.03	3.6	9.0	13.0	49.2	26.2	-0.03	1.22	12.6	27.9	19.2	30.1	10.2
19.Reuse plastic bags	1.14	0.96	1.9	7.2	6.6	42.9	41.4	0.86	0.84	1.7	6.0	14.9	59.3	18.1
20. Buy lead-free petrol	0.49	1.14	6.4	12.2	28.1	32.8	20.5	0.76	0.83	1.5	3.6	29.9	47.8	17.3
21. Use repellant liquids	-0.69	1.20	8.1	10.7	11.7	42.9	26.7	-0.23	1.11	12.8	29.9	32.8	16.8	7.7
22. Turn off veh. Ignition	0.43	1.19	6.8	20.3	14.3	40.5	18.1	1.17	0.75	.6	2.1	10.4	63.1	33.7
23. Buy grocery online	0.40	1.32	23.5	35.4	8.1	23.7	9.4	0.17	0.95	6.2	9.6	54.6	20.0	9.6

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Perceived Green and Normal Dimensions

To explore key green and normal dimensions perceived by the customers, exploratory factor analysis (EFA) was conducted for the 23 activities for green and normal ratings respectively.

Green Dimensions

EFA on the 23 activities (green rating) was done using varimax rotation. KMO (0.694) and Bartlett's test for sphericity ($p < 0.00$) indicated factor analysis was appropriate (Hair et al., 2013). All items with loading < 0.5 or cross-loading on other items, were removed resulting in three dimensions. Each dimension had Cronbach alpha >= 0.6 (Nunnally, 1978) and the overall variance explained was 58.62% (Hair et al., 2013).

The three green dimensions obtained were (Table 2) as follows:

- Using pro-environment packaging
- Saving resources
- Using organic products

While all 23 activities were rated on the green scale by customers, agreement in terms of categorisation of these activities was limited to only three dimensions (Table 2). These groupings can be argued to be driven by the mass pro-environmental campaigns done by various sectors like government and private organisations over time, which have eventually moved people to perceive these as green activities.

Normal Dimensions

EFA was done on the 23 activities (Normal ratings) using varimax rotation. KMO (0.534>0.5) and Bartlett's test for sphericity ($p<0.00$) indicated factor analysis could be conducted for the normal scale items. All items with loading<0.5 or having a cross-loading on other items were removed resulting in

Table 2. Perceived green dimensions, factor loadings for each item and Cronbach alpha values based on EFA on 23 activities (green ratings)

Dimension	Items	Factor Loading	Cronbach Alpha
Use of pro-environment packaging	Using plastic bags given by shopkeeper instead of carrying your own- R	.697	.608
	Buying milk in plastic packets versus cartons- R	.692	
	Use of mosquito repellent liquids instead of mosquito nets-R	.674	
	Purchase of canned food- R	.638	
Saving resources	Using energy saving appliances at home	.771	.632
	Walking instead of using own transport while going for short distance	.764	
	Switching off lights and fans when not in use	.675	
Using organic products	Use of cosmetics and toiletries made from herbs and plant extracts	.860	.742
	Using organic products	.854	

Note: R denotes that the item was reverse coded

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

two dimensions with a Cronbach alpha >= 0.6 for each dimension and an overall variance explained of 65.55%, which indicated satisfactory results (Hair et al., 2013). The two normal dimensions obtained are given below and shown in Table 3:

- Use of private vehicles.
- Use of organic products.

While the study found three green dimensions (Table 2), only two normal dimensions were found (Table 3). "Use of organic products" was the only common dimension having similar green and normal ratings.

Actual Green Behaviour Dimensions

Next, EFA was done on the 15 green behaviour items using varimax rotation. KMO (0.836 > 0.5) and Bartlett's test for sphericity ($p < 0.00$) indicated appropriateness of factor analysis. All items with loading < 0.5 or having a cross-loading on other items were removed resulting in two actual green behaviour dimensions with a Cronbach alpha >= 0.6 (Nunnally, 1978) for each dimension and an overall variance explained of 61.22%, which indicated acceptable results (Hair et al., 2013). The green behaviour factors are given in Table 4.

- Consumption of pro-environmental products
- Consumption of less electricity

Next, the study analysed the impact of green or normal perceptions on the actual green behaviour.

Impact of Green and Normal Perception Factors on Actual Green Behaviour

Expert opinion was used to identify activities relevant to each of the green behaviour factors found in step 3. Then green and normal perception factors were formed using the average of ratings given on the normal and green scales respectively for the above identified activities. Each green behaviour dimension

Table 3. Perceived normal dimensions, factor loadings for each item and Cronbach alpha values based on EFA on 23 activities (normal ratings)

Dimension	Items	Loading	Cronbach Alpha
Use of Private vehicles	Using public transport wherever possible	.836	.600
	Driving in own vehicle to office everyday- R	.726	
	Walking instead of using own transport while going for short distance	.655	
Use of organic products	Use of cosmetics and toiletries made from herbs and plant extracts	.894	.754
	Using organic products	.890	

Note: R denotes the item was reverse coded

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 4. Green behaviour dimensions, factor loadings for each item and Cronbach alpha values obtained from EFA done on 15 green behaviour items

Dimension	Items	Loading	Cronbach Alpha
Consumption of pro-environmental products	I avoid products made by those companies which are irresponsible towards keeping ecological balance	.800	.826
	I make every effort to buy paper products, for example, paper napkins, made from recycled paper	.764	
	I do not buy household products that harm environment	.756	
	I have convinced members of my family or friends not to buy some products that are harmful to the environment	.733	
	When I make choice between two similar products, I buy one which is less polluting	.727	
Consumption of less electricity	I conserve energy by turning off lights and electrical appliances when I am not using them	.837	.722
	I try to minimise the use of electricity to save energy	.820	
	I use those bulbs which use very little of electricity	.711	

was regressed upon the green and normal perception factors relevant to it to assess the impact of green and normal perceptions on the actual green behaviour.

Green Behaviour Dimension 1: Pro-Environmental Product Consumption

To understand whether perceptions of green versus normal impact the consumption of pro-environmental products, 10 activities related to green behaviour factor of pro-environmental product consumption were chosen from the list of 23 activities for each of the green and normal scales. The items are listed below.

- Using plastic bags given by shopkeepers instead of carrying own bag
- Use of cosmetics and toiletries made from herbs and plant extracts
- Using organic products
- Sometimes using a solar cooker for cooking
- Using low-phosphate detergent for cleaning clothes
- Not using disposable dishes for picnic/outings
- Buying products that are recyclable
- Not buying milk in plastic packets and using cartons instead
- Not purchasing canned food
- Use of mosquito repellent liquids at night instead of mosquito nets

Ratings of the above activities on the green and normal scales were taken and averages of items for the green and normal scales respectively were done to arrive at the following factors.

- **Normal Pro-Environment Product Consumption:** This indicates the rating of the above stated activities on the normal scale by respondents. The factor reflects the level of normalisation of pro-environment product consumption related activities.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- **Green Pro-Environment Product Consumption:** This indicates the rating related to the level to which the customers assess the above activities to be green.

The pro-environmental product consumption dimension was then regressed upon the green and normal perception factors identified. The regression results are given in Table 5.

The regression is significant with a R^2 value of 0.143 indicating that 14.3 percent of the variation in green behaviour is explained by the two independent variables (green and normal pro-environment product consumption factors). The results show that only the normal pro-environment factor has a significant impact on the pro-environment product consumption behaviour whereas the impact of the green factor is insignificant ($p>0.05$). This supports the social-normalisation theory wherein as green activities become more embedded in the normal routines of society, people have a higher tendency to confirm to the same, even if they do not have very strong pro-green beliefs (Rettie et al., 2014). Hence, marketers can look upon using the social-normalisation theory to drive pro-environment product consumption sustainability behaviour.

The heat map of each of the 10 items forming the normal pro- environment consumption factor shows that there are two items among the ten items for normal pro-environment product consumption (using disposable dishes for picnics and using mosquito repellent liquids instead of nets) on which there is a consensus among a large percentage of customers with respect to the same being normal. For the other 8 items contributing to this factor, there are different groups, which look upon the activity as being normal/non-normal and therefore, there exist groups for which these activities need to be positioned as normal to ensure pro-environment consumption behaviour. Thus, the impact of socio-demographics on pro-environmental product consumption behaviour is analysed later in the chapter.

Table 5. Regression results for green behaviour related to pro-environment consumption

Model Summary						
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**		
1	.379[a]	.143	.140	.69392		
ANOVA						
1	Regression	37.578	2	18.789	39.020	.000[a]
	Residual	224.390	466	.482		
	Total	261.968	468			
Variable	**Predictor**	**B coefficient**	**Standard error**	**Std. B coefficient**	**t**	**Sig.**
Pro-environment consumption	**Constant**	0.617	.055		11.173	.000
	Normal pro-environment product Consumption	0.697	.079	.379	8.805	.000

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Green Behaviour Dimension 2: Lower Electricity Consumption Behaviour

To understand if attitude towards the activity or normalisation of the activity impacts the lower electricity consumption behaviour, two activities related to lower electricity consumption were chosen from the list of 23 activities for each of the green and normal scales. The activities are:

- Switching off lights and fans when not in use
- Using energy-saving appliances at home,

The average of the ratings of the above two activities on the normal and green scales was done to form the following factors.

- **Normal Lower Electricity Consumption**: This indicates the rating given on the normal scale for the above two activities. The factor reflects the level of normalisation of the above two activities.
- **Green Lower Electricity Consumption:** This indicates the level to which customers assess the above activities to be green.

The lower level of electricity consumption behaviour was then regressed upon these green and normal perception factors. The regression results are given in Table 6.

The regression is significant with a R^2 value of 0.171 indicating that 17.1 percent of the variation in green behaviour is explained by the two independent variables (green and normal lower electricity consumption factors). The results show that both the normal and green lower electricity factors have a significant positive impact on actual lower electricity consumption behaviour. However, the impact of the normal factor is higher than the green factor as indicated by the coefficient values for each. This shows

Table 6. Regression results for green behaviour related to lower electricity consumption

Model Summary						
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**		
1	.414[a]	.171	.168	.51815		
ANOVA						
1	Regression	25.888	2	12.944	48.212	.000[a]
	Residual	125.110	466	.268		
	Total	150.998	468			
Variable	**Predictor**	**B coefficient**	**Standard error**	**Std. B coefficient**	**t**	**Sig.**
Lower electricity consumption	Constant	.705	.079		8.944	.000
	Normal lower electricity consumption	.296	.037	.344	8.048	.000
	Green lower electricity Consumption	.196	.047	.179	4.185	.000

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

that as a green activity becomes a part of the normal routine of people, more people start confirming to it and thus, marketers need to position green activities as normal for them to ensure sustainability of such practices.

Impact of Socio-Demographic Factors on the Green Behaviour Dimensions

Next impact of socio-demographic differences on the green behaviour factors was analysed. The ANOVA results for the same are summarised in Table 7.

Table 7. Results for ANOVA for green behaviour factors

Factor	Group	Pro-Environment Consumption			Lower Electricity Consumption		
		F value	p value	Mean value	F value	p value	Mean value
Gender	Male	0.419	0.518(ns)	0.479	0.748	0.388(ns)	1.316
	Female			0.524			1.362
Marital Status	Married	3.935	0.048**	0.561	4.856	0.028**	1.389
	Single			0.424			1.273
Income	<INR15 lacs	13.196	0.000***	0.604	0.005	0.944(ns)	1.337
	>= INR15 lacs			0.353			1.333
Region	North	6.031	0.000***	0.309	1.705	0.165(ns)	1.253
	South			0.686			1.394
	East			0.573			1.381
	West			0.515			1.352
Occupation	Student	1.833	0.096(ns)	.413	2.232	0.050**	1.275
	Self-employed			.307			1.309
	Profession			.444			1.289
	Homemaker			.656			1.546
	Service			.622			1.367
	Retired			.583			1.694
Age	<= 25 years	6.602	0.000***	.452	7.981	0.000***	1.222
	26-35 years			.402			1.259
	36-45 years			.561			1.519
	>= 46 years			.910			1.510
Family size (no of members)	1	1.722	0.128(ns)	.328	0.530	0.753(ns)	1.476
	2			.320			1.301
	3			.444			1.373
	4			.510			1.291
	5			.621			1.364
	>= 6			.618			1.476
No. of children	None	7.741	0.006**	0.409	1.941	0.1649(ns)	1.301
	1 or more children			0.600			1.374

Note: For p values *** = 1% significance level, **= 5% significance level

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- **Gender:** There is no significant difference across gender for each of the two green behaviour factors (Table 7).
- **Marital Status:** There is a significant difference by marital status for each of the green behaviour wherein married people have higher mean scores than singles for both pro-environment product consumption and lower electricity consumption green behaviour factors (Table 7).
- **Income:** The ANOVA result (Table 7) shows that there are significant differences across income categories for green pro-environment product consumption factor. The post-hoc analysis based on mean differences across the two groups (< 15 lacs and >= 15 lacs) reveals that the < INR15 lacs category has higher mean scores than >= 15 lacs income category for pro-environment product consumption behaviour. However, there are no significant differences across income categories for lower electricity consumption behaviour.
- **Region:** The ANOVA result (Table 7) shows that there are significant differences across regions for green pro-environment product consumption factor. The results show that mean green scores across India are in the following order South>East>West>North, i.e. South has the highest score and North the lowest score. The post-hoc results reveal that North is significantly lower on green consumption behaviour as compared to South and East. Further, South and East form one homogeneous subset. However, there is no significant difference across region mean scores on the consuming less electricity behaviour.
- **Occupation:** Although the ANOVA result shows a significant difference in lower electricity consumption behaviour by occupation (Table 7), the post-hoc results show no significant differences among each of the groups. This could also be due to the unequal group sizes.
- **Age Group:** The ANOVA results show that there are significant differences across age groups for both green behaviour factors (Table 7). The post-hoc analysis results reveal that the older age group (>45 years) has significantly higher pro-environment consumption behaviour than the other three age groups (<25 years, 26-35 years, 36-45 years). The age group greater than 45 years forms a subset considerably different than the other three age groups. Further, for the second green behaviour factor related to less electricity consumption, the age groups <25 years and 26-35 years form a homogeneous subset which is significantly different from the other subset consisting of 36-45 years and >45 years wherein the subset 2 mean scores for lower electricity consumption are significantly higher than the score of subset 1 which is similar to findings by Wang et al. (2011) in Beijing.
- **No of Family Members:** There is no significant difference based on family size for both green behaviour factors.
- **Children:** There is a significant difference across the groups having no child versus groups having 1 or more children for the pro-environment consumption green behaviour factor. Here, the mean score for green behaviour is higher for group having 1 or more children as compared to people having no children. However, there is no significant difference between the two groups for the factor of lower electricity consumption behaviour.

The study finds that pro-environment consumption behaviour (Table 7) is higher for people who are married, have less than INR15 lacs income, have children as compared to those who are single, having income of INR15 lacs or more and having no children. Further, the group with age of 45 years and above has higher pro-environment consumption behaviour than lower age groups. In addition, South and East are higher in pro-environment consumption behaviour than North. Therefore, the 10 activities need to

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

be reinforced by positioning them as normal for the following geo-demographics: lower age groups with respondents less than 46 years of age, marital status as single, income greater than or equal to 15 lacs and belonging to the North region.

FINDINGS AND MANAGERIAL IMPLICATIONS

The study finds that there exists a gap between green-attitudes and actual green behaviour of customers.

This gap may be driven by the fact that customers often find it inconvenient to practice pro-environmental behaviour and hence, do not adopt some of these practices (Carrette et al., 2012; Laroche et al., 2001). For example, Rettie et al. (2011) found that although consumers perceived flying for foreign holidays as not green, they regarded it as a normal part of their routine and did not envisage changing it. Conversely, other researchers suggest that customers are driven by social norms for environmentally friendly activities (Barr et al., 2011). For example, this study indicates that while some of the activities like "walking for short distances," "reusing plastic bags for other purposes," etc. may not be convenient, a high proportion of customers rate them as normal. This can be argued to be a result of customer habituation of these activities as depicted by the normal ratings attached to these activities. Such normalisation may have been driven through several initiatives like banning of plastic bags in some parts across the country by the Indian government, routine of collection of garbage by specific people in societies, shortage of water supply in some regions, etc. It could also have been driven by the economic cost of buying garbage bags for the lower-income group and the issue of not getting plastic bags easily for the higher-income groups. Thus, by using varied methods for different target groups, the same activity can be normalised across the society and result in higher green behaviour among customers. Similar results have been found in other research studies as well, for example; Gregory and Leo (2003) found that households with lower water usage show a higher involvement in water conservation issues and tend to form habits associated with lower water usage thereby entering a self-sustained cycle of conservation.

The study also finds that activities, which are perceived as non-green (driving in a self-owned vehicle to the office), are still part of normal activities. This could be driven by the fact that in many cases, people act habitually and may be guided by automated cognitive structures in their mind rather than reasoning (Steg and Vlek, 2009). Such habits can, however, be modified through some interventions. For example, Fujii et al. (2001) found that temporarily forcing car drivers to use alternative travel modes by closing the freeway access, reduced the level of their individual car use by modifying their beliefs about the alternate transport modes.

The study shows that there is a significant and relatively higher impact of normal factors on both the green behaviour dimensions i.e. pro-environment product consumption and lower electricity consumption factors.

The study finds that perceptions of activities being green do not impact pro-environment product consumption whereas perceptions of activities being normal have a significant impact on actual pro-environment product consumption. This corroborates the applicability of social-normalisation for driving green marketing in India. Further, the study finds a higher level of pro-environment product consumption green behaviour for respondents who belong to higher age group, are married and have children. These results corroborate previous findings (Saxena and Khandelwal, 2010; Laroche et al., 2001). This may be driven by the fear of environment degradation impacting the future of their children. Parents may care for their children and therefore, values of family welfare need to be stressed on pro-environment products

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

related communication. Further, people in the lower-income bracket (income of 15 lacs or less) exhibit higher level of pro-environment product consumption. This contrasts with the findings by Khare (2015) who states that higher income positively impacts pro-environment behaviour of the Indian consumers. This can be argued to be a result of unaffordability of products like canned food or disposable dishes and therefore, such activities may not have been adopted by the lower-level income groups. Thus, higher income levels may not automatically drive pro-environmental behaviour and therefore, incorporating green practices into normal routines of people may be a better way to sustain the same. In addition, pro-environment product consumption is highest in South region followed by the Eastern region in India. The same can be correlated with the fact that government in Southern states like Kerala have heavily focussed on driving green behaviour and promoted policies like organic farming. Government, political systems and institutions have a huge impact in emerging markets like India as they can use both direct and indirect measures to drive both demand and supply of green products (Stevens, 2010). Therefore, public-private partnerships can be used to drive green practices, for example, non-governmental organisations have worked with Spice board to enhance organic production of spices in Kerala, Tamil Nadu and Andhra Pradesh apart from North-eastern states. Further, social practice of relying on the Ayurveda treatment is embedded in traditions in these regions making them prone to buying products, which are green. Therefore, marketers need to have their communication and distribution for pro-environment products implemented in a socially embedded manner (i.e. working with the local community, using local human capital and through developing their relationships with government and non-government stakeholders) to ensure that social-normalisation process is faster and easier. This is especially important as people from different strata of society in a developing country like India may not be able to afford organic products, which are priced higher than normal ones but may adopt the practice based on social norms. Environmentally harmful products can be made less feasible (example, by incorporation of higher taxes or through legal prohibitions) and pro-environmental products can be made widely available (example, recycled paper, organic products, etc.). Marketers need to target specific-groups (as highlighted before) to reinforce social-normalisation of green activities resulting in long-term sustainability.

The empirical study results show that lower electricity consumption behaviour is impacted by both green and normal factors with the latter having a higher impact. Thus, the study finds that social-normalisation of green practices like switching off lights and fans when not in use or using energy saving appliances at home can drive lower electricity consumption in India corroborating the results from previous studies (Alcott, 2011; Nolan et al., 2008). Electricity consumption is different from product consumption as electricity is intangible and consumed only indirectly and as a by-product of other practices. It is not easily measurable in comparison to say price of a product and not socially visible as a lifestyle product. Information on social norms and individual electricity consumption can therefore, be given to customers for them to take steps towards meeting the norms and gradually make it part of their routine. On analysing items in the green and normal factors for lower electricity consumption (switching off lights and fans when not in use; purchasing electricity-saving appliances) there seems to be a consensus amongst customers on the same being green and normal respectively (Figure 1). However, comparison of the individual items shows that a lower percentage of customers rate the use of energy-saving appliances as normal. This essentially points to the need for introduction of higher incentives for people to buy such appliances. Companies selling green-rated products can highlight the savings attained by customers through use of lower-energy consumption electrical fittings/ appliances. Further, government can roll out policies, which necessitate the use of lower energy consumption fittings in corporate buildings to make it part of normal course of life. They can also introduce lesser taxes for such appliances, which

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

may lower the prices of such appliances and lead to their adoption by a higher number of individuals. Rewards like incentives for reduced electricity consumption can be launched, and these may be redeemable as points for purchasing lower electricity consumption products. In this way, the lower consumption behaviour will enter a cycle of self-reinforcement. Additionally, people can be showcased as a role model for others (Schultz et al., 2007) or could be given special memberships to socially important societies or clubs so that the behaviour becomes a social norm and over time is incorporated into routine of larger parts of society. Further, lower electricity consumption has a higher score for higher age group (36 years and above) and retired people. This may be driven by prior experience of these higher aged individuals where they have faced higher frequency of electricity shortfalls and therefore, developed a habit of saving electricity. Younger people may have experience of lesser electricity cuts and hence may not be so conscious about saving electricity or using energy-saving devices. Hence, effort should be made to drive awareness of electricity demand-supply gaps. Further, having price variations based on consumption levels can increase the electricity saving behaviour. Special marketing campaigns and events should be targeted towards youth and should stress on the need for saving electricity and purchase of energy-saving appliances.

In summary, the study concludes that as green activities become part of normal routine of customers, they start confirming to them. Hence, social-normalisation theory can be applied to the context of green marketing. Everyone can contribute to the environment by adopting pro-green behaviours as part of their routine life. The challenge for marketers is to facilitate such transition of activities from being construed as only green to becoming green and normal.

FUTURE RESEARCH DIRECTIONS

The empirical study done has used a limited number of activities in context of green marketing resulting in only two green behaviour dimensions. Therefore, future studies can explore other pro-environmental activities relevant to the green behaviour being researched. Social-normalisation is a continuous process and thus, categorisation of the activities as normal can change over a period thereby, necessitating further research. The research was limited to the four regions of India and therefore, needs to be replicated across other contexts- region, nation, society and culture. In addition, qualitative research can be done to corroborate or identify what is conceived as green or normal by consumers. Further, effect of various contextual factors, for example, physical infrastructure, technical facilities, availability of products, product characteristics, etc. in driving green behaviour need to be explored using techniques like experiments to get greater insights into which interventions can drive targeted behaviour.

REFERENCES

Aagerup, U., & Nilsson, J. (2016). Green consumer behavior: Being good or seeming good? *Journal of Product and Brand Management*, *25*(3), 274–284. doi:10.1108/JPBM-06-2015-0903

Accenture, UN Global Compact. (2013). *UN global compact—accenture CEO study on sustainability 2013. Architects of a better world.* Retrieved June 5, 2016, from https://www.unglobalcompact.org/docs/news_events/8.1/UNGC_Accenture_CEO_Study_2013.pdf

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Allcott, H. (2011). Social norms and energy conservation. *Journal of Public Economics*, *95*(9-10), 1082–1095. doi:10.1016/j.jpubeco.2011.03.003

Barbarossa, C., & Pastore, A. (2015). Why environmentally conscious consumers do not purchase green products: A cognitive mapping approach. *Qualitative Market Research: An International Journal*, *18*(2), 188–209. doi:10.1108/QMR-06-2012-0030

Barr, S., Gilg, A. W., & Ford, N. J. (2001). Differences between household waste reduction, reuse and recycling behaviour: A study of reported behaviours, intentions and explanatory variables. *Environmental & Waste Management*, *4*(2), 69–82.

Barr, S., Shaw, G., & Gilg, A. W. (2011). The policy and practice of sustainable lifestyles. *Journal of Environmental Planning and Management*, *54*(10), 1331–1350. doi:10.1080/09640568.2011.574996

Bhate, S. (2001). One world, one environment, one vision: Are we close to achieving this? An exploratory study of consumer environmental behaviour across three countries. *Journal of Consumer Behaviour*, *2*(2), 169–184. doi:10.1002/cb.98

Black, I. (2010). Editorial: Sustainability through anti-consumption. *Journal of Consumer Behaviour*, *9*(6), 403–411. doi:10.1002/cb.340

Carrete, L., Castaño, R., Felix, R., Centeno, E., & González, E. (2012). Green consumer behavior in an emerging economy: Confusion, credibility, and compatibility. *Journal of Consumer Marketing*, *29*(7), 470–481. doi:10.1108/07363761211274983

Carrington, M. J., Neville, B. A., & Whitwell, G. J. (2014). Lost in translation: Exploring the ethical consumer intention–behavior gap. *Journal of Business Research*, *67*(1), 2759–2767. doi:10.1016/j.jbusres.2012.09.022

Diamantopoulos, A., Schlegelmilch, B. B., Sinkovics, R. R., & Bohlen, G. M. (2003). Can socio-demographics still play a role in profiling green consumers? A review of the evidence and an empirical investigation. *Journal of Business Research*, *56*(6), 465–448. doi:10.1016/S0148-2963(01)00241-7

Eckhardt, G. M., Belk, R., & Devinney, T. M. (2010). Why dont consumers consume ethically? *Journal of Consumer Behaviour*, *9*(6), 426–436. doi:10.1002/cb.332

Elkington, J. (1997). *Cannibals with forks. The triple bottom line of 21st century*. Mankato, MN: Capstone.

Finisterra do Paço, A. M., & Raposo, M. L. (2010). Green consumer market segmentation: Empirical findings from Portugal. *International Journal of Consumer Studies*, *34*(4), 429–436. doi:10.1111/j.1470-6431.2010.00869.x

Fiske, S. T., & Taylor, S. E. (2013). Social Cognition: From Brains to Culture. *Sage (Atlanta, Ga.)*.

Fujii, S., Gärling, T., & Kitamura, R. (2001). Changes in drivers perceptions and use of public transport during a freeway closure: Effects of temporary structural change on cooperation in a real-life social dilemma. *Environment and Behavior*, *33*(6), 796–808. doi:10.1177/00139160121973241

Gassler, B., Meyer-Höfer, M., & Spiller, A. (2016). Exploring Consumers' Expectations of Sustainability in Mature and Emerging Markets. *Journal of Global Marketing*, 1–14.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Gregory, G. D., & Leo, M. D. (2003). Repeated behavior and environmental psychology: The role of personal involvement and habit formation in explaining water consumption. *Journal of Applied Social Psychology*, *33*(6), 1261–1296. doi:10.1111/j.1559-1816.2003.tb01949.x

Gupta, S., & Ogden, D. T. (2009). To buy or not to buy? A social dilemma perspective on green buying. *Journal of Consumer Marketing*, *26*(6), 376–391. doi:10.1108/07363760910988201

Hair, J. F., Jr., Black, W. C., Babin, B. J., & Anderson, R. E. (2013). Multi-variate Data Analysis (7th ed.). Delhi: Dolrling Kindersley(India) Pvt. Ltd.

Jain, S. K., & Kaur, G. (2006). Role of socio-demographics in segmenting and profiling green consumers: An exploratory study of consumers in India. *Journal of International Consumer Marketing*, *18*(3), 107–146. doi:10.1300/J046v18n03_06

Johnstone, M. L., & Tan, L. P. (2015). An exploration of environmentally-conscious consumers and the reasons why they do not buy green products. *Marketing Intelligence & Planning*, *33*(5), 804–825. doi:10.1108/MIP-09-2013-0159

Khare, A. (2014). Consumers susceptibility to interpersonal influence as a determining factor of ecologically conscious behaviour. *Marketing Intelligence & Planning*, *32*(1), 2–20. doi:10.1108/MIP-04-2013-0062

Khare, A. (2015). Antecedents to green buying behaviour: A study on consumers in an emerging economy. *Marketing Intelligence & Planning*, *33*(3), 309–329. doi:10.1108/MIP-05-2014-0083

Krishna, V. V., & Qaim, M. (2008). Consumer attitudes toward GM food and pesticide residues in India. *Applied Economic Perspectives and Policy*, *30*(2), 233–251.

Kumar, P., & Ghodeswar, B. (2015). Green Marketing Mix: A Review of Literature and Direction for Future Research. *International Journal of Asian Business and Information Management*, *6*(3), 42–59.

Laroche, M., Bergeron, J., & Barbaro-Forleo, G. (2001). Targeting consumers who are willing to pay more for environmentally friendly products. *Journal of Consumer Marketing*, *18*(6), 503–520. doi:10.1108/EUM0000000006155

Lee, K. (2009). Gender differences in Hong Kong adolescent consumers green purchasing behavior. *Journal of Consumer Marketing*, *26*(2), 87–96. doi:10.1108/07363760910940456

Manaktola, K., & Jauhari, V. (2007). Exploring consumer attitude and behavior towards green practices in the lodging industry in India. *International Journal of Contemporary Hospitality Management*, *19*(5), 364–377. doi:10.1108/09596110710757534

May, C., Finch, T., Mair, F., Ballini, L., Dowrick, C., Eccles, M., ... Rogers, A. (2007). Understanding the implementation of complex interventions in health care: The normalization process model. *BMC Health Services Research*, *7*(1), 148. doi:10.1186/1472-6963-7-148 PMID:17880693

Mishra, P., & Sharma, P. (2010). Green marketing in India: Emerging opportunities and challenges. *Journal of Engineering. Science and Management Education*, *3*(1), 9–14.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Muralidharan, S., Rejón-Guardia, F., & Xue, F. (2016). Understanding the green buying behavior of younger Millennials from India and the United States: A structural equation modeling approach. *Journal of International Consumer Marketing*, *28*(1), 54–72. doi:10.1080/08961530.2015.1056328

Nittala, R. (2014). Green Consumer Behavior of the Educated Segment in India. *Journal of International Consumer Marketing*, *26*(2), 138–152. doi:10.1080/08961530.2014.878205

Nolan, J. M., Schultz, P. W., Cialdini, R. B., Goldstein, N. J., & Griskevicius, V. (2008). Normative social influence is underdetected. *Personality and Social Psychology Bulletin*, *34*(7), 913–923. doi:10.1177/0146167208316691 PMID:18550863

Nunnally, J. C. (1978). *Psychometric theory*. New York, NY: Mc Graw-Hill.

Ottman, J. A., Stafford, E. R., & Hartman, C. L. (2006). Avoiding green marketing myopia: Ways to improve consumer appeal for environmentally preferable products. *Environment: Science and Policy for Sustainable Development*, *48*(5), 22–36.

Park, J., & Ha, S. (2012). Understanding pro-environmental behavior. *International Journal of Retail & Distribution Management*, *40*(5), 388–403. doi:10.1108/09590551211222367

Parker, H. (2005). Normalization as a barometer: Recreational drug use and the consumption of leisure by younger Britons. *Addiction Research and Theory*, *13*(3), 205–215. doi:10.1080/16066350500053703

phys.org. (2008, May 7). *First-of-its-kind 14-country study ranks consumers according to environmental behavior.* Retrieved June 8, 2016, from http://phys.org/news/2008-05-first-of-its-kind-country-consumers-environmental-behavior.html

Rettie, R., Burchell, K., & Barnham, C. (2014). Social normalisation: Using marketing to make green normal. *Journal of Consumer Behaviour*, *13*(1), 9–17. doi:10.1002/cb.1439

Rettie, R., Burchell, K., & Riley, D. (2012). Normalising green behaviours: A new approach to sustainability marketing. *Journal of Marketing Management*, *28*(3-4), 420–444. doi:10.1080/0267257X.2012.658840

Robert, J. A. (1996). Green consumers in the 1990s: Profile and implications for advertising. *Journal of Business Research*, *36*(3), 217–231. doi:10.1016/0148-2963(95)00150-6

Saxena, R., & Khandelwal, P. K. (2010). Can green marketing be used as a tool for sustainable growth?: A study performed on consumers in India-An emerging economy. *The International Journal of Environmental, Cultural*. *Economic and Social Sustainability*, *6*(2), 277–291.

Saxena, R. P., & Khandelwal, P. K. (2012). Greening of industries for sustainable growth: An exploratory study on durable, non-durable and services industries. *International Journal of Social Economics*, *39*(8), 551–586. doi:10.1108/03068291211238437

Schultz, P. W., Nolan, J., Cialdini, R., Goldstein, N., & Griskevicius, V. (2007). The constructive, destructive, and reconstructive power of social norms. *Psychological Science*, *18*(5), 429–434. doi:10.1111/j.1467-9280.2007.01917.x PMID:17576283

Shove, E. (2003). Converging conventions of comfort, cleanliness and convenience. *Journal of Consumer Policy*, *26*(4), 395–418. doi:10.1023/A:1026362829781

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Sooklal, R., Papadopoulos, T., & Ojiako, U. (2011). Information systems development: A normalisation theory perspective. *Industrial Management & Data Systems*, *111*(8), 1270–1286. doi:10.1108/02635571111170794

Steg, L., & Vlek, C. (2009). Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of Environmental Psychology*, *29*(3), 309–317. doi:10.1016/j.jenvp.2008.10.004

Stevens, C. (2010, February). Linking sustainable consumption and production: The government role. [Blackwell Publishing Ltd.]. *Natural Resources Forum*, *34*(1), 16–23. doi:10.1111/j.1477-8947.2010.01273.x

The World Bank. (2013, June 5). *India diagnostic assessment of select environmental challenges: an analysis of physical and monetary losses of environmental health and natural resources.* Retrieved June 6, 2016, from http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2013/07/16/000442464_20130716091943/Rendered/PDF/700040v10ESW0P0box0374379B00PUBLIC0.pdf

The World Bank. (2014, March 6). *India: Green Growth - Overcoming Environment Challenges to Promote Development.* Retrieved June 5, 2016, from http://www.worldbank.org/en/news/feature/2014/03/06/green-growth-overcoming-india-environment-challenges-promote-development?cid=SAR_TTWBSAREN_EXT

Trott, S., & Sople, V. V. (2016). Brand Equity: An Indian Perspective. PHI Learning Pvt. Ltd.

Uddin, W., Khan, B., Shaukat, N., Majid, M., Mujtaba, G., Mehmood, A., ... Almeshal, A. M. (2016). Biogas potential for electric power generation in Pakistan: A survey. *Renewable & Sustainable Energy Reviews*, *54*, 25–33. doi:10.1016/j.rser.2015.09.083

Varman, R., & Costa, J. A. (2008). Embedded markets, communities, and the invisible hand of social norms. *Journal of Macromarketing*, *28*(2), 141–156. doi:10.1177/0276146708314594

Wang, Z., Zhang, B., Yin, J., & Zhang, Y. (2011). Determinants and policy implications for household electricity-saving behaviour: Evidence from Beijing, China. *Energy Policy*, *39*(6), 3550–3557. doi:10.1016/j.enpol.2011.03.055

Zhao, W., & Schroeder, P. (2010). Sustainable consumption and production: Trends, challenges and options for the Asia-Pacific region. *Natural Resources Forum*, *34*(1), 4–15. doi:10.1111/j.1477-8947.2010.01275.x

This research was previously published in Driving Green Consumerism Through Strategic Sustainability Marketing edited by Farzana Quoquab, Ramayah Thurasamy, and Jihad Mohammad, pages 99-121, copyright year 2018 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 53
Customers' Perceptions of Green Banking:
Examining Service Quality Dimensions in Bangladesh

Mehree Iqbal
North South University, Bangladesh

Nabila Nisha
North South University, Bangladesh

Syed Ali Raza
IQRA University, Pakistan

ABSTRACT

Banks today promote eco-friendly financial services by widely adopting the concept of green banking. This is generally done to minimize the impact of environmental degradation in their business activities. Besides its usefulness for environment, green banking also acts as a competitive edge for banks by offering customers with new channels of financial services delivery. However, service experiences and quality of service delivery often defines customers' perceptions towards the adoption of such services. This paper aims to study service qualities and other underlying factors that influence customers' behavioral intentions towards using green banking in Bangladesh. Under PLS-SEM technique, factors like reliability, privacy, responsiveness, empathy and information quality has significant positive effect on performance expectancy; while, performance expectancy, effort expectancy and facilitating conditions significantly influence customers' behavioral intention. Implications of these findings can provide practical recommendations and directions for further work to banks in Bangladesh.

DOI: 10.4018/978-1-5225-7915-1.ch053

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

INTRODUCTION

The influence of service quality factors is generally overpowering for banking services, since banks often use it as a means of differentiation for their survival in the competitive environment as well as to gain a competitive edge. Particularly, for alternate customer interaction channels like green banking, it is crucial to address the issues relating to customer expectations regarding service encounter experiences and the quality in service delivery for developing customers' intentions to use green banking. The acceptability of green banking services thus depends on the assessment of customers' perspective of the banks' overall service quality.

In response to the global initiative to save environment, many emerging economies today promote environmental-friendly practices by implementing various forms of green banking services. Green banking involves the environmental and social responsibility of banks in terms of the contribution they make towards ensuring sustainability of the environment and ecological system, through their in-house operations and the wide range of financial products and services that they offer (Nisha, 2016). Beyond its usefulness for the environment, green banking also benefits the clients by offering new channels of financial services delivery (Hossain et al., 2015).

However, technology is a vital element of green banking, since the design and delivery of its financial services vastly depends on it. The major objective behind this change is to attract more customers, improve customers' perceptions, and encourage loyalty towards alternative delivery channels (Sharma & Malviya, 2011). This rapidly changing technology in the service delivery of the banking sector has profoundly changed the way customers today interact with their financial service providers (Sulaiman et al., 2007). Moreover, an increase in the use of wireless telecommunications like mobile phones and Internet-enabled Smartphone has also contributed to the change in customer behavior to a large extent (Nisha et al., 2015). With the shift of the banking sector from the traditional brick-and-mortar model to the branchless mode of banking, the interest of researchers shifted towards the examination of green banking services on the grounds of service quality.

Bangladesh has been particularly successful in implementing the green banking approach particularly in the country's banking sector. This is because most of the leading banks today offer mobile banking, internet banking services in Bangladesh following the trend of financial globalization. As a result, customers often need to choose among different banks by making a trade-off between relationships and economies, trust and products, or service and efficiency (Sachdev & Verma, 2004). Additionally, customers are increasingly aware of the different offerings of electronic banking and this knowledge makes them more critical of the quality of service provided by the banks (Sharma & Malviya, 2011). As such, it is very important for banks to understand the service qualities that can influence customers' behavioral intentions towards the use of green banking services in Bangladesh.

The importance of various service qualities for customer satisfaction and subsequent adoption of banking services has been evidenced in numerous studies, but there is a paucity of research that explores the linkage between green banking service quality perceptions and customer adoption intentions in the context of Bangladesh. This study fills into the void by aiming to conceptualize selected factors of electronic service quality (E-S-QUAL) to identify the service quality dimensions, as perceived by customers, in the case of green banking services. To pursue this purpose, a proposed research model has been designed in this study by combining the factors of E-S-QUAL and the unified theory of acceptance and use of technology (UTAUT) constructs. This study, therefore, has both theoretical and managerial implications. Theoretically, this hybrid model is a contribution to the literature since it is capable of

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

understanding the service quality determinants, along with other factors, behind the adoption of green banking in Bangladesh. From a managerial perspective, the findings of this research should provide further insights into understanding and managing potential and current users. This study can also assist banks to discover the qualities that existing users demand and potential users anticipate from the existing green banking system in Bangladesh.

LITERATURE REVIEW

To further the objectives of this study, the theoretical background of the proposed service quality determinants, followed by the research platform and finally, the current practice of green banking services and its implications in Bangladesh has been discussed to determine the gaps for the study.

Proposed Constructs of the Model

A number of previous studies identified service quality as one of the important attributes of service providers when regarded from the customers' perspective. This is because service quality has repeatedly been linked to the perceived performance of that service by researchers like Lin (2007), Aghdaie and Faghani (2012) and Islam (2012). Moreover, studies by Zhao et al. (2012), Cheng et al. (2013) and Ozer et al. (2013) found that service quality has a significant effect on behavioral intentions of customers through their level of satisfaction regarding the service performance. On this note, two important research models related to customer perception of electronic service quality and technology acceptance and usage intentions of customers has been considered to develop a conceptual hybrid model for this study.

Initial efforts in defining and measuring service quality was largely originated by Parasuraman et al. (1988), who proposed a service quality measurement scale, commonly known as 'SERVQUAL'. Following this innovation, Brady and Cronin (2001) and Brady et al. (2001) argued that the specific characteristics of electronic services are completely different from those of the physical service industry. Accordingly, Zeithaml et al. (2002) developed the electronic service quality (E-S-QUAL) scale to measure the service quality of websites. Later, Parasuraman et al. (2005) modified this scale and developed a multi-item scale for the assessment of electronic service quality on the basis of the service quality literature in general. This E-S-QUAL model consisted of two different scales, wherein the factors of efficiency, fulfillment, system availability, privacy, responsiveness, compensation and contact with the service provider were included. Researchers like Lin (2011), Sharma and Malviya (2011), Rejikumar and Ravindran (2012) and Lau et al. (2013) then used the scales of E-S-QUAL and examined the quality perceptions of customers in areas of internet and mobile banking services. Recent applicability of the E-S-QUAL model for banking services includes studies by Swaid and Wigand (2009), Bedi (2010), Munusamy et al. (2010), Ganguli and Roy (2011), Aghdaie and Faghani (2012), Cheng et al. (2013) and Ozer et al. (2013). Findings of Swaid and Wigand (2009) suggested that only the dimensions of reliability and assurance clearly influence customers' behavioural intention towards electronic banking services. Bedi (2010) and Munusamy et al. (2010), however, identified factors like assurance, empathy, responsiveness, tangibility and interactions with the bank as important dimensions of e-service quality from the customers' perspective. Ganguli and Roy (2011) reported similar findings highlighting e-service quality factors of responsiveness, assurance, security, easy to use and reliability in their studies. Other studies by Aghdaie and Faghani (2012), Cheng et al. (2013) and Ozer et al. (2013) further supported these

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

findings by claiming that dimensions of tangibility, responsiveness, reliability, empathy, availability, ease of use and assurance can define customers' intentions to use green banking services to a large extent.

Research Platform of the Study

Most of the previous studies' findings stressed upon that fact that the perception of both positive and negative service quality was related to the customers' future behavioral intentions towards various green banking services. In fact, since the possibility of direct interaction with human involvement is absent in such services, the service quality perceptions here purely includes a system-oriented evaluation. In such a context, service quality is typically decided by system quality, network quality and information quality as suggested by Rejikumar and Ravindran (2012). Accordingly, the current study selected seven dimensions of E-S-QUAL along the lines of system quality, information quality and interaction quality of different green banking services from these previous studies.

While service quality perceptions has been used in past studies as an antecedent to assess customers' intentions to use green banking services, there are other influencing factors that can further explain the acceptance and use of such services from the customers' perspectives. Following this notion, this paper used the concepts of the UTAUT2 model where factors has been primarily used to predict the behavioral intention of customers to use a technology, moderated by individual difference variables like age, gender, experience and voluntariness (Venkatesh et al., 2012). Against this backdrop, this study has selected the original UTAUT2 model as a theoretical foundation and combined the scales of E-S-QUAL to develop a proposed research model for this study. Since quality perceptions of customers are interrelated to the performance of a service, dimensions of the E-S-QUAL model has been linked to the factor of performance expectancy of the UTAUT model in order to demonstrate the influence of service quality along with other factors on customer acceptance and use of green banking services.

Green Banking Services in Bangladesh

The financial sector is nowadays aware of and concerned about all environmental problems of Bangladesh and considers the sustainability of the environment as part of their corporate social responsibilities (Kaeufer, 2010). As a result, the central bank of Bangladesh formulated Green Banking Policy which aims to ensure environment-friendly business practices by banks and financial institutions by promoting sustainable financial and economic growth across the entire country (Nisha, 2016).

The most important aspect of this Green Banking Policy is actually directed towards the bank clients. Bangladesh Bank has mandated the commercial banks to introduce rigorous programs in order to educate clients and influence them to comply with the environmental regulations as well as to undertake activities which are going to benefit the environment (Islam & Kamruzzaman, 2015). The common green banking services that all banks offer in Bangladesh today includes the use of e-statements instead of printed statements or e-mails instead of paper documents, internet banking, SMS banking, mobile banking, the use of Automated Teller Machines (ATM), Bangladesh Automated Cheque Processing System (BACPS), Bangladesh Electronic Fund Transfer Network (BEFTN) or other mobile financial services in the form of e-currency like bKash, mCash, EasyCash, etc (Masukijjaman & Aktar, 2013).

According to Bangladesh Bank, all these green banking services are necessary for the sustainability in the long-run. However, the application of green banking chiefly requires the involvement of the bank clients, since they are the ones who are at the forefront of using such initiatives to conduct their banking

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

transactions. Therefore, it is crucial to address the issues relating to customer expectations regarding service encounter experiences and the quality in service delivery for developing intention to use green banking by the customers.

RESEARCH MODEL AND HYPOTHESES

In conceptualizing the hybrid model for exploring the dimensions of green banking service quality, the four key constructs of the original UTAUT2 model (i.e. performance expectancy, effort expectancy, social influence and facilitating conditions) and the seven factors of service quality, drawn from previous literature of mobile banking and E-S-QUAL, has been incorporated. Figure 1 shows the proposed research model. In addition, all the variables hypothesized in this study and their likely relationships towards consumers' behavioral intention and usage of green banking services in Bangladesh has been discussed next.

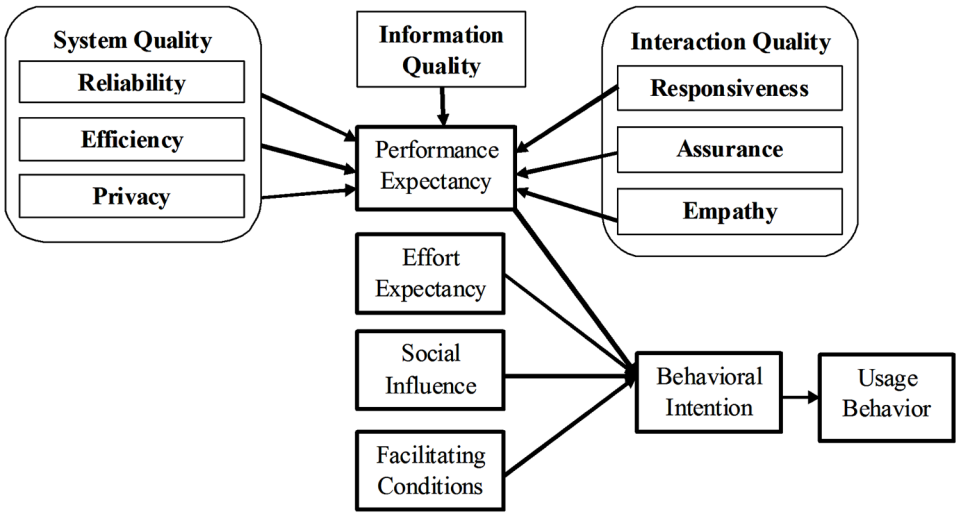
System Quality

System quality is referred to as the overall measure of the information processing system of the mobile banking service and is often perceived to be closely related to service quality (Rejikumar & Ravindran, 2012). As such, three most significant dimension of system quality has been drawn from previous E-S-QUAL literatures to be included in the hybrid model, as discussed.

Reliability

Reliability of green banking services refer to the probability that the banks will satisfactorily perform as intended and consistently provide the same service through internet/mobile phone as it did through physical branches (Sharma & Malviya, 2011). In other words, whenever a customer will attempt to do

Figure 1. The Proposed Research Structure



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

banking transactions through a technological device, the service will have technical availability and it will provide error free services (Ganguli & Roy, 2011). Often, consumers' perception of reliability for a service plays a vital role in measuring the performance of that service (Munusamy et al., 2010). Particularly, for countries like Bangladesh where the concept of green banking is relatively new, consumers' perception of reliability regarding such service needs to be investigated.

Efficiency

From a consumer's perspective, green banking services can only be considered efficient if the system is simple to use, structured properly, and requires minimum information to be input by the customers (Sharma & Malviya, 2011). To be precise, how quickly consumers can access the service, how flexible is the user interface of the system and how quickly or timely the system responds to requests for banking information or transactions by the customer – all these attributes define the efficiency of green banking service (Ganguli & Roy, 2011). These attributes generally have a strong influence on performance expectancy of a service as they guide the perceptions of system quality and ultimately affect the usage intention of customers (Nelson et al. 2005). As such, efficiency of green banking service can be an interesting determinant for this study.

Privacy

Privacy can be defined as the degree to which the green banking service is safe and protects customers' banking information from any intrusion (Sharma & Malviya, 2011). Countries like Bangladesh tend to suffer from technological shortcomings – a reason why customers often object to the transmission of their personal bank account or transactional information over any other alternate channels outside the physical branches of the banks (Ganguli & Roy, 2011). Hence, if privacy issues related to green banking can be assured by the banks, customer will automatically be convinced of the performance of the service – thereby, leading to an increased use of such services in Bangladesh (Angst & Agarwal, 2009). In this regard, privacy can be an important quality determinant of green banking services.

This study, therefore, proposes the following hypotheses:

$H1_A$: Reliability positively influences performance expectancy of green banking services.
$H1_B$: Efficiency positively influences performance expectancy of green banking services.
$H1_C$: Privacy positively influences performance expectancy of green banking services.

Information Quality

Information quality can significantly predict users' perception regarding the use of technology-based services like green banking (Lee & Chung, 2009). This is because certain information regarding such services is very confidential in nature and it is crucial that such information is accurate, complete and up-to-date. Customers often determine the performance of a service on the basis of their satisfaction from the information available from that service (Swaid & Wigand, 2009). Also, the quality of information available can play a critical role in building user satisfaction and customer loyalty for services like green banking. Thus, the study hypothesizes:

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

H2: Information quality positively influences performance expectancy of green banking services.

Interaction Quality

Customer perceptions of the interactions that take place during service delivery are known as interaction quality. Past studies like Lin (2011) and Aghdaie and Faghani (2012) claim that the quality of interactions between customers and the alternate banking systems can affect customers' intentions directly towards the use of services like green banking. As a result, three element of this quality from previous E-S-QUAL literature has been taken into account.

Responsiveness

Responsiveness can be defined as the willingness to help customers and to provide prompt services (Lau et al., 2013). In terms of green banking, it can be further explained by the banks' ability to understand the customers' problems and to provide precise financial services (Bedi, 2010). Munusamy et al. (2010) and Lau et al. (2013) found a positive relationship between responsiveness and customer satisfaction, as in, the more responsive the service is the more satisfied the customer will be for that service. Based on this evidence, this study used responsiveness as a factor that will guide customers regarding green banking service adoption.

Assurance

Often, the providers' knowledge, competency and courtesy levels and their ability to inspire trust and confidence in a service can influence customers' perception regarding the use of that service (Lau et al., 2013). Such assurance by the providers can inspire customer satisfaction as well and this satisfaction time and again can determine the performance of a particular service (Munusamy et al., 2010). For instance, banks' ability to provide their promised and accurate service and their tendency of keeping commitments within a given time frame can provide assurance to customers to consider the adoption of green banking services (Aghdaie & Faghani, 2012). Evidence of a positive relationship between assurance and consumers' acceptance of such services by many researchers has thus made it an influencing factor in this study.

Empathy

The dimension of empathy generally involves care and personalized attention that a firm can provide to its customers in terms of accessibility, communication and understanding of the service being provided (Bedi, 2010). Particularly for sensitive services like banking transactions, customers always appreciate a friendly and considerate environment. Hence, if the banks show genuine interest, enthusiasm and seriousness toward the customers' modern banking needs, it will automatically lead customers towards the usage of alternate financial delivery services like green banking (Ganguli & Roy, 2011). Based on this perspective, past studies like Aghdaie and Faghani (2012) and Lau et al. (2013) argue that empathy from the service provider can act as a determinant of the performance of that service. As a result, empathy has been considered as an influencing factor in the hybrid model of this study.

This study, therefore, hypothesizes the following:

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

$H3_A$: Responsiveness positively influences performance expectancy of green banking services.
$H3_B$: Assurance positively influences performance expectancy of green banking services.
$H3_C$: Empathy positively influences performance expectancy of green banking services.

Performance Expectancy

Several empirical evidences like Amin et al. (2008) and Dasgupta et al. (2011) argue that when a user perceives a technology useful, the likelihood of adopting that technology increases. As such, this factor can significantly influence individual's intention to adopt any technology-based services. Also, since it has been empirically demonstrated to include factors like relative advantage and perceived usefulness, this study hypothesizes that performance expectancy can have a considerable impact on the intention to use green banking services (Holden and Karsh, 2010). In fact, past studies like Lu et al. (2009) supports this claim of performance expectancy significantly influencing the adoption of green technology-based services. Thus, the proposed hypothesis is:

H4: Performance expectancy significantly affects individual intention to use green banking services.

Effort Expectancy

Effort expectancy is the degree of ease associated with technology use, particularly during the early stages of adopting a new technology (Phichitchaisopa & Naenna, 2013). Prior empirical studies of green banking adoption like Dasgupta et al. (2011), Moores (2012) and Nisha et al. (2015) have employed the construct of effort expectancy in various setups and found evidence of it being a determinant that can influence customers to use such services. Based on these findings, this study hypothesizes that:

H5: Effort expectancy significantly affects individual intention to use green banking services.

Social Influence

Venkatesh et al. (2003) defines social influence as the degree to which an individual perceives that important others believe he/she should use a technology. Customers often intend to use a new technology only because they believe it will enhance their image among their family and peers (Venkatesh & Davis, 2000). Singh et al. (2010) and Nisha et al. (2015) claim that the adoption of green banking can help people appear special and gain a personal and social identity in the society at large. Empirical findings thus suggest that the individual intention to use green banking services can significantly be affected by the people around them. Accordingly, the following hypothesis has been conceived:

H6: Social influence significantly affects individual intention to use green banking services.

Facilitating Conditions

Facilitating conditions is the degree to which an individual believes that an organizational and technical infrastructure exists to support technology use (Venkatesh et al., 2003). According to Venkatesh and Zhang (2010) and Venkatesh et al. (2012), facilitating conditions like the access of respondents to

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

internet/mobile and banking services are necessary in order to build proficiency for the use of green banking. In other words, facilitating conditions indicates the prospective conditions that may restrain or facilitate adopting a technology. In recent times, Nisha et al. (2015) empirically identified that facilitating conditions is a determinant of green banking intention and usage behavior. Taking this concept into account, the next hypothesis is:

H7: Facilitating conditions significantly affects individual intention to use green banking services.

Behavioral Intention

Many empirical studies like Venkatesh and Zhang (2010) and Nisha et al. (2015) claimed that the behavior of using any technology is often influenced by the intention to use that technology. Particularly, findings of these past studies argue that individual behavior is predictable and can be influenced by individual intention that, in turn, can have a significant influence on technology usage. Now, in the context of green banking, the ultimate goal of banks is to ensure that customers adopt their services rather than just having an intention to adopt it. Following the lead, Sripalawat et al. (2011) and Nisha et al. (2015) took this relationship between behavioral intention and actual use into consideration against the backdrop of green banking services. Accordingly, this study hypothesizes that:

H8: Behavioral intention significantly affects individual behavior of using green banking services.

RESEARCH METHOD

Data Collection

The population selected for this study represents customers of the young age group of Bangladesh who are more aware about environmental problems these days compared to the other age groups. As such, they are more concerned about the use of green technologies as well. Moreover, it is generally the young people who are the most active and innovative users of technology and more critical of the quality of technology-related services in any country (Kinnally et al., 2008).

A structured questionnaire has been used in order to gather the data from a sample of 700 respondents who resides in Dhaka - the capital city of Bangladesh. Respondents for the sample were selected by probability sampling, using a stratified random sampling method.

Measurement

All the items used to measure the research variables of the survey were adapted from previous studies, with minor changes in wording to tailor them to the different green banking context in Bangladesh. This ensured the content validity of the questionnaire used to assess each constructs depicted in Figure 1.

The quantitative survey contained 40 statements in order to evaluate the original constructs of the UTAUT model and the seven quality dimensions proposed for the hybrid model of this study, as given in Table 1. The scales for the UTAUT constructs (performance expectancy, effort expectancy, social influence, facilitating conditions and behavioral intention) were adapted from Venkatesh et al. (2003),

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Venkatesh and Zhang (2010) and Lin (2011). Alternatively, the scales for system quality (reliability, efficiency and privacy), information quality and interaction quality (responsiveness, assurance and empathy) were drawn from Nelson et al. (2005), Lee and Chung (2009), Lin (2011), Sharma and Malviya (2011), Rejikumar and Ravindran (2012) and Lau et al. (2013). All these items were measured using a five-point Likert scale, ranging from "strongly disagree" (rated 5) to "strongly agree" (rated 1). After a six-week survey starting from January 2016 till mid-February 2016, 575 completed and usable responses were obtained from the structured questionnaires.

Table 1. Constructs and Corresponding Items

Constructs	Corresponding Items
Reliability	[Ry1] I believe green banking services operate reliably [Ry2] I believe green banking services perform reliably [Ry3] I believe the operation of green banking is dependable
Efficiency	[Ey1] I feel green banking makes my banking information easy to access [Ey2] I feel green banking provides me banking information in a timely fashion [Ey3] I feel green banking takes too long to respond to my banking problems
Privacy	[P1] I trust the ability of green banking services to protect my privacy [P2] I feel safe to release my banking information to green banking services [P3] I feel matters on security has no influence in using green banking services
Information Quality	[IQ1] I believe green banking provides me complete banking information [IQ2] I believe green banking provides me up-to-date banking information [IQ3] I believe green banking provides me relevant banking information
Responsiveness	[Rs1] I think green banking provides me precise banking services [Rs2] I think green banking has the ability to understand my banking needs [Rs3] I think green banking services are helpful
Assurance	[AS1] I think green banking provides me banking services as promised [AS2] I think green banking provides me accurate banking services [AS3] I think green banking services will keep their commitments
Empathy	[E1] I think green banking has the knowledge to solve my banking problems [E2] I think green banking has the enthusiasm to understand my banking needs [E3] I think green banking services will put my banking needs in the first place
Performance Expectancy	[PE1] Using green banking can make my banking transactions more efficient [PE2] Using green banking can save me time in conducting banking transactions [PE3] Using green banking can make my banking transactions more convenient [PE4] Using green banking can be useful in managing my finances
Effort Expectancy	[EE1] Learning to use green banking is easy for me [EE2] Becoming skillful at using green banking is easy for me [EE3] Interaction with green banking is easy for me [EE4] Overall, I think green banking is easy to use
Social Influence	[SI1] People who are important to me think that I should use green banking [SI2] People who are familiar with me think that I should use green banking [SI3] People who influence my behavior think that I should use green banking [SI4] Most people surrounding me use green banking
Facilitating Conditions	[FC1] Using green banking suits my living environment [FC2] Using green banking fits into my working style [FC3] Using green banking is compatible with my life [FC4] Help is available if I have problems in using green banking
Behavioral Intention	[BI1] I prefer to use green banking [BI2] I intend to use green banking [BI3] I believe it is worthwhile for me to use green banking

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

DATA ANALYSIS AND RESULTS

This study applied SmartPLS to analyze the empirical data by using the structural equation modeling (SEM). The method of partial least squares (PLS) was primarily chosen to conduct this analysis since a number of interaction terms have been included in the research model and PLS is capable of testing these effects. To pursue the analysis, the Likert scale was transformed into numerical ratings, as suggested by Fornell and Larcker (1981). A two-stage analysis process was followed in order to include both outer model analysis (measurement model) and inner model analysis (structural model). Outer model mainly examined the reliability and convergent validity, whereas the inner model evaluated the hypotheses testing.

Measurement Model

The measurement results presented in Table 2 shows that all standardized factor loadings and composite reliability are larger than 0.7 on a stand-alone basis, as recommended by Nunnally and Bernstein (1994). The AVE was also greater than 0.5 in all cases and greater than each square correlations. Table 3 further shows that the internal consistency reliabilities (ICRs) of multi-item scales modeled with reflective indicators was 0.75 or greater. AVE values thus indicate that the model has convergent validity for all the constructs while the values of composite reliability and internal consistency reliabilities (ICRs) display adequate reliability in all selected cases. The pattern of loadings and cross-loadings too supported internal consistency and discriminant validity for the model, with few exceptions: one item from each construct of information quality, empathy (interaction quality), social influence, facilitating conditions and two items from reliability (system quality) and efficiency (system quality) were deleted due to their low loadings and high cross-loadings.

Structural Model

The path coefficients and significance levels in the structural model are presented in Figure 2. Among the three constructs of system quality, reliability [0.241, $p<0.05$] and privacy [0.133, $p<0.05$] showed significant and positive path towards performance expectancy, while efficiency [0.086, $p>0.05$] reported an insignificant path. The factor of information quality [0.101, $p<0.05$] also displayed a significant and positive path towards performance expectancy. On the other hand, responsiveness [0.147, $p<0.05$] and empathy [0.078, $p<0.05$] under interaction quality had a significant and positive path towards performance expectancy, but assurance [0.170, $p>0.05$] showed an insignificant path.

Other factors like performance expectancy [0.325, $p<0.05$], effort expectancy [0.199, $p<0.05$] and facilitating conditions [0.125, $p<0.05$] too showed significant and positive paths to the behavioral intention of using green banking, in their order of influencing strength. However, the construct of social influence [0.108, $p>0.05$] reported an insignificant path towards the individual behavior of using green banking services.

Therefore, all hypotheses [except H1B, H3B, H6] dealing with behavioral intention to use green banking services are supported. Subsequently, the hypothesized relationship between behavioral intention and usage [0.394, $p<0.05$] is found to be statistically significant, thereby supporting hypothesis H8.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 2. Factor Loadings, Composite Reliability and AVEs

Constructs	Items	Factor Loadings	Composite Reliability	AVE
Reliability	Ry1	1.000	1.000	1.000
Efficiency	Ey1	1.000	1.000	1.000
Privacy	P1	0.758	0.788	0.580
	P2	0.734		
	P3	0.747		
Information Quality	IQ1	0.918	0.881	0.707
	IQ2	0.875		
Responsiveness	Rs1	0.821	0.840	0.645
	Rs2	0.850		
	Rs3	0.723		
Assurance	AS1	0.827	0.882	0.719
	AS2	0.828		
	AS3	0.895		
Empathy	E2	0.830	0.876	0.787
	E3	0.929		
Performance Expectancy	PE1	0.817	0.809	0.669
	PE2	0.849		
	PE3	0.853		
	PE4	0.766		
Effort Expectancy	EE1	0.820	0.855	0.684
	EE2	0.834		
	EE3	0.841		
	EE4	0.842		
Social Influence	SI1	0.868	0.898	0.729
	SI2	0.874		
	SI3	0.825		
Facilitating Conditions	FC1	0.777	0.866	0.681
	FC2	0.887		
	FC3	0.819		
Behavioral Intention	BI1	0.864	0.892	0.733
	BI2	0.875		
	BI3	0.824		

FINDINGS AND IMPLICATIONS

This study systematically explores whether the service quality of the green banking system can influence the behavioral intention of customers by providing them the satisfaction expected from such alternate financial delivery service. Results conclude that quality dimensions like reliability, privacy, information

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 3. Measurement Model Estimations

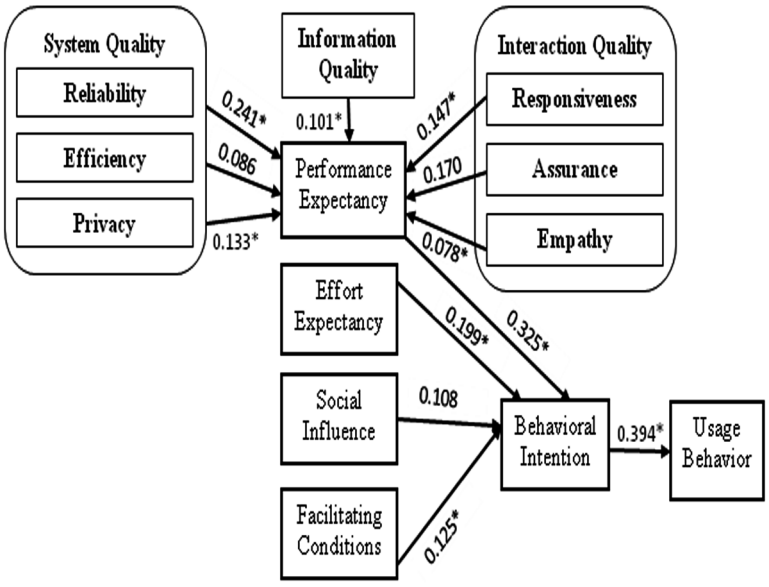
	ICRs	AS	BI	E	EE	FC	IQ	PE	Rs	Ey	SI	P	Ry
AS	0.87	**0.96**											
BI	0.81	0.32	**0.78**										
E	0.80	0.14	0.05	**0.83**									
EE	0.79	0.36	0.53	0.06	**0.80**								
FC	0.77	0.31	0.15	0.04	0.45	**0.84**							
IQ	0.81	0.23	0.57	0.30	0.49	0.87	**0.98**						
PE	0.75	0.38	0.44	0.19	0.62	0.44	0.46	**0.86**					
Rs	0.89	0.26	0.04	0.12	0.35	0.17	0.39	0.18	**0.81**				
Ey	1.00	0.85	0.20	0.11	0.13	0.35	0.34	0.42	0.24	**Single-Item Construct**			
SI	0.88	0.32	0.40	0.10	0.64	0.31	0.03	0.21	0.26	0.12	**0.92**		
P	0.78	0.30	0.55	0.13	0.41	0.72	0.47	0.22	0.30	0.39	0.73	**0.79**	
Ry	1.00	0.24	0.42	0.09	0.14	0.53	0.37	0.46	0.31	0.27	0.22	0.32	**Single-Item Construct**

Notes:

1. AS [Assurance]; BI [Behavioral Intention]; E [Empathy]; EE [Effort Expectancy]; FC [Facilitating Conditions]; IQ [Information Quality]; PE [Performance Expectancy]; Rs [Responsiveness]; Ey [Efficiency]; SI [Social Influence]; P [Privacy]; Ry [Reliability].

2. Diagonal elements represent the AVEs, while off-diagonal elements represent the square correlations.

Figure 2. Results of Structural Equation Modeling



quality, responsiveness and empathy can significantly affect the performance of the green banking. The performance of the system can develop customer satisfaction which can then positively influence the behavioral intention of customers towards the use of green banking services. The observations from this study generally supports the results of various recent studies in the field of service quality like Sharma

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

and Malviya (2011), Aghdaie and Faghani (2012), Rejikumar and Ravindran (2012), Cheng et al. (2013) and Ozer et al. (2013).

Apart from performance expectancy, the study additionally identify factors like effort expectancy and facilitating conditions to saliently influence the behavioral intention of customers, which in turn, has been found to directly stimulate the use of green banking in Bangladesh. This finding is also in line with past studies like Venkatesh et al. (2003), Venkatesh & Zhang (2010), Lin (2011) and Nisha et al. (2015). The inclined reason behind such findings has mostly been shaped by the local culture and infrastructure of the country and has certain implications for the banking sector as a whole.

Findings of this study reveal that most of the current and potential users of green banking facilities judge the importance of using this service based on the relative advantages this form of banking can provide them. As such, the better the performance that people can expect from the use of green banking services, the more people are likely to use green banking in Bangladesh. This is particularly true if customers are satisfied with the performance of the system and satisfaction can only be achieved when certain quality dimensions are present in the green banking service. For instance, if banks consider the need of their customers when designing new services like e-currency, global fund transfers, international bill payments, mobile banking, internet banking under the green banking system, customers will be convinced of the responsiveness of the system. Again, if customers observe that banks are taking the responsibility for environmental degradation and acting responsible, they will be satisfied with the system's reliability and empathetic quality of the service. Often, banks may need to upgrade their system programs and in the process if the banks maintain the system stability and transaction security, customers will be assured of the privacy and reliability qualities of the green banking service. Similarly, the more accurate and complete information that banks can provide their users with, the more positive feeling the customers will have regarding the information quality of the service.

As such, the takeaway for the banks will be to adopt or improve these five qualities of their green banking services in order to achieve customer satisfaction and thereby, result in an increased growth rate in the use of green banking services in Bangladesh. For this, banks should maintain a safe online communication, electronic currency transfer, mobile banking and internet banking transaction platform to protect the privacy of the customers, resolve problems quickly if transaction errors occur and provide assistance to all new or confused green banking users. Also, the banks should actively inform their customers about the processes and time needed for certain services under the green banking system in order to aware user regarding the time saving and ensure quality information. The better quality of efficient transaction services due to more integration in the services the banks will provide the higher satisfaction their customers will have and this will ultimately result in higher behavior intention to use green banking. In fact, exploring the dimensions of service quality in one way also falls under the Performance Measurement System (PMS) that can later be used to evaluate and improve the performance of banking services (Michael, 2015). Banks should thus enhance their service quality if they expect an increase in the behavioral intention of the customers towards the use of green banking services.

Furthermore, the results of this study claims that respondents who expect less effort input in the service consuming process are more likely to show positive attitude in embracing the concept of green banking services. In green banking, users requires less effort as online transactions and communications are widely used which requires less time and the user do not physically has to go to the banks to avail any services. The underlying cause behind this can be the newness of the green banking in the culture of Bangladesh, since most of the banking transactions are still traditionally offered from physical bank

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

branches. Adoption of any new technology initially shows such similar pattern in Bangladesh, since this country is neither technologically-sound nor does it have a technology savvy culture. Along the same line, facilitating conditions is found to be yet another determinant that can influence respondents' behavioral intention and use of green banking services. Facilitating conditions generally tend to be the wide availability of computers, strong mobile networks and fast internet services in the context of Bangladesh. Banks thus need to emphasize upon the compatibility between the offered services and the working/living styles of their target users.

The takeaway for the banks in this case will be to create the right perception in the mind of the customers regarding the use of green banking services. For instance, a common misconception among people in Bangladesh is that green banking services will be expensive and complex compared to the traditional banking. However, most banks in Bangladesh only need the support internet and mobile network operators and their network services for green banking. It is, thus, important for banks to inform customers that only internet, mobile phone and a mobile network connection is required to take the benefits of green banking services. On the other hand, since effort expectancy demonstrated a strong significance in influencing the behavioral intention of people in using green banking in Bangladesh, it is imperative that banks design simplified user interface or customized account query rules that can be useful for convincing new banking users of the ease of use of this service.

Interesting findings of the research also include the fact that quality factors like efficiency and assurance by the banks does not significantly impact the behavioral intention of people in using green banking in Bangladesh. This may imply that since banking is an essential service, respondents are willing to accept the service even if it is inefficient or non-committal at times. Moreover, society's perceptions regarding green banking was not found to contribute to the shaping up of people's behavioral intention towards the use of such services in Bangladesh.

Implementation of green banking might be a long-term project in emerging economies, but the fairly positive perception and an equally positive attitude of customers towards such services clearly paves the way of a higher rate of adoption of green banking in Bangladesh. However, since green banking has been initiated very recently (year 2011) and is still in the adoption process, the marginal adoption and usage rate currently reported by the banks for such services is rightly justified. Consequently, it may be argued that the perception of customers can be altered if banks in Bangladesh can design various green banking services with desired quality dimensions and other influencing factors identified in this study.

LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

Like most empirical research, this study has several limitations. First, the conclusions drawn from this study are based solely on the young population of Bangladesh. Future research can explore the behavioral intention of other age groups so that their perceptions regarding the service qualities of various green banking services can be considered by the banks. Second, a longitudinal study can be adopted in future works to examine and compare the hybrid research model in different time periods, thereby providing a better insight into the quality of services expected from green banking in Bangladesh. Finally, other than the quality dimensions included in this study, there can be more constructs characterizing green banking services or moderator effects like that of age, gender, voluntariness, etc that can be added in the research model to enhance the understanding of service qualities that customers expect from green banking.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

CONCLUSION

This paper contributes to the literature by combining selected factors of electronic service quality (E-S-QUAL) and the unified theory of acceptance and use of technology (UTAUT) constructs to identify the service quality dimensions and other factors, as perceived by customers regarding green banking services. It is a unique study in itself, since there has been no such study conducted in the context of developing countries like Bangladesh. Moreover, no previous study has made green banking the focus of research while examining service quality perceptions of the consumers.

In particular, this study is important since customers are very rational in this era and they only want those services or products which give them maximum utility. They also prefer those services that are high in quality. Results of this study show that service quality has a significant effect on customers' intention to use green banking services. The more the banks improve their service quality, the improved will be the customer performance which ultimately increases customers' intention to use green banking.

The banks can improve their service quality by timely informing their customers the actions taken by them on the customer issue. They can increase their communication through the website, leaflet, and poster, seminars etc. with their present or prospective customers. To improve the service quality, management of the bank should ensure error-free transactions and monitor customer satisfaction level regularly. Information quality is another important factor that affects customer's intention via performance expectancy to use the product or service. The managers of the banks should ensure that information provided should be accurate, timely updated on the websites and circulated among the customers.

The UTUAT constructs, i.e. performance expectancy, effort expectancy, facilitating condition, has a significant positive effect on the customer intention to use green banking as well. So, the managers should provide user-friendly interface, 24/7 support and emphasize on security and privacy aspects in order to improve the association with the customers. The interactive quality dimensions too play an important role in enhancing the performance of the customers. The banks can upgrade their website so that it is more efficient, more secured, and responsive. They should personalize their website according to the needs of the users and improve the information quality. The bank can also explain their online transaction procedures, guidelines on how to tackle with the security procedures to the customers as this will increase their intention to use the system. The banks can even hire motivated and enthusiastic employees who will solve customers' complaints and problems effectively.

All these necessary and pro-active steps by the banks can ultimately influence customers' intention to adopt and use green banking service at an increased pace. So, the banking sector of Bangladesh should understand the importance and monitor its service quality by developing a systemic assessment program.

REFERENCES

Aghdaie, S. F. A., & Faghani, F. (2012). Mobile banking service quality and customer satisfaction (application of SERVQUAL model). *International Journal of Management and Business Research*, *2*(4), 351–361.

Amin, H., Hamid, M. R. A., Lada, S., & Anis, Z. (2008). The adoption of mobile banking in Malaysia: The case of Bank Islam Malaysia Berhad. *International Journal of Business and Society*, *9*(2), 43–53.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Angst, M. C., & Agarwal, R. (2009). Adoption of electronic health records in the presence of privacy concerns: The Elaborate Likelihood Model and individual persuasion. *Management Information Systems Quarterly*, *33*(2), 339–370.

Bedi, M. (2010). An integrated framework for service quality, customer satisfaction and behavioral responses in Indian banking industry: A comparison of public and private sector banks. *Journal of Service Research*, *10*(1), 157–172.

Brady, M. K., & Cronin, J. J. Jr. (2001). Some new thoughts on conceptualizing perceived service quality: A hierarchical approach. *Journal of Marketing*, *65*(3), 34–49. doi:10.1509/jmkg.65.3.34.18334

Brady, M. K., Robertson, C. J., & Cronin, J. J. (2001). Managing behavioral intentions in diverse cultural environments: An investigation of service quality, service value and satisfaction for American and Ecuadorian fast-food customers. *Journal of International Management*, *7*(2), 129–149. doi:10.1016/S1075-4253(00)00041-7

Cheng, S., Jong, D., Chen, H., & Chen, S. (2013). Investigating the impact of service quality on consumers' intention to use mobile banking. *International Journal of Management Research and Business Strategy*, *2*(3), 13–22.

Dasgupta, S., Paul, R., & Fuloria, S. (2011). Factors affecting behavioral intentions towards mobile banking usage: Empirical evidence from India. *Romanian Journal of Marketing*, *3*(1), 6–28.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *JMR, Journal of Marketing Research*, *18*(1), 39–50. doi:10.2307/3151312

Ganguli, S., & Roy, S. K. (2011). Generic technology-based service quality dimensions in banking: Impact on customer satisfaction and loyalty. *International Journal of Bank Marketing*, *29*(2), 168–189. doi:10.1108/02652321111107648

Holden, R. J., & Karsh, B. T. (2010). The technology acceptance model: Its past and its future in health care. *Journal of Biomedical Informatics*, *43*(1), 159–172. doi:10.1016/j.jbi.2009.07.002 PMID:19615467

Hossain, M. Z., & Ahmed, M. (2015). Green banking in Bangladesh. In Green Banking in Bangladesh and Beyond, (pp. 17-47). Zaman Printing and Packaging.

Hossain, M. Z., Ahmed, M., & Nisha, N. (2015). Consumer attitudes and perception towards green banking in Bangladesh. In Green Banking in Bangladesh and Beyond, (pp. 48-76). Zaman Printing and Packaging.

Islam, M. A., & Kamruzzaman, M. (2015). Green banking practices in Bangladesh. *IOSR Journal of Business and Management*, *17*(4), 37–42.

Islam, R. M. D. (2012). Application of SERVQUAL model in customer service of mobile operators: A study from the context of Bangladesh. *European Journal of Business and Management*, *4*(1), 47–54.

Kaeufer, K. (2010). *Banking as a Vehicle for Socio-economic Development and Change: Case Studies of Socially Responsible and Green Banks*. Cambridge, MA: Presencing Institute.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Kinnally, W., Lacayo, A., McClung, S., & Sapolsky, B. (2008). Getting up on the download: College students motivations for acquiring music via the web. *New Media & Society*, *10*(6), 893–913. doi:10.1177/1461444808096250

Lau, M. M., Cheung, R., Lam, A. Y. C., & Chu, Y. T. (2013). Measuring service quality in the banking industry: A Hong Kong based study. *Contemporary Management Research*, *9*(3), 263–282. doi:10.7903/cmr.11060

Lee, K. C., & Chung, N. (2009). Understanding factors affecting trust in and satisfaction with mobile banking in Korea: A modified DeLone and McLeans model perspective. *Interacting with Computers*, *21*(5), 385–392. doi:10.1016/j.intcom.2009.06.004

Lin, H. (2011). An empirical investigation of mobile banking adoption: The effect of innovation attributes and knowledge-based trust. *International Journal of Information Management*, *31*(3), 252–260. doi:10.1016/j.ijinfomgt.2010.07.006

Lin, H. (2011). The effect of multi-channel service quality on mobile customer loyalty in an online-and-mobile retail context. *Service Industries Journal*, *32*(11), 1865–1882. doi:10.1080/02642069.2011.559541

Lin, W. B. (2007). The exploration of customer satisfaction model from a comprehensive perspective. *Expert Systems with Applications*, *33*(1), 110–121. doi:10.1016/j.eswa.2006.04.021

Lu, J., Yu, C. S., & Liu, C. (2009). Mobile data service demographics in urban China. *Journal of Computer Information Systems*, *50*(2), 117–126.

Masukujjaman, M., & Aktar, S. (2013). Green banking in Bangladesh: A commitment towards the global initiatives. *Journal of Business and Technology*, *8*(1&2), 17–40.

Michael, O. B. (2015). Performance measurement systems and firms' characteristics: Empirical evidences from Nigerian banks. *International Journal of Business Analytics*, *2*(3), 67–83.

Moores, T. T. (2012). Towards an integrated model of IT acceptance in healthcare. *Decision Support Systems*, *53*(3), 507–516. doi:10.1016/j.dss.2012.04.014

Munusamy, J., Chelliah, S., & Mun, H. W. (2010). Service quality delivery and its impact on customer satisfaction in the banking sector in Malaysia. *International Journal of Innovation. Management and Technology*, *1*(4), 398–404.

Nelson, R. R., Todd, P. A., & Wixom, B. H. (2005). Antecedents of information and system quality: An empirical examination within the context of data warehousing. *Journal of Management Information Systems*, *21*(4), 199–235.

Nisha, N. (2016). Exploring the dimensions of mobile banking service quality: Implications for the banking sector. *International Journal of Business Analytics*, *3*(3), 60–76. doi:10.4018/IJBAN.2016070104

Nisha, N. (2016, forthcoming). Green investments and returns: A developing country perspective. In M. Mihai (Ed.), *Measuring Sustainable Development and Green Investments in Contemporary Economies*.

Nisha, N., Idrish, S., & Hossain, M. Z. (2015). Consumer acceptance and mobile banking services in Bangladesh. In Green Banking in Bangladesh and Beyond, (pp. 155-182). Zaman Printing and Packaging.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric Theory*. New York: McGraw-Hill.

Ozer, A., Argan, M. T., & Argan, M. (2013). The effect of mobile service quality dimensions on customer satisfaction. *Procedia: Social and Behavioral Sciences*, *99*, 428–438. doi:10.1016/j.sbspro.2013.10.511

Parasuraman, A., Zeithaml, V. A., & Berry, L. L. (1988). SERVQUAL: A multiple item scale for measuring consumer perceptions of service quality. *Journal of Retailing*, *64*(1), 12–40.

Parasuraman, A., Zeithaml, V. A., & Malhotra, A. (2005). E-S-QUAL: A multiple-item scale for assessing electronic service quality. *Journal of Service Research*, *7*(3), 213–233. doi:10.1177/1094670504271156

Phichitchaisopa, N., & Naenna, T. (2013). Factors affecting the adoption of healthcare information technology. *EXCLI Journal*, *12*, 413–436. PMID:26417235

Rejikumar, G., & Ravindran, D. S. (2012). An empirical study on service quality perceptions and continuance intention in mobile banking context in India. *Journal of Internet Banking and Commerce*, *17*(1), 1–22.

Sachdev, S. B., & Verma, H. V. (2004). Relative importance of service quality dimensions: A multisectoral study. *Journal of Service Research*, *4*(1), 93–116.

Shakil, M. H., Azam, M. K. G., & Raju, M. S. H. (2014). An evaluation of green banking practices in Bangladesh. *European Journal of Business and Management*, *6*(31), 8–16.

Sharma, G., & Malviya, S. (2011). Exploring the dimensions of mobile banking service quality. *Review of Business and Technology Research*, *4*(1), 187–196.

Singh, S., Srivastava, V., & Srivastava, R. K. (2010). Customer acceptance of mobile banking: A conceptual framework. *SIES Journal of Management*, *7*(1), 55–64.

Sripalawat, J., Thongmak, M., & Ngramyarn, A. (2011). M-banking in metropolitan Bangkok and a comparison with other countries. *Journal of Computer Information Systems*, *51*(3), 67–76.

Sulaiman, A., Jaafar, N. I., & Mohezar, S. (2007). An overview of mobile banking adoption among the urban community. *International Journal of Mobile Communications*, *5*(2), 157–168. doi:10.1504/IJMC.2007.011814

Swaid, S. I., & Wigand, R. T. (2009). Measuring the quality of e-service: Scale development and initial validation. *Journal of Electronic Commerce Research*, *10*, 13–28.

Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science*, *46*(2), 186–204. doi:10.1287/mnsc.46.2.186.11926

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *Management Information Systems Quarterly*, *27*(3), 425–478.

Venkatesh, V., Thong, J. Y. L., & Xin, X. (2012). Consumer acceptance and use of information technology: Extending the Unified Theory of Acceptance and Use of Technology. *Management Information Systems Quarterly*, *36*(1), 157–178.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Venkatesh, V., & Zhang, X. (2010). Unified theory of acceptance and use of technology: U.S. vs. China. *Journal of Global Information Technology Management*, *13*(1), 5–27. doi:10.1080/1097198X.2010.10856507

Zeithaml, V. A., Parasuraman, A., & Malhotra, A. (2002). Service quality delivery through web sites: A critical review of extant knowledge. *Journal of the Academy of Marketing Science*, *20*(4), 362–375. doi:10.1177/009207002236911

Zhao, L., Lu, Y., Zhang, L., & Chau, P. Y. K. (2012). Assessing the effects of service quality and justice on customer satisfaction and the continuance intention of mobile value-added services: An empirical test of a multidimensional model. *Decision Support Systems*, *52*(3), 645–656. doi:10.1016/j.dss.2011.10.022

This research was previously published in Managerial Strategies and Solutions for Business Success in Asia edited by Patricia Ordóñez de Pablos, pages 1-20, copyright year 2017 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 54
Evaluating Factors Affect Green IT Readiness (Part 1)

Yas A. Alsultanny
Arabian Gulf University, Bahrain

Fatma M. Alnassar
Arabian Gulf University, Bahrain

ABSTRACT

The IT departments must have green IT readiness to control emissions from data centres and selecting equipments of low power consumption. The purpose of this study is to evaluate the factors affecting green IT readiness. A questionnaire of developed to evaluate green IT readiness from the perspective of the IT staff. The questionnaire divided into two parts. The first part is for demographic information and general questions. The second part for green IT dimensions; technology, practice, policy, governance, and attitude. The data collected from 401 respondents. The results showed that the factors; technology, practice, attitude, and maintenance have an agree degree of agreement, while the factors; policy, governance, and green IT readiness have neutral degree of agreement. The governance has the highest correlation and influence on green IT readiness. The study recommends organizations, to setup strategies for implementing green IT as short-term solutions, and the government needs new laws and policies to implement green IT as a long-term solution.

INTRODUCTION

Since the advent of information technology, the power consumption is continuously increasing, and the consumption of fuel in turn has increased pollution. The disadvantages have reached the stage of risk for human health. Green technology has emerged to protect the environment from pollution.

The greenness of IT mostly depends on societies' readiness to adopt the green IT approach throughout the business. Green-readiness is referring to the use of technology by individuals in an organization, and easily identified by the indicators; green business infrastructure, development of green IT standards, server consolidation and virtualization, green buildings, and green power sources (RMIT, 2007).

DOI: 10.4018/978-1-5225-7915-1.ch054

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Green IT auditing is one of the methods used to measure power consumption; its benefit will reduce costs, and improve energy efficiency (Ambtman, 2011). Green IT emissions are considered the major interest of concern, which could be related either to the rate of production or consumption of carbon dioxide (CO_2). There are many sources of CO_2 emissions; one of them is the emission from the use of IT technologies (Jonathon, 2012). IT assessment is a method used to reach green IT implementation, and the government plays an important role in monitoring green IT (Jongsaguan & Ghoneim, 2013).

ICTs have estimates around 2% of global CO_2 emissions that is equal to the quantity generated by the airline sector (Goasduff & Forsling, 2007). The enlargement in IT emissions were expected to reach 6% at the end of 2020, while data centre emissions are expected to grow by 7% each year if no action is taken (Mingay, 2006).

The first section of this paper provides an introduction. The second section is for the motivations for this study. The third section is for the literature review. The fourth section is for the study objective. The fifth section is for research methodology. The sixth section describes data analysis. The final section is for the conclusion.

MOTIVATIONS FOR THIS STUDY

Two main factors that motivate any size of organizations toward green IT, these are the lack of natural resources demands and the stakeholders' environmental awareness (Esty & Winston, 2009). The motivational factors cause public employees to go for green theoretical framework based on connectedness to nature, organizational commitment, public service motivation, and organizational citizenship behaviour (Stritch & Christensen, 2014).

In the future, the expected demand for ICT will be increased, thus increasing power consumption and air pollution, critical issues that affect human life. Organizations must try to gain competitive advantage by practicing green IT readiness. Green IT readiness becomes very important in terms of the performance of any organization, saving money, and power consumption. In addition, it is necessary to provide IT staff an awareness of the importance of the green IT readiness, and reducing the misuse of IT facilities. All of these justify the needs of evaluating the green IT readiness factors.

LITERATURE REVIEW

Green IT defined as; an organization's ability to systematically applying environmental sustainability criteria to the design, production, sourcing, use and disposal of the IT technical infrastructure as well as within the human and managerial components of the IT infrastructure (Elliot, 2007).

Green IT contributes to reducing the environmental impacts of business IT activities (such as; adopting green technologies), green IT support for environmentally sustainable business practices (such as; enabling green supply chain management through building tools for energy management) and its role (such as; supplanting high CO_2 emitting business practices) in the low-carbon economy (Molla et al., 2009).

Greening IT mean that organizations have to be efficiently design their data centres and IT technologies in order to reduce energy consumption as well as cost (Graaf, 2008). The Energy Star is is an international standard for energy efficient consumer products which originated in the United States in

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

1992 by the Environmental Protection Agency (EPA) under the authority of the clean air, to help in protecting the environment by reducing energy consumption in an efficient way, for manufacturing and trade association, to retail and small business, to homebuilder.

ICT is a key driver for improving both business and private undertakings. E-readiness regarded as critical qualities that companies have to continue upgrade, in order to operate in the digital economy (Molla & Licker, 2005). Economically, ICTs have a vital role in improving and creating various economic opportunities. This explains why there are many national and international initiatives to measure the e-readiness of countries regarding access, connectivity, network security, and regulatory environments (Mia & Dutta, 2007).

Green IT readiness is the firm capability and state of maturity in applying environmental criteria to its IT technical infrastructure, as well as within its IT human infrastructure and management across the key areas of IT sourcing, operations, and disposal. Molla et al. (2008) developed a green IT readiness model. It consists of five factors. These factors are; attitude, policy, practice, governance, and technology. A green IT attitude means an organization has an IT sentiment towards environmental sustainability. The green IT policy means that the organization measures its IT impact on the environment. Green IT practice means the application that organizations consider in order to reduce emissions or enhance environmental awareness. Governance related to the organization's infrastructure required to implement green IT. Green information technology is about an information system that needed to reduce the end users' usage of energy and its consumption, as well as optimizing the power efficiency (InfoTech, 2007; InfoTech, 2008; Molla & Cooper, 2009).

Molla et al., (2009) compared the green IT readiness between Australia, New Zealand, and USA implemented the five dimensions; technology, attitude, governance, practice, and policy. Data collected from 143 respondents by surveying the chief information officers and other IT managers, the results showed that USA ranked the first in governance, technology, and practice dimensions but not policy, while New Zealand implemented the green IT policy. Hooia et al. (2012) explored the readiness of a green university framework in Malaysia. The results showed, that in order to be successfully green, the organizations and countries have to measure IT user readiness and the motivation for organizations to move toward green. The study recommended; awareness, acceptance, and assimilation to mechanism to achieve a sustainable and successful implementation. Jonathon (2012) found in his study that the green IT benchmarks sustainable in the USA, India, UK, and Australia, the development of an overall green IT readiness index for any IT organizations depends on five keys of green IT: Green IT Lifecycle, end user IT efficiencies, enterprise and data centre IT efficiencies, usage of IT as a low-carbon enabler, and green IT measurement and monitoring. The best performing was the United Kingdom and USA rated second, followed by Australia and India.

Wabwoba et al. (2013) looked at difficulties in adopting green IT in Kenya. Their result showed that green IT is a solution to countries and firms to overcome various difficulties and hence satisfy the need of stakeholders to protect the environment, there is an urgent need to make sure of the high level of green ICT readiness among end users as well as IT managers to enhance business sustainability. Buchalcevova (2015) showed a design of a green ICT maturity model for assessing green ICT capability in small and medium enterprise companies. He recommended a model that has six maturity factors; carbon emissions management, smart motors, smart logistics, smart building, and smart energy.

In Kuwait, the estimated increase of electricity consumption per capita is 16,090 Kw/hr per person. Kuwait ranked the third highest consumable country over the world in the year 2012. This increase cre-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

ated emissions such as CO_2, which has an impact on the environment. In addition, the mobile phones increased the Internet usage. The Kuwaiti mobile users according to information index was ranked 17th in the world in year 2012 (www.indexmundi.com).

STUDY OBJECTIVE

The main objective of this study is to evaluate the factors affecting green IT readiness in the Kuwaiti public sector from the perspectives of the IT staff, by identifying the factors that effecting green-IT readiness and study the effect of demographics information on the green IT readiness factors.

From the study objective the following questions derived;

1. What are the factors that affect green IT readiness from the perspective of IT staff?
2. Does the demographics information of IT staff have significant effect on green IT factors and green IT readiness?

RESEARCH METHODOLOGY

Research methodology is a plan of actions, processes or design lying behind the choice and use of particular methods to execute studies Crotty (1998). This study used descriptive and quantitative methods. The descriptive method used in order to provide descriptive information about the topic. Quantitative analysis is the processing and manipulating of raw data into meaningful information. A questionnaire designed for evaluating the factors impact on green IT readiness, from the perspectives of IT staff who are working in IT departments to install, configure, and optimize operating system, test security patches, develop, backup, and oversee maintenance.

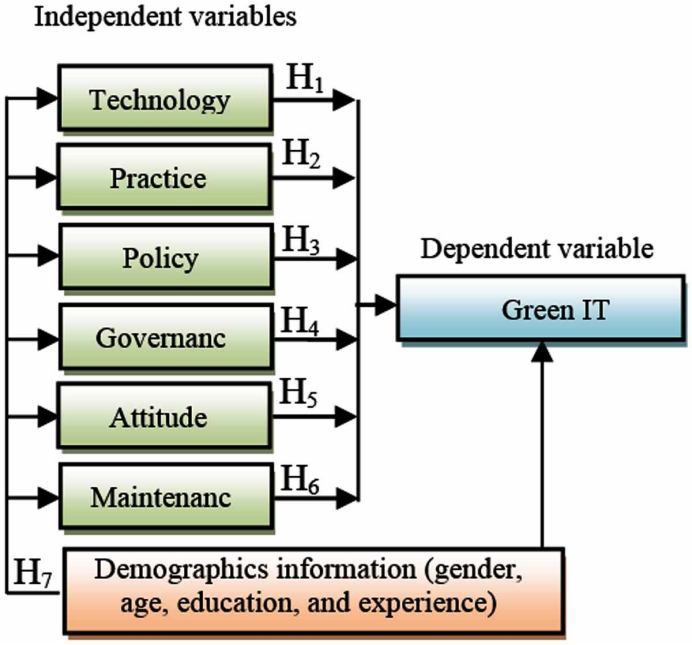
This questionnaire divided into two parts. The first part was for demographics information. The second part for green IT dimensions. These dimensions adopted from Molla et al., (2009), which had five dimensions (technology, practice, policy, governance, and attitude). Maintenance as a sixth dimension added to this model, these dimensions are the independent variables of the study, the statements of dimensions measured by 5-points Likert Scale, where; Strongly Disagree (SD=1 points), Disagree (D=2 points), Neutral (N=3 points), Agree (A=4 points), and Strongly Agree (SA=5 points). The demographics information (gender, age, education, and experience) used to find their effect on the green IT readiness and on the six dimensions of this model. Figure 1 shows the conceptual model of the study.

The hypotheses of the study are;

H_1: There is a statistically significant effect of technology on green IT readiness.
H_2: There is a statistically significant effect of practice on green IT readiness.
H_3: There is a statistically significant effect of policy on green IT readiness.
H_4: There is a statistically significant effect of governance on green IT readiness.
H_5: There is a statistically significant effect of attitude on green IT readiness.
H_6: There is a statistically significant effect of maintenance on green IT readiness.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 1. The IT staff conceptual model



H_7: The IT staff demographics information (gender, age, education, and experience) have a statistically significant differences in (technology, practice, policy, governance, attitude, maintenance, and green IT readiness).

The questionnaire evaluated by universities experts. The degree of respondents' agreement ranked by the following scale: Strongly Disagree (SD) ranged from 1-1.8, Disagree (D) ranged from 1.81-2.6, Neutral (N) ranged from 2.61-3.4, Agree (A) ranged from 3.41-4.2, and Strongly Agree (SA) ranged from 4.21–5.

The correlation coefficient represented by R in this study. According to Gerstman (2003) coefficient with a value of more than ±0.7 indicates a strong association between variables, values ±0.7>=R>=±0.3 are moderate correlation, and values less than ±0.3 have weak correlation.

The population of the study is from the Kuwaiti Public sector. The questionnaire distributed online and manually, 401 respondents used in the analysis.

The validity checked by a correlation as shown in Table 1; the Spearman indicates a statistical linear relationship between each dimension and its statements for all the dimensions. Since the coefficient R>0 and p-value≤0.05, it is clear that all the correlations of the questionnaire are positively and significantly ranging from 0.103 to 0.886 and the sig. are significant and equal to zeros.

Cronbach alpha used to measure reliability. Yin (2003) determined that the cut-off-point for Cronbach alpha is 0.7. Table 2 shows the results of testing Cronbach alpha. The highest alpha value is in the maintenance dimension (0.917), and the lowest alpha value for green IT readiness dimension is (0.701), the total alpha value for this questionnaire is (0.851). This indicates the data collected by this questionnaire is reliable for analysis.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 1. Spearman correlation for questionnaire validity test

Dimensions	Spearman correlation	Sig.*
Technology	0.271**	0.000
Practice	0.364**	0.000
Policy	0.103**	0.000
Governance	0.315**	0.000
Attitude	0.539**	0.000
Maintenance	0.886**	0.000
Green IT readiness	0.893**	0.000

Sig*: significant value
** correlation is significant at the 0.01 level (2-tailed)

Table 2. Cronbach alpha for reliability

Dimension	No. of statements	Alpha	Reliability
Technology	6	0.751	0.851
Practice	7	0.844	
Policy	4	0.767	
Governance	3	0.857	
Attitude	6	0.911	
Maintenance	5	0.917	
Green IT readiness	3	0.701	

Data Analysis

This section is for analyzing the data collected from 401 IT staff respondents. The demographics information of the respondents is as shown in Table 3.

The second section of the questionnaire contains 34 statements divided into 7 dimensions. For each statement the average of each statements calculated by the responds values [(SD+D+A+A+SA)/5], where its ranges are from 1-5. The standard deviation (Sd) calculated for each statement. The rate (degree of agreement), and rank (sorted from the highest average to lowest average) were calculated. The rank is the order of agreement of each statement in the dimension.

Table 4 shows the descriptive statistics of respondents for the seven dimensions. The table shows that for the technology dimension, the first rank goes to the statement (3), which states, "Data was stored in optimal utilization methods", with the highest average (3.72) and standard deviation (1.644). The average of this dimension is (3.456) with a standard deviation of (1.244). The results of this dimension indicates an agree degree of agreement, which means the respondents are agreeing with the level of the technology used in their organization like optimal storage utilization, data centres are cooled efficiently, and satisfaction with the IT equipment size.

The table shows the first rank of the Practice dimension goes to the statement (7), which states, "Prefers IT suppliers that have green track record", with the highest average (3.61) and standard deviation

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 3. Respondents' demographics information

No.	Demographics Information	Type	F	%
1	Gender	Male	311	77.6
		Female	90	22.4
2	Age	Less than 20 years	44	11.0
		21-30 years	174	43.4
		31-40 years	106	26.4
		41-50 years	47	11.7
		Above 50 years	30	7.5
3	Education	Diploma degree	35	8.7
		Bachelor degree	245	61.1
		Higher education degrees	121	30.2
4	Experience	Less than 1 year	119	29.6
		1-5 years	77	19.2
		6-10 years	60	15.0
		11-15 years	113	28.2
		More than 15 years	32	8.0

F: Frequency
%: Percentage

(1.099). The practice dimension average is (3.442) with a standard deviation of (1.136). The result of this dimension indicates an agree degree of agreement, which means that they prefer IT suppliers that have a green track record, and switch off unnecessary equipment when not needed.

The table shows the first rank of the Policy dimension goes to the statement (14), which states "Dispose of old IT items in an environmentally friendly manner", with the highest average (3.43) and standard deviation (1.190). The dimension average is (3.295) with a standard deviation of (1.190). The results of this dimension indicated a neutral degree of agreement. They agreed with disposal of old IT items in an environmentally friendly manner, their policy must be directed toward using IT in an efficient manner to save energy, which is the responsibility of managers and government.

The table shows that the first rank of the Governance dimension goes to the statement (19), which states, "The organization is applying green IT policy", with the highest average (3.43) and standard deviation (1.175). The dimension average is (3.220) with standard deviation (1.181). The results of this dimension indicated a neutral degree of agreement, which means that the IT staffs needs more awareness for green IT governance to shift to green sources of energy and apply green IT policy.

The table shows that the first rank of the dimension Attitude goes to the statement (23), which states "My responsibilities on green IT are clearly defined", with the highest average (3.58), and standard deviation (1.174). The average of this dimension is (3.516) with a standard deviation of (1.161), which is an agree degree of agreement. The IT staff agreed that their responsibilities on green IT are clearly defined which means they are aware of the green IT concept, and they are concerned with green IT and IT energy consumption.

The table shows that the first rank of the dimension Maintenance goes to the statement (31), which states "your organization has an information system to monitor workloads and to shutdown components

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

when unused", with the highest average (3.97) and standard deviation (1.094). The dimension average is (3.896) with a standard deviation of (1.052). The results of this dimension is an agree degree of agreement, which means the IT staff agreed that their organization has an information system to monitor workloads and to shutdown components when unused. It also removes the energy of the inefficient IT components.

The table shows that the first rank of the dimension Green IT readiness goes to the statement (33), which states, "Set target for implementing green IT factors", with an average (3.37) and standard deviation (1.189). The dimension average is (3.320) with a standard deviation of (1.171). The results of this dimension indicates a neutral degree of agreement, which means the IT staff are neutral satisfied with target setting for implementing green IT in their organization. Also the IT staff is neutral satisfied whether the CEO`s role is active in leading green IT initiatives.

The data distribution of the statements was tested by Kolmgrov-Simirnov, the results showed that the data distribution for the statements had non normal distribution, because the sig. values of the statements are less than 0.05. Therefore, the Spearman association used to test the correlation between the dimensions of the statements. Table 5 shows the matrix of correlations. The results indicated a positive and significant correlation between the seven dimensions. There is a strong correlation between governance and green IT readiness with a value 0.742; this indicates that governance is an important factor affecting green IT readiness. The maintenance dimension has the lowest moderate correlation effect on the green IT readiness with a value of 0.341.

A simple linear regression test carried out for testing the hypotheses (H_1 to H_6). Table 6 shows the result of testing the effect of technology on green IT readiness.

The table shows a moderate correlation *R=0.397*, with determent factor *R square=0.158*, between technology and green IT readiness, and sig. value is 0.000, which is less than (α=0.05). It indicates there is a significant effect of technology on green IT readiness. Therefore, hypothesis H_1 is accepted. The regression equation is: Green IT readiness=1.869+0.419(technology). Molla et al. (2009) stated that all of the technology components of green readiness focus on technological solutions that improve IT energy.

The table shows a moderate correlation *R=0.672*, with determent factor *R square=0.451*, between practice and green IT readiness, and sig. value is 0.000. It indicates there is a significant effect of practice on green IT readiness. Therefore, hypothesis H_2 is accepted. The regression equation is: *Green IT readiness=0.808+0.729(Practice).* Which shows a linear relationship between the two variables. Murugesan (2008) stated in his study the benefits of using and implementing green IT practices design for environmental sustainability, energy efficient computing, and responsible disposal and recycling.

The table shows a moderate correlation *R=0.473*, with determent factor *R square=0.223*, between policy and green IT readiness, and sig. value is 0.000. It indicates there is a significant effect of policy on green IT readiness. Therefore, hypothesis H_3 is accepted. The regression equation is: *Green IT readiness =1.806+0.459(policy)*, which shows a linear relationship between the two variables. There is a need for policy to direct staff to use IT in an efficient manner to save energy in their organization. Molla et al. (2009) stated the maturity of policy dimension affect the green IT and guide the use of IT in reducing carbon footprint.

The table shows a strong correlation *R=0.742*, with determent factor *R square=0.550*, between governance and green IT readiness, sig. value is 0.000. It indicates there is a significant effect of governance on green IT readiness. Therefore, hypothesis H_4 is accepted. The regression equation is: *Green IT readiness=1.289+0.631(governance)*, which shows a linear relationship between the two variables, because governance has a major role in set the rules and laws for the country so governance had the highest ef-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 4. Descriptive statistics for the questionnaire dimensions

No	Statements	Average	Sd	Rate	Rank
1.	There is a power shut down system after the end of the official working hours.	3.11	1.331	N	6
2.	The organization use right sizing IT equipment.	3.51	1.112	A	3
3.	Data was stored in optimal utilization methods.	3.72	1.644	A	1
4.	Data was used virtualization storage.	3.39	1.189	N	5
5.	Highly efficient cooling system for data center used.	3.52	1.138	A	2
6.	More energy efficient lights were used.	3.49	1.051	A	4
Technology dimension average		**3.456**	**1.244**	**Agree**	
7.	Prefers IT suppliers that have a green track record.	3.61	1.099	A	1
8.	Consider environmental factors in the design of the IT site infrastructure (lighting, power, and cooling systems).	3.42	1.155	A	4
9.	The organization switch off data center lights.	3.33	1.161	N	7
10.	Switch off unnecessary equipment when not needed.	3.51	1.120	A	2
11.	There is a system for recycle consumable equipment (e.g. batteries, ink cartridges, and paper).	3.45	1.182	A	3
12.	The organization organizes print optimization.	3.38	1.123	N	6
13.	To what extent your organization practices double sided documents.	3.40	1.114	N	5
Practice dimension average		**3.442**	**1.136**	**Agree**	
14.	Dispose of old IT items in an environmentally friendly manner.	3.43	1.190	A	1
15.	Applied green data centers policy.	3.20	1.215	N	4
16.	The policy of directing staff to use IT in an efficient manner to save energy.	3.23	1.161	N	3
17.	Relocation of data center near clean sources of energy.	3.32	1.194	N	2
Policy dimension average		**3.295**	**1.190**	**Neutral**	
18.	The organizations consider shifting to green sources of energy for IT equipment.	3.15	1.247	N	2
19.	The organization is applying green IT policy.	3.43	1.175	A	1
20.	Analyzing IT`s energy bill separately from the overall corporate bill.	3.08	1.123	N	3
Governance dimension average		**3.220**	**1.181**	**Neutral**	
21.	I am concerned with green IT.	3.54	1.086	A	3
22.	I am concerned with IT energy consumption.	3.56	1.169	A	2
23.	My responsibilities on green IT are clearly defined.	3.58	1.174	A	1
24.	Your organization is concerned with the energy consumption for lighting and cooling data centers.	3.51	1.206	A	4
25.	Your organization is concerned with the efficiency of powering our IT infrastructure (storage, servers, and network).	3.43	1.192	A	6
26.	Your organization is concerned with the environmental impact while disposing of IT items at the end of their lifecycles.	3.48	1.142	A	5
Attitude dimension average		**3.516**	**1.161**	**Agree**	
27.	Your organization manages data center airflow efficiency.	3.86	1.083	A	5
28.	The power system was upgraded to more efficient transformers.	3.90	1.029	A	3
29.	Your organization uses highly efficient stand-by power systems.	3.83	1.053	A	4
30.	Remove energy of the inefficient IT components.	3.92	1.003	A	2
31.	Your organization has an information system to monitor workloads and to shutdown components when unused.	3.97	1.094	A	1
Maintenance dimension average		**3.896**	**1.052**	**Agree**	
32.	CEO plays a leading role in green IT initiatives.	3.35	1.099	N	2
33.	Set targets for implementing green IT factors.	3.37	1.189	N	1
34.	Purchase IT components more environmentally friendly.	3.24	1.226	N	3
Green IT readiness dimension average		**3.320**	**1.171**	**Neutral**	

fect on green IT readiness. Molla et al. (2009) mentioned in his study that governance had the highest impact on green IT readiness in the USA.

The table shows a moderate correlation *R=0.447*, with determent factor *R square=0.200*, between attitude and green IT readiness, and sig. value is 0.000. It indicates there is a significant effect of at-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 5. IT staff matrix of correlation

Dimension	Technology	Practice	Policy	Governance	Attitude	Maintenance	Green IT readiness
Technology	1						
Practice	0.421*	1					
Policy	0.395*	0.348*	1				
Governance	0.299*	0.698*	0.239*	1			
Attitude	0.224*	0.454*	0.132*	0.460*	1		
Maintenance	0.175*	0.421*	0.125*	0.309*	0.579*	1	
Green IT readiness	0.365*	0.678*	0.413*	0.742*	0.456*	0.341*	1

Means statically significant at the level of significance (α=0.05) *

titude on green IT readiness. Therefore, hypothesis H_5 is accepted. The regression equation is: *Green IT readiness=1.847+0.419 (attitude)*. This shows a linear relationship between the two variables. This indicates that the IT staffs are more concerned with power consumption, and they are responsible for using the IT in a green method. This corresponds with results of the Tenhunen (2011) study, that green IT readiness is more characterized as an attitude rather than a set of planned tasks.

The table shows a moderate correlation *R=0.347*, with determent factor *R square=0.120*, between maintenance and green IT readiness, and sig. value is 0.000. It indicates there is a significant effect of maintenance on green IT readiness. Therefore, hypothesis H_6 is accepted. The regression equation is: *Green IT readiness=2.007+0.337(maintenance)*, which shows a linear relationship between the two variables, because the organizations have information systems to monitor workloads and to shutdown components when unused. This is compatible with Boudreau et al., (2010) results, which showed regular maintenance increase the performance of the IT product through time, decrease repair, and minimize disposal items.

Table 7 shows the IT staff gender variance test, by using the Independent T-test on the dimensions of the questionnaire. The table shows that gender would have different perceptions regarding practice only, with sig.=0.036, which indicate that males have more practices on using green IT than the females. All the other dimensions have sig. values greater than (α= 0.05). Therefore, the gender has no statistically significant differences in these dimensions.

Table 8 shows that the IT staff age, education, and experience variance tests, by using one way ANOVA on the dimensions of the questionnaire. For age, the table shows that only the attitude has no statistically significant differences, while the other dimensions have statistically significant differences according to age.

For educational, the table shows that the IT staff education has no statistically significant differences in the dimensions policy, governance, and attitude dimensions. The other dimensions have statistically significant differences for the IT staff education on the other dimensions.

For experience, the table shows that the IT staff experience variance test. The table shows that the IT staff experience have statistically significant differences on the dimensions; practice, policy, governance, attitude, maintenance, and green IT readiness.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 6. Regression test for the hypotheses H_1 to H_6

Hypothesis	Source of variance	Sum of square	df*	Mean square	R	R square	F value	Sig.
H_1	Regression	49.681	1	49.681	0.397	0.158	8.651	0.000
	Residual	264.895	399	0.664				
	Total	314.577	400					
H_2	Regression	142.020	1	142.020	0.672	0.451	18.122	0.000
	Residual	172.557	399	0.432				
	Total	314.577	400					
H_3	Regression	70.258	1	70.258	0.473	0.223	10.712	0.000
	Residual	244.319	399	0.612				
	Total	314.577	400					
H_4	Regression	173.107	1	173.107	0.742	0.550	22.096	0.000
	Residual	141.470	399	0.355				
	Total	314.577	400					
H_5	Regression	62.843	1	62.843	0.447	0.200	9.980	0.000
	Residual	251.734	399	0.631				
	Total	314.577	400					
H_6	Regression	37.823	1	37.823	0.347	0.120	7.384	0.000
	Residual	276.754	399	0.694				
	Total	314.577	400					

df*: degree of freedom

Table 7. Independent T-test for the gender

Dimension	Gender	N	Average	SD	T-value	df	Sig.
Technology	Female	90	3.48	0.871	0.313	399	0.754
	Male	311	3.45	0.832	0.305		
Practice	Female	90	3.28	0.875	-2.105	399	0.036
	Male	311	3.48	0.795	-1.997		
Policy	Female	90	3.16	0.734	-1.458	399	0.146
	Male	311	3.31	0.917	-1.645		
Governance	Female	90	3.10	0.951	-1.937	399	0.053
	Male	311	3.32	0.985	-1.975		
Attitude	Female	90	3.45	0.927	-0.672	399	0.502
	Male	311	3.53	0.952	-0.681		
Maintenance	Female	90	3.96	0.844	0.769	399	0.442
	Male	311	3.87	0.932	0.812		
Green IT readiness	Female	90	3.17	0.868	-1.757	399	0.640
	Male	311	3.36	0.889	-1.780		

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 8. One way ANOVA test for the age, education, and experience

Dimension	Age		Education		Experience	
	F value	Sig.	F value	Sig.	F value	Sig.
Technology	8.216	0.000	4.113	0.017	1.810	0.126
Practice	8.416	0.000	4.532	0.011	3.546	0.007
Policy	5.611	0.000	0.506	0.603	3.597	0.007
Governance	6.955	0.000	2.803	0.062	4.843	0.001
Attitude	0.593	0.668	0.292	0.747	6.531	0.000
Maintenance	2.492	0.043	5.519	0.004	6.337	0.000
Green IT Readiness	5.961	0.000	5.449	0.005	7.182	0.000

CONCLUSION

Green IT readiness is one of the most important subjects in daily life, because it is related to the environment. The dramatic increasing of IT equipment, especially through ICT, requires increasing power consumption. To evaluate green IT readiness, this study measured the factors effect on green IT readiness from the perspective of the IT staff.

To answer the first question of this study; what are the factors that affect green IT readiness from the perspective of IT staff? The results showed that the technology, practice, attitude, and maintenance have an agreed degree of agreement, while the; policy, governance, and the green IT readiness have a neutral degree of agreement. The highest correlation coefficient was between governance and green IT readiness. The strongest dimension with a significant effect on green IT readiness was governance, followed by practice.

For the second question; Does the demographics information of IT staff have significant differences effect on green IT factors and green IT readiness? The results showed that gender has no statistically significant differences in green IT readiness dimensions except practice. Age groups have statistically significant differences in green IT dimensions except attitude. Educational level has no statistically significant differences on (policy, governance, and attitude). Years of experience have statistically significant differences in green IT readiness except technology.

The recommendations of this study are; the government must setup strategies for implementing green IT as a short-term solution. Moreover, the government needs new law and policies to implement green IT and became part of the employee behavior as a long-term solution. The cloud computing may be one of the solution if the security available to the extent that satisfying public sectors.

REFERENCES

Ambtman, E. (2011). *Green IT Auditing* [MSc Thesis]. Amsterdam.

Boudreau, M., Chen, A., & Watson, R. (2010). Information Systems and Environmentally Sustainable Development: Energy Informatics and New Directions for the IS Community. *Management Information Systems Quarterly*, *34*(1), 23–38.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Buchalcevova, A. (2015). Green ICT Maturity Model for Czech SMEs. *Journal of Systems Integration*, *6*(1), 24–36. doi:10.20470/jsi.v6i1.220

Crotty, M. (1998). *The Foundation of Social Research: Meaning and Perspectives in the Research Process*. London: Sage.

Elliot, S. (2007, July 4-7). Environmental Sustainable ICT a Critical Topic for IS Research. *Proceedings of PACIS '07*, Auckland, New Zealand.

Esty, D., & Winston, A. (2009). *Green to Gold*. New Jersey: John Wiley & Sons.

GerstmanB. (2003). StatPrimer. Retrieved from ww.sjsu.edu

Goasduff, L., & Forsling, C. (2007). *Gartner Says 50 Percent of Mid and Large Sized Western European IT Organizations Will Develop a Green Strategy by the End of 2008.*Gartner, Egham, 22 May.

Graaf, C. (2008). *Search of Green IT Governance*. Greener Computing.

Hooia, K., Hassanb, F., & Matb, M. (2012, July 16-18). An Exploratory Study of Readiness and Development of Green University Framework in Malaysia. *Procedia-Social and Behavioral Sciences, 50*, 525-536.

Index Mundi. (2015). Retrieved from http://www.indexmundi.com/kuwait/

InfoTech. (2007). PC Power Saving Plans Reduce Costs and Environmental Impact. *Info~Tech Research Group*.

InfoTech. (2008). North America Underperforms in Green IT Attitude and Actions. *Info~Tech Research Group*, 1-15.

Jonathon, P. (2012). *Green IT: The Global Benchmark A Report on Sustainable IT in the USA, UK, Australia and India.* Retrieved from http://www.ictliteracy.info/rf.pdf/green_IT_global_benchmark.pdf

Jongsaguan, S., & Ghoneim, A. (2013, October 17-18). Investing in the Factors Affecting Information Systems Evaluation within Sustainable Environments. *Proceedings of the Mediterranean and Middle Eastern Conference on Information Systems*, Windsor, United Kingdom.

Mia, I., & Dutta, S. (2007). *The Global Information Technology Report 2006/2007, World Economic Forum.* Geneva.

Mingay, S. (2006). *The IT Industry is Part of the Climate Change and Sustainability Problem*. Retrieved from www.gartner.com

Molla, A., & Cooper, V. (2009). Green IT Readiness; A Framework and Preliminary Proof of Concept. *Australasian Journal of Information Systems*, *16*(2), 271–385.

Molla, A., Cooper, V., Corbitt, B., Deng, H., Peszynski, K., & Pittayachawan, S. (2008, December 3-5). E-Readiness to G-Readiness: Developing a Green Information Technology Readiness Framework. *Proceedings of the 19th Australasian Conference on Information Systems*, Christchurch, New Zealand.

Molla, A., Cooper, V., & Pittayachawan, S. (2009, December 15-18). IT and Eco-Sustainability: Developing and Validating a Green IT Readiness Model. *Proceedings of the 13th International Conference on Information Systems*, Phoenix, Arizona, USA.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Molla, A., & Licker, P. (2005). Perceived E-Readiness Factors in E-Commerce Adoption: An Empirical Investigation in a Developing Country. *International Journal of Pare*, *10*(1), 83–110.

Murugesan, S. (2008). *Harnessing Green IT: Principles and Practices*. IEEE Computer Society.

RMIT. (2007). *RMIT Goes a Deeper Shade of Green*. Retrieved from www.rmit.edu.au

Stritch, J., & Christensen, R. (2014). Going Green in Public Organizations: Linking Organizational Commitment and Public Service Motives to Public Employee` Workplace Eco-Initiatives. Retrieved from www.arp.sagepub.com/content/early/2014/09/29/0275074014552470

Tenhunen, M. (2011). Conceptualizing and Measuring Green IT Readiness in Finnish Companies. Application Area: Electronic Invoice [Msc Thesis]. Aalto University, Canada.

Wabwoba, F., Wanyyemi, G., Omuterema, S., & Omieno, K. (2013). Green ICT Readiness Model for Developing Economics: Case of Kenya. *International Journal of Advanced Computer Science and Applications*, *4*(1), 51–65. doi:10.14569/IJACSA.2013.040108

Yin, R. (2003). *Case Study Research: Design and Methods* (3rd ed.). Thousand Oaks: Sage Publications Inc.

This research was previously published in the International Journal of Green Computing (IJGC), 6(2); edited by Vicente Gonzalez-Prida, pages 30-42, copyright year 2015 by IGI Publishing (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 55
Created Shared Value and Sustainable, Inclusive Development of Developing Countries

James Odia
University of Benin, Nigeria

ABSTRACT

The created shared value represents a paradigm shift in business corporate social responsibility (CSR) and sustainability strategy. Apart from addressing the limitations inherent in the traditional CSR which is mainly philanthropic, short-lived and separated from the core business strategy and activities, it enhances the company's competitiveness while simultaneously advancing the economic and social conditions in the community of operation. Companies can create shared values through re-conceiving products and markets, redefining productivity in the value chain and building supportive industry clusters at the company's locations and solving society problems. Despite the criticisms and challenges of the shared value concept, there are convincing evidences that the created shared value is a veritable instrument for addressing the bottom of the pyramid resulting in inclusive, sustainable development of developing countries and it has the potentials to unleash the next wave of global economic growth, prosperity and sustainable development when governments, companies and non-government organizations in developing countries demonstrate commitment to their roles in shared value creation and companies start to think and take long-term views of social investments and economic prosperity, and look at corporate decisions and opportunities through the lens of shared value by incorporating social and societal values into their economic agenda.

INTRODUCTION

The concept of Created Shared Value (CSV) has been pioneered by Professor Michael Porter and Mark Kramer of the Harvard University since 2011. Although the idea of shared value was first expressed in their publication in the Harvard Business Review on "Strategy and society: The link between competitive advantage and corporate social responsibility" in 2006 where they advocated a mutual dependence

DOI: 10.4018/978-1-5225-7915-1.ch055

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

between corporations and society or a win-win business-society relationship. There would be a symbiotic relationship and reciprocity between business and society as firms redefine and readjust their concept of value in a broader, more "shared" perspective (Davenport, 2011). It is business paving ground for its own success by curing the defects of a dysfunctional society through provision of infrastructure (such as roads, water supplies, schools) required for its production and produce shared value for the whole area (Kleemann & Krieger-Boden, 2011).

The CSV is a new revolutionary way of business thinking in the business-society relationship, which integrates social goals within business practice without distracting a firm from its primary purpose of achieving profit (Porter & Kramer, 2011; Rocchi & Fererro, 2014). This could trigger once again the greatest economic wealth, growth and innovation for humanity and business (Porter & Kramer, 2011). According to Porter and Kramer (2011), shared value can be defined as policies and operating practices that enhance the competitiveness of a company while simultaneously advancing the economic and social conditions in the community in which it operates and companies can create shared values through re-conceiving products and markets, redefining productivity in the value chain and building supportive industry clusters at the company's locations.

Porter and Kramer's propositions for the CSV have been laudable and applauded by many supporters (Bockstette & Stamp, 2011; Hills, Russell, Borgonovi, Doty, & Lyer, 2012; Pfitzer, Bockstette & Stamp, 2013; Visser, 2013) in re-connecting the disconnected corporations' successes to society's development, particularly in the advancement of social causes to strategic level, specifying the roles of government in enhancing shared value and introducing a broader conception of capitalism- the "caring or conscious capitalism". Without doubts, the world has experienced unparalleled prosperity following the industrial revolution and the free-market economy. Nevertheless Ringmar (2005) argued that although capitalism has produced comparable levels of economic prosperity, it has brought to human beings and societies the consequences of income inequality, erosion of non-market values, commodification and alienation of people and hence it should be controlled.

The arguments on CSR have revolved around the CSR continuum of Professor Friedman's neo-classical economic theory and Professor Freeman's stakeholder theory. Although Porter and Kramer (2011) argued that CSV is not social responsibility, philanthropy or even sustainability, it does appear that CSV is beyond CSR of business! In fact, In every country, particularly the developing ones, CSR has become inescapable priority for businesses (Porter & Kramer, 2006; Jean & Yazdanifard, 2015) and they are being blamed for every society's failures (Porter & Kramer, 2011), as corporate prosperity at the expense of the society's deep poverty and problems. Moreover, most of companies' efforts have not pay off greatly in their productivity due to the disconnect from or the ditch against society and the failure to link CSR to their strategy (Porter & Kramer, 2006). Porter and Kramer (2011) argued that there is a growing perception of companies' successes at the expense of society's social, environmental and economic problems. The companies' CSR have not been strategic to be a source of business opportunity, innovation, revenue growth, competitive advantage and benefits to society (Moore, 2014).

The CSV represents a win-win situation where an organization creates value for the society by tackling its needs and challenges in a way, which also creates economic value to them. Epstein (2012) remarks that CSV will grow future markets as well as strengthen economies and communities The CSV challenges the academic literature on corporate social responsibility as well as business practice in the few years of its existence. No wonder, CSV has been studied from different point of views, contexts such as industrial sectors and multinationals, social entrepreneurship (Pirson, 2012) and countries e.g. Brazil (Spitzek & Chapman, 2012), India (Vaidyanathan & Scott, 2012), and Australia (Leth & Hems,

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

2014). Some have tried to reconstruct/redesign or extend the original CSV framework by Porter and Kramer (Michelini & Fiorentino, 2012; Moon, Pare, Yim & Park, 2011) and/or widely applied the CSV to regional development, poverty reduction and to other disciplines like finance and banking (Bockstette, Pfitzer, Smith, Bhavaraju, Priestley & Bhatt 2014), education (Kramer &Tallant, 2014), global health (Peterson, Rehrig, Stamp & Kim, 2012), oil, gas and mining companies (Hidalgo, Peterson, Sith & Foley, 2014), agriculture, business corporate strategy, low-income markets and emerging markets (Hills, Russell, Borgonovi, Doty & Iyer, 2012).

A global assessment of CSV projects by Kreckova (2015) shows that CSV by regions is very uneven with South America, Central America and Caribbean region (22%), Africa (18%), North America (14%) and Asia (14%). The top social incidents are health and nutrition projects (21%), education, including workforce development (19%), financial inclusion, human rights and poverty with 9% each. Again AT Kearney (2015) study of over 200 social impact initiatives of United Nations Global Compact led companies reveals that 40% was shared value, 35% fall into philanthropy and 25% in community investments. This study was different from 2011 study where 75% of corporate social investment was philanthropy. The reason for the shift was attributed to the increased focus on minimizing environmental impacts and expanding employment and educational opportunities.

There are lots of literature and empirical evidences that the CSR approach in the developing countries of Africa including Nigeria has been mainly philanthropic and normative CSR (Visser, 2006, 2008; Visser, Matten, Pohl & Tolhurst, 2007; Amaeshi, Adi, Ogbechie & Amao, 2006; Odia, 2016). There are also increasing expectations by various stakeholders that corporate organizations, especially the multinational companies (MNCs) and transnational companies (TNCs) should go beyond profit maximization and regulatory compliance to take up responsibilities that make significant impact on society by helping to remedy the social problems including the ones caused by them (Odia, 2016). Some of the multinational oil companies in Nigeria like Shell Petroleum and Chevron have tried to move towards value sharing in their social responsiveness to oil producing communities in the Niger Delta region through partnership and social investments in host communities. Chevron's Partnership Initiatives in the Niger Delta (PIND) through the collaborative venture with the United States Agency for International Development (USAID), the Department for International Development (DFID), and others was aimed at enabling economic growth in the nine (9) oil-producing States of the Niger Delta area of Nigeria through investment of over $100 million in five years to create opportunities in other areas other than its value chain.

The CSV may just be the desired solution that the stakeholders have been waiting for to make corporations break away from the restricted CSR involvement to embrace the broader view of "caring, conscious capitalism" and respond to social issues and problems (Visser, 2013; Kreckova, 2015). While there are social and economic benefits, and prospects associated with CSV to the society and businesses at least from evidences of companies that have keyed into the CSV, a research gap exists on how CVS is linked to the sustainable, inclusive development of developing countries. There are also numerous limitations and criticisms regarding CSV such as: measurement issues, changing corporate mindsets to view environmental and social problems not as constraints but as business opportunities, gaining support of top management of MNCs, TNCs and other companies to key in and their voluntary CSV compliance and getting support of governments and agencies at the local, national and international levels to encourage more businesses to adopt shared value strategies.

Therefore, based on the review of extant literature and case studies on CSV, the objective of the chapter is to examine the relationship between CVS and sustainable, inclusive development from the perspective of developing countries like Nigeria. The rest of the chapter is divided into four sections:

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The immediate section clarifies the concept of CSV and differentiates it from CSR. Section three considers the issues, controversies and problems relating to CSV such as the problems with the presents CSR, the creation of shared value, shared valued opportunities in the extractive industries including the roles of government, extractive industries and civil society in creating in-country shared value, CSV opportunities and benefits in developing countries, criticisms and limitations of CSV measurement and the inclusive, sustainable development through CSV. Section four proffers solutions and recommendations to the constraints of the effective implementation of CSV in developing countries. Section five is the conclusion and suggestions for further study.

BACKGROUND

The Concept of Created Share Value

According to Porter and Kramer (2011), shared value can be defined as policies and operating practices that enhance the competitiveness of a company while simultaneously advancing the economic and social conditions in the community in which it operates. Shared value was born due to the need to address societal needs, mostly in the bottom-of-the-pyramid segments of the customers (Kreckova, 2015). Shared value creation focuses on identifying and expanding the connections between societal and economic progress. It describes how firms can incorporate CSR activities to their overall business strategy so that they not solely represent a cost but also create value for the firm in terms of a unique market position. Creating shared value implies ethical standards and complying with the law, and it also considers any mitigation after harms that may affect results of business practices. Shared value involves creating economic value in a way that also creates value for society by addressing its needs and challenges. It aligns CSR activities with core business activities to generate business returns and thereby create a business case for sustained commitment and investment (Porter & Kramer 2011). Shared value positions social engagement as a "long-term investment that is intrinsic to business success." (Bockstette & Stamp 2011, p. 21). A shared value perspective recognizes the interdependency between business and society. It is creating economic value in a way that also creates value for society by addressing its needs and challenges. The idea is combining "traditional objectives with additional benefits for society" (Altman & Berman, 2011).

Again shared value is being referred to as a new way to address the underlying root causes of community concerns and unlock economic opportunities for companies in the extractives sector which have made little progress using current approaches (philanthropy, reputation building, local content requirements), with rising disputes, unending conflicts, violence and militancy like in the Niger Delta Region of Nigeria. CSV is a differentiation strategy (Spitzeck & Chapman 2012) that creates business value by tackling social issues or converting social issues into tangible business opportunities based on three pillars of (i) re-conceiving products and markets, (ii) re-defining productivity in the value chain and (iii) enabling local clusters development (Porter & Kramer, 2011; Porter, Hills, Pfitzer, Patscheke & Hawkins, 2012).

Although there are numerous social issues as generic, value chain social impacts and social dimensions of competitive context impacts, the CSV concept focuses particularly on those issues within the business context that have significant impact on firm competitiveness. The CSV is about creating social and business values simultaneously. The social values refer to positive improvements in the social issues targeted by the firm, and social outcomes or social changes that are needed to be achieved. The business

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

values are the actual economic benefits to the firms (Porter et al., 2012). According to Porter and Kramer (2011), the most pressing social issues that could be targeted by shared value strategy include supplier access and viability, employee skills, worker safety, employee health, water use, energy use, and environmental impact. It is argued that businesses acting as businesses, not as charitable, philanthropic givers, are arguably the most powerful force to address pressing society's issues. It is believed that businesses' quest to create economic value while simultaneously creating shared value for society will give rise to far broader opportunities for strategy and profitability that would drive the next wave of innovation, productivity and economic growth while also motivating and attracting consumers, business partners, employees, shareholders, and the public to them (Porter, 2014). This is because only the companies who address social issues strategically and understand the interdependence between business and society (Porter & Kramer, 2006, 2011) would be able to compete in this new world (Bockstette, 2011; Porter & Kramer, 2011). It must be emphasized that solving social problems requires innovation (Pfitzer et al., 2013), collective impact (Kania & Kramer, 2011) and changes to the traditional CSR mindset.

While many researchers have presented corporate responsibility with regard to social and environmental problems as an ethical duty (Donaldson & Dunfee, 1999), a political responsibility (Scherer & Palazzo, 2007, 2011; Whelan, 2012; Néron, 2013; Whelan, 2013; Scherer, Palazzo & Matten, 2014) or a response to business risks (Fombrun, Gardberg & Barnett, 2000), the CSV makes corporations to see social and environmental problems not as disconnected and externally imposed but as real opportunities and serious strategic targets for genuine business decisions. According to Brown and Knudsen (2013), the shared value replaces and expands the notion of CSR, which as a practice has too often become affiliated with misguided initiatives, costly sideshows and shallow public relation activities.

Camilleri (2012) has argued that there seems to be Adam Smith's "invisible hand" in force with regard to the CSV conceptualization since businesses contribute to society's value creation when they pursue their own interests. Thus the CSV argument tends to support Adam Smith's (1776) remark that it is not from the benevolence of the butcher, the brewer or the baker, that we can expect our dinner, but from their regard to their own interest. Again, Moczadlo (2015) argues that taking into account the examples cited by Porter and Kramer in their 2011 article, their understanding of CSV seems to correspond in some respects with strategic CSR. Strategic CSR can be located between strict compliance of given rules and regulations and good corporate citizenship (Windsor, 2013). Nonetheless, CSV is going beyond the pure business case approach of CSR because it requires integrating shared value into the core business and the long-term strategic alignment of companies. Porter and Kramer (2011) posit that strategic CSR, value co-creation, social innovation and inclusive business model follow the principle of the CSV. Young (2012) argues that CSV represents one particular model for implementing strategic CSR in larger organizations. Like CSV, strategic CSR reframes sustainability and social benefits as a driver of business innovation, value creation and competitive advantage.

The Differences Between CSR and CSV

CSV goes beyond CSR because shared value creates long-term potential for a company's profitability and competitive position in the market, while corporate social responsibility is a short-term remedy that is hard to justify in the long run. While CSR is based on being responsible, philanthropy and doing good for society, its impacts are too reactionary and cursory to make a significant impact in improving either society or the company's earnings potential. On the other hand, CSV is a readjustment of the company's overall operations in order to create new value. Again, whereas CSR is a short-term solution,

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

CSV is a long-term realignment of the company‘s entire budget, market position and overall mission. CSV is distinct from CSR where companies are challenged to sponsor the (costly) production of social goods, or like social businesses and social entrepreneurs that refrain from profit maximization in favour of a social goal and accept forgoing a higher income. Nevertheless, compliance with laws and ethical standards and reducing harm from corporate activities are assumed in both CSR and CSV (see Table 1).

The European Commission changed the definition of CSR in 2011 to include CSV as a core element for companies with their owners and shareholders respectively, as well as for other stakeholders and the society. Moreover, the Commission sees strategic CSR as an important tool for the competitiveness of companies and a measure for business to contribute to inclusive growth, employment and well-being of the society. Therefore, companies should take into account economic, social and environmental targets including ethical human rights and consumer concerns when developing their long-term business strategy. Maczaldo (2015) differentiates between the CSV of the European Commission and Porter and Kramer (see Table 2). First, the CSV of Porter and Kramer goes beyond the pure business case of CSR because CSV is a long-term measure integrated systematically into the strategic core business of companies. The Commission sees the shareholders as just one common group of a company’s stakeholders and gives no preference to them. For Porter and Kramer the simultaneous creation of profit and societal value are decisive. While the European Commission sees CSR as a driving concept, Porter and Kramer differentiate CSV from CSR-development of a new strategic business concept which can simultaneously create economic and societal value as well as increase the competitiveness of companies.

Table 1. Differences between CSR and CSV

	Bases	CSR	CSV
1	**Motivation/focus**	Corporate reputation	Competitive advantage
2	**Main driver**	External stakeholders	Corporate strategy
3	**Approach**	Reactive and defensive	Proactive
4	**Measurement**	Spending, standard ESG metrics	Social and economics values
5	**Management**	CSR/ public affairs	Across the firm
6	**Business Benefits**	Risk reduction and goodwill	New business opportunities
7	**Social benefits**	Successful projects	Large scale, sustainable chain
8	**Value**	Doing good	Economic and societal benefits relative to cost
9	**Type**	Citizenship, philanthropy, sustainability	Joint company and community value creation
10	**Profit definition**	Separate from profit maximization	Integral to profit maximization
11	**Motives**	Discretionary in response to external pressures	Integral to competing strategy
12	**Budget**	Impact limited by company’s footprint and CSR budget	Realign the entire company’s budget.
13	**Agenda**	Defined by external reporting and personal preference	Company’s specific and internally guidelines
14	**Person(s) in charge**	Typically led by CSR, marketing, corporate communications, external/public/government affairs, community relations, sustainability and foundation departments	Typically led by CEO, senior executive team and individual champions across the company in close collaboration with corporate affairs and sustainability departments
15	**Example**	Fair trade purchasing	Transforming procurement to increase quality and yield

Source: Adapted from Porter and Kramer (2011)

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 2. Distinction between European Commission (2011) CSR and Porter and Kramer (2011) CSV

Category	European Commission (2011)	Porter and Kramer CSV
Role of business in society	CSR as core element for legitimation of business	
Pre requisite	Companies fulfill their legal obligations; collective between social partners	Companies fulfill their legal obligations
Aims	Contribution to inclusive growth and well-being of the society; triple-bottom	To reach simultaneously economic and social progress through value creation quantified by the relation of benefits to costs
Stakeholder	Shareholders, other stakeholders, the whole society	Varied with the concrete projects
Strategic orientation	CSR/CSV is a long-term strategy and included in the core activities of business	
Role of government	No strict regulation but flexible for businesses; Government procurement directives can be used to enhance CSR	Government should set clear and measurable social goals; public authorities should support business rather than over-regulate them

Source: Maczaldo (2015)

ISSUES, CONTROVERSIES, AND PROBLEMS

What Is Wrong With the Present (Traditional) CSR?

Basically, traditional CSR activities in most developing countries of Africa encompass employment benefits, community development and philanthropy which is not linked to the core business strategy. Porter and Kramer (2006) argued that the prevailing approach of CSR is so fragmented and so disconnected from business and its strategy that many of the greatest opportunities of companies to benefit society are obscure and lost. Again all four schools of CSR (moral obligation, license to operate sustainability, reputation) focus on the tensions between society and business rather than the interdependence; and they are not sufficient enough to enable a company to identify, prioritize and address social issues it can make the biggest impact.

According to Browne and Nuttall (2013), this CSR has failed to fulfill its core purpose in building stronger relationships with the external world because of the following. First, the head-office initiatives rarely gain the full support of the business and tend to break down in discussions over who pays and who gets the credit. Second, centralized CSR teams can easily lose touch with reality- they tend to take too narrow view of the relevant external stakeholders. Firms' investments in CSR are moderate and minimum because they consider such investments as a cost or expense factor only which takes its share of the firm's profit (Christmann & Taylor, 2006). Corporate social responsibility is considered as a means to an end, and the bare-minimum mentality de-motivates companies from further pursuing any other sort of contributory value to society (Davenport, 2011). Third, CSR focuses too closely on limiting the downside. Companies often see it only as an exercise in protecting or enhancing their reputations- to get away with irresponsible behavior elsewhere. Fourth, CSR programs tend to be short-lived and because they are separated from the company's commercial activity, they survive on the whims and caprices of senior executives rather than the value they deliver. Therefore the programs are vulnerable when there are changes in management or costs are cut. Besides, they fail to see the future business opportunities and competitive advantages that may accrue to them over their competitors in the longer term. Fifth, there is wrong perception of CSR and lack of top management support. Also, it is hard to determine the social impact and business benefits of CSR.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Many MNCs do only what they must in order to please stakeholders and obtain legitimacy, seeking to keep their actions to a minimum (Chen & Bouvain, 2009; Christmann & Taylor, 2006). According to Salzmann (2004), firms are only interested in making profits while supporting employment, investments, purchases, wages and taxes without any consideration of the welfare of the community around them. The responsible actions were due to external pressure and reputation enhancing, public relation and gaining a positive score on CSR scorecards which ultimately failed to connect CSR activities to their core business strategy; and not the desire to do good (Aspelund, Fjell & Rødland, 2015; Milliman, Ferguson & Sylvester, 2008). Porter and Kramer (2006) summed up the traditional CSR as a hodgepodge of uncoordinated CSR and philanthropic activities disconnected from the company's strategy that neither make any meaningful social impact nor strengthen the firm's long-term competitiveness.

Furthermore, scholars have argued that CSR has not proved itself in businesses of the current century because it lacks criteria of differentiation for businesses to follow this theory (Szmigin & Rutherford, 2013). The benefits of traditional CSR are often nebulous, difficult to define and measure, externally influenced, and only indirectly connected to the action being taken (Bockstette & Stamp, 2011). The traditional CSR is differentiated in motivation, implementation, and impact from strategic CSR (Werner, 2009). The CSR is carried as a reactionary and reputation-enhancing agenda with no clear strategic framework link to core business. Hence the result has suboptimal economic or social impacts on stakeholders and society. The present CSR does not fully comply with the society needs; CSR means a reduction of profits for the sake of an environmental or social environmental end (Bosch-Badia, Montllor-Serrats & Tarrazon, 2013), and stakeholders' interests are being ignored (Székely & Knirch, 2005). Although CSR has some potentials to deal with environmental issues such as carbon emission, pollution, waste disposal and oil spills (Frynas, 2009), and also emphasizes various activities including corporate governance, sustainability, stakeholders management, relationship with employees, unions, suppliers and community representatives, commitment to transparent reporting and harm reduction (Petrovic-Lazarevic, 2008), it is reactive, defensive, lack active strategic choices within companies, and fail to deal with key challenges in the business-society relationships (Frynas, 2009). Jonikas (2013) contends that CSR can often create use-value for stakeholders and society but little value for companies in terms of profit increases. He suggests that CSR should become more oriented towards CSV to help companies gain sustainable competitive advantage and make significant social impact on society.

Salzmann (2005) argues that corporations currently used both social benefits theory and practice to fulfill the requirements of environmental and social issues by rising up, at the same time, the financial aspects of the firms themselves. There has been a shift from philanthropic or ancillary CSR to a more strategic perspective because the current models of CSR have been largely ineffective at addressing society's pressing and urgent challenges (Visser, 2010; McWilliams & Siegel, 2011; Young, 2012). This requires that firms should move away from the emphasis on image to emphasis on substance; from fragmented, defensive CSR posture to an integrated, affirmative approach; go beyond good corporate citizenship, philanthropy and pre-occupation with measuring shareholders' satisfaction to creating shared value by becoming more selective in mounting initiatives whose social and business benefits are larger and distinctive (Porter & Kramer, 2006). Strategic CSR helps firms to build trust and reputation, increase financial performance, minimize risk, gain competitive advantage, enhance strategic positioning and synergistic value creation (Porter & Kramer, 2006; Juscius & Jonikas, 2013; Fleming & Jones, 2013). Strategic CSR unlocks shared value by investing in social impacts that strengthen company's

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 3. Philanthropic and created shared value approach

Philanthropic Approach	Areas of Investments	CSV Approach	Business Benefit	Social Benefit
Drinking water/wells for local communities	Infrastructure e.g. water	Develop sustainable water utility leveraging business process	Reduce water treatment costs by charging commercial water rates	Provide water to communities that lack access to it
Provide broad- based skills training with no link to employment opportunities	Training	Create training program based on business and supplier needs and link it to jobs	Reduce employee costs by reducing on expatriate employees	Improve employability and wage-earning capabilities of local workforce
Invest in Environmental restoration unrelated to the business	Environment	Restore degraded coastlines or wetlands to reduce risk of a natural disaster to the business	Protect assets (e.g. pipelines) near coastlines from disasters	Improve the resilience of host communities to natural disasters
Funds construction of local clinic	Health Care	Develop program to reduce disease burden among population living in mine catchment area	Improve employee productivity and reduce company's health care costs	Reduce the disease burden in local communities
Provide scholarship for local students	Education	Catalyze coalition to improve secondary school educational outcomes in host community	Improve the quality of the future talent pool in host communities	Improve educational achievement and job prospects for students

Source: Hidalgo et al. (2014)

competitiveness. The CSV theory recognizes the social needs rather than focusing only on the economic needs to define markets. It also goes beyond the strategy theory by motivating companies to look at opportunities that strive to satisfy fundamental social needs of the community (Porter & Kramer, 2011).

Creation of Shared Value

Bockstette and Stamp (2011) identify ten common building blocks to create shared value to include: articulate a vision, prioritize key issues, set specific ambitious goals, deploy a wide range of assets to address the issue, manage efforts holistically across the organization, collaborate with partners, measure progress on key indicators, learn from measurement to improve efforts, address issues at scale, and communicate progress to internal and external audiences. Pfitzer et al. (2013) provide a five-step framework in the development of shared value strategy as (a) embedding a social purpose; (b) rigorously defining the social need;(c) measuring the social and business value; (d) creating the optimal innovation structure; and (e) co-creating with external stakeholders like government, universities, NGOs, and other companies. There are usually many values created but Jonikas (2013) argues that only shared value creation through CSR seems to be sustainable.

According to Porter and Kramer (2011), companies can create shared values in three levels as: re-conceiving products and markets, redefining productivity in the value chain and building supportive industry clusters at the company's locations. In order to re-conceive products and markets, companies should re-evaluate the relationships they have with their consumers, and then incorporate shared value

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

into the process of goods exchange. They can use strong advertisement, rebrand their mission to be more socially conscious and address many unmet needs in order to attract consumers to their company and products/services. This level focuses on revenue growth, market share and profitability that arise from the environmental, social, or economic development benefits delivered by a company's products and services (Porter et al, 2012). For example, Shell has established a sustainable utility company on Bonny Island, Nigeria, that serves and supply energy to over 93,000 customers (Hidalgo et al 2014).

Redefining productivity can be done in the value chain through: (a) energy use and logistics, (b) resource use, (c) procurement, (d) distribution, (e) employee productivity, and (f) location. It could also be by sub-contracting. The level focuses on improvements in internal operations that improve cost, input access, quality and productivity achieved through environmental improvements, better resource utilization, investment in employees, supplier capability and other areas. For instance, Intercontinental Hotels Group (IHG), the largest hotel company in the world, launched its Green Engage programmes in 2009 with the objective of testing dozens of options for reducing energy use, water consumption, and waste disposal in pilot hotels, and providing a detailed ranking of all possible shared value opportunities in terms of returns to IHG through substantial reductions in hotel operating costs, including energy savings of up to 25%.

Clusters include not only businesses, institutions such as academic programmes, associations and standards organizations but also broader public assets in the surrounding community such as schools and universities, clean water, fair-competition laws, quality standards and market transparency. Creating shared value from enabling local cluster development derives from improving the external environment for the company through community investments and strengthening local suppliers, local institutions, and local infrastructure in ways that also enhance business productivity. As the world's largest food and beverage company, Nestlé created clusters by implementing a rural development strategy that trains, assists and supports small diary Indian farmers with better technology in order to increase the productivity of their cattle thereby ensuring the reliable supply of high quality raw materials. In fact without a supporting cluster, productivity suffers. According to Porter and Kramer (2011), a focus on clusters and location has been all but absent in management thinking. Cluster thinking has also been missing in many economic development initiatives which have failed because they involved isolated interventions and overlooked critical complementary investments. While a key aspect of cluster building in developing and developed countries alike is the formation of open and transparent markets, companies can support cluster development in the communities in which they operate by identifying gaps and deficiencies in areas such as logistics, suppliers, distribution channels, training, market organization and educational institutions. Delgado, Porter and Stern (2010) argue that clusters help to reduce the costs and risks associated with new venture formation, and they can also increase the likelihood of survival during early years of a business' development.

They drive local competition by not only increasing operational effectiveness and strategic positioning (Porter, 2000) but also resulting in more resilient competitive advantage.

Porter and Kramer (2006) argued that firms can create shared value by using CSR strategically to achieve a competitive advantage. Companies can create and sustain a competitive advantage by cooperating with other companies in a supply chain by nurturing and building competencies through collaborative partnerships. In fact, the success of every company is affected by the supporting companies and infrastructure around it. Gradl and Jenkins (2011) noted that inclusive business model acts as a catalyst for the CSV concept. Bisgaard (2009) consideres cross-sector partnership, collaboration and alliances with non-governmental organizations (NGOs), governmental bodies and other business companies, co-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 4. Social and business benefits associated with the levels of shared value

Levels of Shared Value	Business Results	Social Results
Re-conceiving products and markets: How targeting unmet needs drives incremental revenue and profits	-Increased revenue - Increased market share - Increased market growth - Improved profitability	- Improved patient care - Reduced carbon footprint - Improved nutrition - Improved education
Redefining productivity in the value chain: How better management of internal operations increases productivity and reduces risks	-Improved productivity -Reduced logistical and operating costs -Secured supply -Improved quality -Improved profitability	- Reduced energy use - Reduced water use - Reduced raw materials - Improved job skills - Improved employee incomes
Enabling cluster development: How changing societal conditions outside the company unleashes new growth and productivity gains	-Reduced costs - Secured supply - Improved distribution infrastructure - Improved workforce access - Improved profitability	-Improved education - Increased job creation - Improved health - Improved incomes

Source: Porter et al (2012)

creation with stakeholders and development of new business models as the strategic dimensions to create shared value. Saul (2011) focuses on social innovation to enhance shared value creation.

Fjell and Rødland (2015) found that MNCs can create shared value by pursuing the two different methods of responsible differentiations to obtain competitive advantage over competitors, and by sustainable value innovation to have a blue ocean based on responsible actions (green planet strategy). Also a company can instigate shared value by solving problems through the products and services it creates, addressing problems through company operations, including better use of natural resources and a business investing outside its operations in order to solve problems connected with company growth and productivity, such as improving growing techniques. According to Porter and Kramer (2011), to create social value companies must invest in areas that address social and environmental objective; to create share value they must invest in long-term business competitiveness that simultaneously address social and environmental objectives and to create business value, they should invest in long-term competitiveness. Effective internal communication of CSR implementation is one essential ingredient to embed value creation in a company. Companies with economies of scale can also use pricing to create shared value (Bertini & Gourville, 2012).

Shared Value Creation and Appropriation

There is distinction between value creation and value appropriation; organizations that create new value may lose except they share this value with other stakeholders such as employees, competitors or society (Nohria & Ghoshal, 1994; Makadok & Coff, 2002; Chatain & Zemsky, 2011; Porter & Kramer, 2011). According to Di Gregorio (2013), value appropriation is a two-step process through which a firm first competes against other firms to create and protect appropriation streams (inter-organizational value appropriation), and then managers, employees, shareholders and other stakeholders compete to capture the value that has been retained within the firm (intra-organizational value appropriation). Companies will not only benefit by creating and capturing value, but also by sharing or appropriating it. Both value creation and value appropriation capabilities are required for achieving sustainable competitive advantage and superior financial performance (Ghemawat, 1991; Mizik & Jacobson, 2003). But a firm must strive

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

for balance (March, 1991; Mizik & Jacobson, 2003) or integrate the two (Di Gregorio, 2013) depending on its choice. It is argued that value appropriation is the more relevant process since it only impacts firm profitability (Barney, 2001); it is also of more immediate concern to managers and researchers than value creation (Di Gregorio, 2013).

Basically, societal value created is captured by the innovating firms, consumers, communities and other firms-competitors and non-competitors (Mansfield et al., 1977). Value creation often entails the development of strategic resources while value appropriation entails the extraction of value that is embedded in resources. Whereas value creation influences the potential magnitude of the advantage, value appropriation influences the amount of the advantage the firm is able to capture and the length of time the advantage persists. Nevertheless there is a trade-offs in the strategic emphasis by firms between developing customer-value creation and value appropriation capabilities. Various organizational resources and capabilities such as technological (R&D), financial, physical, legal, human, organizational, informational, and relational capabilities influence value creation and value appropriation (Mizik et al., 2003). Di Gregorio (2013) argued that value is not created by resources, but by the actions of individuals and organizations in factor markets, internalized transactions, and product markets (dynamic capabilities). However, resources plays key role because they are the result of value creation processes and they are exploited in value appropriation processes. Di Gregorio (2013) identifies four elements of value appropriation that apply to both inter- and intra-organizational contexts to include: market-based bargaining power, relation-based power, isolating mechanisms, and opportunity-based action.

CREATED SHARED VALUE IN THE EXTRACTIVE INDUSTRIES: FROM LOCAL CONTENT TO CREATED SHARED VALUE

According to Porter (2014), the extractives sector represents a significant opportunity for impact on society given its unique characteristics which include: $3.5 trillion in annual revenues (about 5% of global GDP as at 2012); long time horizon for operations; multiple points of interaction with local communities; and often located in remote areas with major societal needs and poor infrastructure, generate employment, revenues for the government and with significant impact on procurement and the gross domestic product (GDP). The economic value created by extractive companies can transform the lives of millions living in resource-rich, cash-poor countries. The extractives sectors are a critical source for economic and social development in many of these countries. But most developing countries have failed to fully capitalize on the societal opportunities created by oil and gas or mining companies. Instead there are increasing conflicts, agitations and militancy in this sector and countries like the Niger Delta region of Nigeria and the platinum mines in South Africa. Consequently, 23 out of the 25 nations that depend most heavily on minerals and fuels are poor with low Human Development Index (HDI) and GDP.

The local content, "non-technical" risk management and current CSR approach used by the extractive industries have largely limited the actualization of this objective. Therefore, shared value is advocated as a new way to address the underlying root causes of community concerns and unlock economic opportunities for companies in the extractive sector including the oil and gas industry (Hidalgo, Peterson, Sith & Foley, 2014; Organization for Economic Co-operation and Development-OECD, 2016; Swartout, 2016). The concept of shared value is becoming a linchpin of the modern mining and extractive sectors (Crosbey et al., 2016). Given advances and changes in technology, it is predicted that the mining of the future will involve decreased local equipment-related procurement resulting in drop in benefits derived

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

from local procurement and employment. The consequence is of critical concerns to firms, host communities and countries like Nigeria which depend and earn a greater part of their revenues from the sector. Therefore, firms and countries are expected to focus on other ways in which mining can contribute to the host economy and communities. Table 5 indicates the shared valued opportunities in the extractive industries.

Outside the realms of procurement and employment, there are four other avenues through which shared value can be created (Cosbey et al., 2016). These include:

- **Downstream (Forward) Linkages:** Relate to the beneficiation of extracted commodities through refining, smelting and further downstream processing of the commodity before reaching the final consumer(s).
- **Horizontal (Lateral) Linkages:** Relate to the development of new non-mining-related industries adapting the capabilities developed to serve the mining-related value chain.
- **Knowledge (Technological) Linkages:** Relate to the transfer of knowledge and technological know- how to state-owned companies, the employees of the mine and to the labour force involved in the mine's value chain.
- **Spatial (Infrastructure) Linkages:** Relate to the benefits associated with the infrastructure developed for an extractive-industry project (such as railways) profiting other actors in the economy.

There might be revision to the fiscal element of shared value, adoption of more progressive fiscal regimes, changes to the fundamental relationship between investor and host governments and evolution of a more collaboration and commitment to defined roles for government, extractive industries and civil societies. National or host governments can help companies create shared value by creating enabling policies and regulations as well as show collaboration by acting as knowledge broker, serving as convener of interested stakeholders, acting as operating partner for shared value strategies and incentivizing shared value investments. On the other hand companies can take a long-term view toward solving societal issues to benefit the business; they should invest in improving business unit operations' knowledge of societal issues and vice-versa, measure societal outcomes and their impact on the business, and work with other multinational companies in the extractive sectors, NGOs, and governments. The five actionable steps specified in the OECD (2016) framework on collaborative strategies for in-country shared value creation of extractive projects and the roles of government, extractive industries and civil societies are shown in Table 6.

Table 5. Shared values opportunities in extractives and mining industries

Re-Conceiving Products and Market	Re-Defining Productivity in the Value Chains	Creating Enabling Local Environment
Build local markets for intermediate products created by extractive activity (e.g., water, electricity, transport, housing)	Improve local workforce capabilities Develop local suppliers Improve the health of employees Improve utilization of water, energy and other resources in operations Increase local emergency response capabilities	Develop the local cluster supporting the extractives sector Invest in shared local infrastructure and logistics networks Partner with other local clusters and government in building community infrastructure Play an active role in broad-based regional economic and community development

Source: Porter (2014)

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 6. Actionable steps and roles of government, extractive industries and civil societies for in-country shared value creation

Actionable Steps	Roles of Government, Extractive Industries and Civil Societies			
	Government	**Extractive Industries**	**Government & Extractive Industries**	**Government, Extractive Industries & Civil Societies**
1.Adopt a comprehensive long-term vision and implementation strategy to build competitive and diversified economies and create in-country shared value out of resources	Articulate vision, coordination; limit rent seeking opportunities; enhance economic competiveness; transparent reporting; counter macro-economic policies	Take long-term approach, engage with relevant stakeholders; understand local dynamics and power structures in resource-bearing communities; share best practices developed		Build inclusive fora for continuous dialogue; forecast the necessary infrastructure and capacity to achieve extractive stage; identify opportunities to which business activities can make a significant positive contribution
2.Build an empirical basis to inform decision making through an inclusive participatory process	Serve as conveners and identify the stakeholders; Identify trade-offs and associated costs/benefits; create the conditions for proactive interventions and reduce conflicts recognize areas of value creation	Provide information on an individual basis (to avoid any anti-competitive issues) to governments on future demand		Assess the extractives sector's collective current and future needs; map out potential economic opportunities and potential negative impacts and constraints of project; Identify barriers to entry for production of goods/
3.Unlock opportunities for in-country shared value creation: local workforce and supplier development; shared infrastructure (power, water and transport)				
3A. Shared Power	Take a long-term perspective of potential synergies, affordability and willingness to pay design appropriate power pricing mechanisms consider other partners in development of power generation capacity; engage in regional and sub-regional policy co-ordination for infrastructure development and power sharing	Provide forecasts regarding anticipated demand for power and sourcing of power; implement energy efficient operations; develop electricity self-supply plans that align with government's plans	Undertake early discussions regarding power infrastructure needs, synergies, efficiencies and other opportunities for shared value creation with respect to power generation and distribution; articulate government and company responsibilities and liabilities for any project undertaken; consider power usage and distribution	
3B.Shared value for water	Adopt an integrated approach to water resource management; have a well-designed, adjustable and transparent plans for allocating water resources among competing uses; ensure policy coherence and adequate institutional framework for used water	Engage with local communities and water users to understand water-related issues and risks and offer solution; collaborate with other extractives; collaborate with other extractives companies for water management and allocation	Devise mutually beneficial arrangements; share knowledge, information and expertise	
3C.Shared use for transport infrastructure	Provide a clear and effective regulatory framework for multi-purpose and multi-user infrastructure; avoid exclusive access or monopoly pricing; effective coordination and policy encouraging investment in transport infrastructure	Collaborate with other extractive companies from the same basin to determine the potential for shared value by developing shared transport infrastructure	Devise mutually beneficial arrangements concerning transport infrastructure	
4.Support and contribute to innovation leading to new products and services	Identify changing trends in global consumption and production patterns; consider trade-offs associated with technological innovation; support R&D efforts to identify, adapt, and transfer technology	Invest in specialized technologies that reduce environmental impact; increase use of renewable energy; Contribute to improving the innovative capacity of subsidiaries and subcontractors and finding solutions to challenges shared by extractive industries	Engage in co-operation based on project life cycle analysis, covering the entire value chain and offering the opportunity to build on best practices of several sectors	
5.Establish effective and transparent monitoring and evaluation systems and regularly review the collaborative strategy		Integrate the standardized methodology and reporting procedures into internal local monitoring and evaluation system; Provide detailed reporting to better measure and manage company activities		Build on existing structures e.g. EITI, MSG develop governance mechanisms to ensure effective and transparent monitoring and evaluation; evaluate impact, local industry participation, efficient use of limited resources and creation of value for all stakeholders; re-evaluate measurements from time-to-time communicate results to stakeholders

Source: Adapted from OECD (2016)

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

CSV Opportunities and Benefits in Developing Countries

Despite the criticisms, CSV has been applauded for the strengths in appealing to practitioners and scholars, elevating social goals to a strategic level, defining a role for government in responsible behaviour and propagating the idea of "conscious and caring capitalism" (Crane, Palazzo, Spence & Matten, 2014). Moreover, there is growing consensus that through CSV firms can better respond to the societal, environmental and market needs, support business activities, and develop innovative capacity. Moczadlo (2015) argued that Porter and Kramer's CSV bring the business world closer to society's issues as it focuses on unmet needs and under-served markets or Blue Ocean Strategy (Kim &Mauborgne, 2005) and the business model innovation which is a key factor in competitiveness (Scott-Kemmis, 2012). In fact, the shared value has already made some companies like WEG Corporation in Brazil and HP to be industry leaders, improved companies' value chains as well as strengthened local economies in companies such as Intel, Nestle, Unilever and Nepresso, and led to long-term company's profitability, competitive advantage and sustainability like the case of Coca Cola Company.

There are numerous examples of multinational organizations that are either already implementing and investing in CSV or making efforts to implement CSV as part of their business strategies such as: Coca-Cola, Nestlé, Nepresso, Unilever, Intel, Nutreco, McDonald's, IBM, Cisco, Dow, Intel, Becton Dickinson (BD), Novartis, Wal-Mart, Inter-American Development bank, General Motor (GM), General Electric (GE), Google, Johnson and Johnson, InterContinental Hotels Group (IHG) and social entrepreneurs like Gramen Bank in Bangladesh among others (Porter & Kramer, 2011; Porter et al. 2012; World Bank, 2013).

A typical example of CSV is the corporate Water Stewardship Programme particularly the Replenish Africa Initiative (RAIN) water for schools created by Coca-Cola Company in 2009 but presently in 37 African countries. The programme has the intention to provide sustainable and safe water access to 6 million people across Africa by the end of 2020.Similarly, the WASH programme, particularly the RAIN Water for Schools, not only creates social value and but also indirectly promotes business value and contributes to virtuous cycles of creating value for local communities (Mitler, Rostorfer & Ledbetter, 2015). The Coca Cola Company also launched a two-month Coletivo Retail training programme for Brazilian low-income (including youth and students) in 2009 to enable retailers gain hands-on experience, placement and enhance their performance. By 2015, about 25,000 youths have graduated with over 10% of Coletivo graduates setting up their own retail stores with micro-credit support as well as the Coletivo Retail community sales growing on an annual average of 9.5% (Coca-Cola Supports, 2015). Moreover, the Coca Cola Company's 5by20 Initiatives aim to improve the economic empowerment of five million women entrepreneurs within the company's global value chain by 2020 through a combination of core business operations, cross-sector partnership and strategic social investment mostly in developing countries. The Coca-Cola Company began working toward its 5by20 commitment in Brazil, India, the Philippines, and South Africa in 2010. Over, 300,000 women have participated in 5by20 initiatives in 12 countries (Brazil, China, Costa Rica, Egypt, Haiti, India, Kenya, Mexico, Nigeria, Philippines, South Africa, and Thailand) as at 2013. The company expects 5by20 initiatives to reach 1.5 million women in 20 to 30 countries by 2015 and 5 million women in 100 countries by 2020. The Coca Cola's 5by 20 initiatives include: Coletivo Recycling and Artesians in Brazil, Project Nurture in Kenya and Uganda, the STAR Programme in the Philippines, and Kwanza's Micro Distribution Center Model in Tanzania (Jenkins, Valikai & Baptista, 2013).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The CSV of Nestle for joint value optimization with society encompasses three areas of water, rural development and nutrition. Nestlé aligned corporate vision with a social purpose and set enterprise-wide shared value goals to guide business planning. For instance, Nestlé trains and assists smallholder farmers to foster rural development while ensuring a reliable supply of high quality raw materials. Nepresso's collaboration focuses on three commitments: Coffee, Capsules and Carbon Footprint as well as creating shared value for society. The areas where value was created and shared in McDonald were: employee welfare, waste, climate/energy, animal welfare, water, raw materials and community impact. Unilever's poverty eradication, women empowerment, education of rural dwellers and hand-washing campaigns have recorded a huge success in bringing profitable micro-enterprise opportunities for rural women, reducing diseases and saving many lives of children in Asia and Africa (Kreckova, 2015). Intel tied a portion of incentive compensation to performance on social and environmental priorities.

BHP Billiton invested $50M in northern Chile to create a cluster of world-class mining suppliers. BHP created the "World Class Supplier Program" in Chile which engaged local suppliers to develop innovative solutions to manage various areas of BHP Billiton's operations such as water, energy, human capital, maintenance, air quality, acid mist control, and leaching. The goal of the initiative was for Chile to have at least 250 world-class suppliers that can export their services to mining projects around the world by 2020.The 36 suppliers involved employ 5,000 people, and BHP Billiton has achieved $121m in net present value of cost savings as at 2012 (Porter, 2014) and generated combined sales of $400 million. The social and economic benefits for BHP Billiton include: creation of world-class suppliers for the mining sector and high-quality employment, and reduced cost of inputs, goods, and services. Rio Tinto's Diavik Diamond Mine in Northern Canada worked with communities, contractors, local governments and education institutions to develop a local workforce and supplier base which enables it to hire 62% of its employees, and sources 71% of goods and services locally, saving transportation costs (Porter, 2014). For SNC-Lavalin with interest in mining and metallurgy, oil and gas, infrastructure and environment and power, the Local Resource Development Initiative ™ (LRDI) helps to maximize local benefits and create shared value with communities as the LRDI aligns project objectives with community objectives whenever possible, promotes sustainability opportunities, reduces project costs and generates values for farmers, communities and operating company in many countries of Africa, Latin America and Asia.

Criticisms of Porter and Kramer's CSV

Despite the many benefits and opportunities acclaim to CSV, there are also many critics of Porter and Kramer's CSV (such as Crane, Palazzo, Spence & Matten, 2014; Mohammed, 2013; Denning, 2011 & 2012; Hartman & Werhane, 2013; Wilburn & Wilburn, 2014; Rocchi & Fererro, 2014; Escudero, 2013 and others) who argued that CSV is not new or original; CSV ignores the tensions inherent to responsible business activity, naïve about business compliance and it is based on a shallow conception of the corporation's role in society (Crane et al., 2014). CSV is "undercooked", ignores tensions and differences between societal and economic goals, lacks specific framework upon which shared value creation can be measured (Crane et al., 2014; Mohammed, 2013), can't fix capitalism (Denning, 2011, 2012), incomplete mental model (Hartman & Werhane, 2013), misunderstood concept (Wilburn & Wilburn, 2014), incomplete and process-orientation ignoring the people in the work process (Rocchi & Fererro, 2014), akin to strategic CSR and not a new approach (Escudero, 2013). It has also been argued that the CSV is not different from Elkington's (1998) that focused on the triple-bottom line of economic, environmental and social goals. Again, the main idea is not so different from strategic CSR concept

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 7. Examples of created shared value social and economic benefits in developing countries

S/no	Company/ Organization	Country	Initiatives	Social Benefits	Economic/Business Benefits
1	Coca Cola	37African countries including South Africa	Corporate water stewardship and Replenish Africa Initiative (RAIN) water for schools	-Improvements across a wide range of capabilities, both directly and indirectly -Increase in the value of natural capital	Every US$1 invested would yield at least US$2 in benefits, and in some locations it could be over US$11 in benefits for every US$1 invested
		Brazil	A two-month Coletivo Retail training programme for Brazilian low-income (including youth and students employment) in 2009	- 30% of the young people trained immediately land their first job with Coca-Cola or one of its partners - 10% set up their own business with micro-credit support from the company	- Increased sales of Coca-Cola products - Higher penetration of consumers among the emerging lower middle class segment - Better retailer performance and a stronger Coca-Cola brand connection
2	Chevron	Nigeria	Niger Delta Partnership Initiative (NDPI) and Partnership Initiative in the Niger Delta in 9 oil producing in the Niger Delta region and creation of addition value chains	Development of economic opportunities outside of Chevron's direct oil and gas supply chains	Reduction in business disruptions due to greater economic opportunities outside of oil and gas; potential reductions in supply chain costs
			Chevron's General Memorandum of Understanding (GMOU) approach in the Niger Delta for building local governance and decision-making capabilities through delivering value for the business via reduced risk and a stronger operating environment	- Community-led disruptions to Chevron operations dropped from 81 in 1998 to 11 in 2011 to zero in 2012 - Create a platform for communities to debate, discuss, and agree on their priorities	- Create enabling environment for the company to do its business -Significant cost saving in company's operations - Saving of tens of millions of dollars in lost revenues in vandalism and theft
3	BHP Billiton	Chile	Creation of at least 250 world-class suppliers that can export their services to mining projects around the world by 2020	Creation of world-class suppliers for the mining sector and high-quality employment	Reduced cost of inputs, goods, and services
4	AngloGold Ashanti	Ghana	Addresses health problems (endemic malaria) by implementing an integrated control programme involving multiple community-level interventions	Decrease in disease incidence by over 72% in the first two years of the programme	Improved employee productivity, lowered treatment costs, with the number of person-shifts lost per month falling from 7,500 to around 90 in 2012 and declining treatment costs resulting in cost savings to the company of around $600,000 per year by 2013
5	Anglo American	South Africa	Water Reclamation Plant for treatment of water for drinking and irrigation water by the local municipality in the Malahleni and Mpumalanga provinces	Access to potable water in local community, generating 25-30 million liters per day or 12% of the water requirement	Over 60% offset of treatment costs from revenues in water sold to BHP Billiton and local community, reduction in the cost of responsible environmental management and compliance with regulation
6	Banka BioLoo	India	Bio-toilet system to dispose human waste in eco-friendly manner	Improved hygienic sanitation, treated, recycle human wastes and bio-toilet for millions of people	Increased employment opportunity, growing revenues in multi-fields
7	Capital Diamond Star Group with Action Aid	Myanmar	Provide farmers with necessary training, technical and financial skills for optimal productivity, quality livelihood and increased bottom line.	Improved livelihoods through empowerment of farmers, sustainable agriculture and better access to finance and to markets for rural communities	More productive, better quality and more reliable supplier base; stronger, more loyal and better educated customer base

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

earlier defined by Porter and Kramer in 2006 (Neves, 2013). Nevertheless, Drucker (1984) has argued that the proper "social responsibility" of business is to tame the dragon, that is, to turn a social problem into economic opportunity and economic benefit". Wheeler, Colbert & Freeman2003 (2003) have also defended that "in certain circumstances the creation of communities and social networks or value-based networks is a pre-requisite to economic pay-off'. The idea that businesses should address new markets based on social issues, being profitable had been presented by Prahalad and Hart (2002) arguing that "low-income markets present a prodigious opportunity for the world`s wealthiest companies to seek their fortunes and bring prosperity to the aspiring poor".

Hartman and Werbane (2013) see Porter and Kramer's CSV as an incomplete mental model with imprecise conception of "profit," overemphasis on the novelty of their theory, and broadly negative description of prior attempts to achieve social progress through private enterprise. They argue that there was no explanation on the calibration of shared value from profits. Besides, some have argued that Porter and Kramer were not the first and novel to propose alternative to the single-minded pursuits of shareholders' gain, and that "shared value" is just one of the many viable means to reconstruct a corporate worldview to tackle new-world social, environmental and economic problems. Moreover, many profitable companies have been successful in addressing social problems through profitable business ventures without the need of the shared value approach. Again, the CSV omits the revision of companies' core mission to reflect the pursuit, not of "profit per se," but "profits involving social purpose". Beschorner (2013) argued that Porter and Kramer's CSV is "neither so radical nor such a departure from standard management thinking" and their ultimate reliance on economic arguments is too normatively thin to reconnect businesses with society. He suggested that prospects for a genuine reinvention of capitalism lie elsewhere. There is also criticism that ethics and integrity is left out of the CSV as well as its measurement. Companies that are most advanced in pursuing shared value lack the data they need to optimize its results. Besides, some of the companies that claim to implement CSV are not doing the right thing (Brown & Knudsen, 2013).

Challenges and Limitations of CSV

Cane et al. (2014) concluded that the short comings of CVS take us further from the solution to a challenge that we are already struggling to address. Although shared value has gained momentum, it is still largely experimental and short-term. Only a few companies particularly multinational companies like Coca-Cola, Novo Nordisk, Nestlé, Intel, and InterContinental Hotels Group among others have enshrined the shared value into their corporate objective and core business strategy due to CSR fatigue. Most companies around the world remain unaware of shared value improvement opportunities and are ill-prepared to capitalize on them when they materialize thereby limiting the company's bottom line and short- changing society of the much needed innovation to solve social problems (Porter et al., 2012). Brown and Knudsen (2013) have argued that failure to appropriately manage shared value could result in wasted resources, unsustainable projects, and in the worst cases, marred corporate reputations thereby resulting in negative social and environmental consequences. This could be as a result of companies' failure to (1) carry through responsible practice in its implementation, (2) change their overall business model to address a social or environmental problem, and (3) discuss how they should manage the complexities and trade-offs required to address social issues.

Again, studies from various sectors (food, beverages, agriculture, pharmaceutical, health care, financial services, extractives, and natural resources) advocated that firms can enhance their competitiveness by embracing the CSV concept in their business strategy (Hills et al., 2012). However, the results are

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

mainly based on successful individual cases from large Multinational corporations and the nature of the relationships between CSV and firm competitiveness in those studies is still unclear and has not been verified empirically. Also, examples and number of local listed companies as well as small and medium scale enterprises embedding CSV in their core business or moving beyond traditional CSR to the shared value in their CSR are limited. Haxby, Compela and Weperen (2014) argued that CSV can be complicated because of the diverse interests of each stakeholder and attempts to optimize value for one stakeholder can have a negative effect for others.

It is not easy to measure social activities and their impacts on a company and the economy. There are also several problems in finding reasonable and significant key performance indicators (KPIs) or metrics to measure shared value of the social and business outputs, outcomes and impacts (Giddens, 2011). In fact, the lack of understanding of the interdependency between social and business results by companies limit the opportunities for innovation, growth and social impact (Porter et al., 2012). Despite lot of suggested frameworks and approaches to measure shared value including employee engagement, stakeholder feedback, scalability, growth opportunities, risk mitigation, public policy impact, and brand and reputation impact, there is no holistic framework or universal tool on how to measure value created through CSR. Besides decision making on CSR implementation still remains subjective and one-sided in most cases (Jonikas, 2014). Again, Porter et al. (2012) argued that the framework to link social progress directly to business success and vice versa is still missing Moreover, the relationship between social welfare and company profitability is complex (Lin et al., 2009). The analysis of sustainability results is complicated "due to the wide range of reporting practices for environmental, social and corporate governance risks/opportunities and also due to the difficulty of verifying the accuracy of the information provided by companies" (Székely & Knirsch, 2005). Hidalgo et al. (2014) summarized four interrelated and entrenched challenges that inhibit creation of shared value to include: inadequate organizational structure and behavior or culture, incomplete measurement costs and benefits, low motivation for collaboration and lack of alignment with government.

CSV AND SUSTAINABLE, INCLUSIVE DEVELOPMENT OF DEVELOPING COUNTRIES

The Brundtland Report of the World Commission for Environment and Development (1987) defines sustainable development as development that meets the needs of the present generation without compromising the ability of the future generations to meet their needs. In 2015, the world leaders agreed that the realization of the sustainable development goals (SDGs) by 2030 needs governments' partnership with businesses and other stakeholders. A recent survey by Fleishman Hillard and the U.S. Chamber of Commerce Foundation in May, 2015 identified top 5 SDGs as important to business in the post 2015 to include: build resilient infrastructure (67%), sustain economic growth (65%), achieve gender equality (60%), ensure quality education (52%) and strengthen global partnership (44%). The 'My world 2015' survey by the United Nations put the three top concerns the world over to include: good education, better health care and better job opportunities. The CSV tends to be moving corporations towards the direction of achieving these goals through shared value approach which is premised on the simultaneous realization of economic, social and societal progress. Through the inclusive business strategy, the CSV helps to integrate poor and low income communities into the leading companies' value chains in order to create

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

new opportunities for poor people at the bottom of the pyramid, increase their incomes, improve the living standards and create a competitive value chain and long term economic value for the companies.

At its heart, the notion of shared value pertains to the sustainable development of the host community and countries. For instance, the OECD (2016) framework for collaborative Strategies for in-country shared value creation in the extractive sector is a tool for forging a public-private alliance which can be used to advance the sustainable development agenda of 2030 adopted by the United Nations in 2015. Specifically, the OECD framework supports the achievement of SDGs 8 (promote inclusive and sustainable economic growth, employment and decent work for all), 9 (build resilient infrastructure, promote sustainable industrialization and foster innovation), 6 (ensure access to water and sanitation for all) and 7 (ensure access to affordable, reliable, sustainable and modern energy for all). According to Cosbey et al. (2016), the shared-value paradigm, by promising to deliver benefits to host communities, regions and countries, has become increasingly critical for mining companies in securing their social license to operate. The delicate balance inherent in the shared-value paradigm is especially relevant for developing countries and other states (most of which are resource-driven countries) where poverty eradication, social development and environmental protection are urgent development challenges.

Due to the expectations that the application of the shared-value paradigm in the mining and extractive sector would bring substantial developmental benefits to large populations and the link to sustainable development, it has been endorsed to become the mainstay of most major mining policy frameworks such as: the Africa Mining Vision (African Union, 2009), the Mining Policy Framework (Intergovernmental Forum (IGF) on Mining, Minerals, Metals and Sustainable Development (2012), and the OECD Framework on Public-Private Collaboration for in-Country Shared Value Creation from Extractive Projects (OECD, 2016).The International Council for Mining and Metals (ICMM) also reference the shared-value concept in their good practice guidance (ICMM, 2015).Leading civil society organizations working in the area of mining and sustainable development like Columbia Center on Sustainable Investment (CCSI), 2015; International Institute for Environment and Development (IIED); International Institute for Sustainable Development (IISD), 2014; and Natural Resource Governance Institute (NRGI), 2015 have fully subscribed to shared value. Both the developed and developing countries are benefiting and enjoying from the shared value concept as more and more corporations are keying into the social change. While the focus in developed markets is less on poverty but more on education, income inequalities, health and wellness, environment and sustainability, the CSV focus by corporations in developing markets is building capacity and financing, empowerment and entrepreneurship, expansion of the value chain and raising the standard of living in the communities of operations.

Shared value approach has the potentials to foster sustainable development of developing countries as CSV concept is embraced and promoted not only by the few multinationals but all companies. For instance, the activities of Novartis to provide the locals in remote villages with health services and train some of them to be health educators in India, Vietnam, Kenya and Indonesia resulted in over 10 million receiving health education and 750,000 direct health services. The '+' projects by Phillips a multi-sector partnership with governments, NGOs and consumers in Southeast Asia reached over 50 million people in Indonesia, Thailand and Singapore, generating 28,000 social media conversations. The goal was to increase Philips' bottom line and simultaneously have positive social impact. Phillips sourced ideas from local consumers to provide insights that enabled the company to accelerate innovation and ultimately improve the health and well-being of consumers. Vodafone partnered with a Kenyan telecoms firm, Sarifoam and created a new market by launching M-Pesa in Kenya in 2007.Vodafone's goal was to support financial inclusion in Kenya through a money transfer solution with a simple key message, "Send Money

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Home", which enabled customers to send money directly between each other using mobile technology. By 2015, M-Pesa is now available in many countries including India, Egypt, Tanzania, South Africa, Democratic Republic of Congo, Lesotho, Mozambique, Romania and Albania with over 19.9 million active customers who used M-Pesa with over 3.4 billion transactions processed yearly.

Following the challenges of a quadruple burden of disease, an undersupply of doctors and an egalitarian healthcare system presented a significant challenge to the healthcare industry in South Africa, Discovery Insurance Company developed Vitality, a behaviour based wellness solution that incentivized healthier behavior by giving customers access to wellness partners such as gyms, empowering them with healthcare knowledge and tools, and offering financial incentives that increased as members engaged with the Vitality programme. The increased health and fitness levels, lowered the frequency and cost of hospitalization and reduced the disease burden of customers improve the financial incentives and rewards that by 2015, the company currently serves over 5.1 million clients across South Africa, the United Kingdom, the United States, China, Singapore, Australia and Hong Kong. Discovery is globally acknowledged as the pioneer of shared value insurance. The shared value presents an open window of opportunities and benefits not only for economic prosperity of business but also the sustainable development of developing economies. Therefore a high level corporate commitment to the shared value concept, and ingenuity of the private sector and business leaders in forming alliances would lead to the actualization of the United Nation's sustainable development goals (UN SDGs) by eradicating poverty in all its forms by 2030.

SOLUTIONS AND RECOMMENDATIONS

In an era of increasingly stakeholders' knowledgeable demands and expectations amidst the increasing global challenges, integrating economic and social goals will demonstrate corporation's real concerns and ability to achieve the "win-wins" of the shared value model, long-term sustainability, competitive advantage and economic prosperity. In order to give concrete meaning to the concept of CSV in developing economies, the companies must change the philanthropic way that CSR is presently conceptualized and organized because of its limitations in helping them to achieve competitive advantages and adequately address societal problems. Based on the shared value approach, companies in developing countries should restructure and prioritize CSR to be part of their organizational culture, value and core business strategy that emphasizes sustainability by redefining corporate leadership and integrating economic and social goals in their business pursuits in addressing societal problems. The integration makes CSR a core element of strategy, structure and process, eliminates distinct CSR functions in the organization and makes CSR a mutual responsibility across the firm - from top down and thereby increasing its credibility and implementation.

However, achieving shared value will require a radical and collective rethinking of management practice by all parties. There must be strong commitment at the executive, top management level and employees; Leading managers of global players as well as of small and medium companies in developing countries must discuss and take CSR very seriously by going beyond "green washing" or "window dressing". They must begin to embrace and transmit the CSV vision and ideology among all employees of their organizations through re-conceiving new products and services in new markets, improving productivity and developing clusters. Therefore, companies would need to incorporate shared value thinking into the operations of employees at all levels of their businesses to really transform capitalism and bring about

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

inclusive and sustainable development. The realization of the SDGs in 2030 requires that companies in developing countries have a major mindset change towards the adoption of the CSV agenda. This will involve the companies working inside out and embracing top down leadership, commitment and strategy as well as a bottom up overhauling of the operating models to reflect total commitment; CSV takes time, energy, tenacity and patience to embed and thus the process requires change managers and skilled leaders rather than programme managers (Bockstette & Stamp, 2011; AT Kearney, 2015). In fact, achieving a successful, sustainable and scalable shared value requires significant changes in the way that corporations do business. Therefore, businesses in developing countries must change their business models and current CSR philosophy to include shared value creation and business value sustainability.

Government and regulators in developing countries should recognize their roles in helping businesses to create shared value by focusing on measuring environmental performance and introducing standards, phase-in periods and support for technology that would promote innovation, improve the environment and increase competitiveness of business simultaneously. They would need to limit the pursuit of exploitative, unfair or deceptive practices in which companies benefit at the expense of society. Governments can help companies create shared value by: creating enabling policies and regulations, showing collaboration by acting as knowledge broker, serving as convener of interested stakeholders, acting as operating partner for shared value strategies and incentivizing shared value investments. Regulatory authorities like the National Hydrocarbon Agency (NHA) in Columbia must promote shared value creation through its regulatory framework. Although local content presents one of the clearest opportunities to create shared value, governments in developing countries particularly those with rich minerals and extractive industries must collaborate with companies to access opportunities to deliver real value for business and society across different areas of investments based on shared value approach.

On the other hand, companies must take a long-term view toward solving societal issues that would benefit the business by investing in improved business unit operations' knowledge of societal issues. They should measure societal outcomes and their impact on the business, and work with other multinational companies, NGOs and governments to create shared value. They must also take concrete actions to shift the current dynamic relationships between the corporations and government from one that views for instance extractive companies as contractors who pay for the privilege of carrying out extraction to one that sees these companies as development partners who could help solve societal issues of concern to government and create shared values through direct engagement with various levels of governments and communities, capacity building and indirect support for independent, third-party efforts. Faculties and business schools would also need to broaden their curricula and teaching to include: efficient use and stewardship of all forms of resources, human and societal needs and how to serve non-traditional customer groups; because these would define the next-generation thinking on value chains.

CONCLUSION

The chapter examines CSV and the inclusive, sustainable development of developing countries The CSV is a (r)evolutionary strategic management thinking meant to enhance the companies' competitiveness while simultaneously advancing their economic and social conditions in the society they operate. It challenges the constrained corporate mindset of lip-service philanthropic CSR activities of business over half a century to making it a major solver of society's problems in a much beneficial and profitable ways through creation of shared values. Created shared value tasks companies in developing countries

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

to go beyond CSR to addressing social and society's issues in addition to their pursuit of profits by incorporating social and societal values into their economic agenda. The shared values created by these companies in developing countries would give rise to long-term corporate profitability, competitiveness and sustainable development of host communities and countries. Interestingly, evidence abound of companies at least of global multinational and transnational companies in developed and developing countries, which have already keyed into the CSV enjoying immense profits, sales growth and sustainable competitive advantages through integration of social and economic goal while also addressing societal needs. Therefore, companies including extractive and mining industries in developing countries must begin to take a long-term approach to social investments and prosperity of company, host communities or countries by embracing the pillars of shared value of re-conceiving new products and services, identifying new market opportunities and enabling clusters development. It has been demonstrated that the created shared value has the potentials to foster unparalleled economic growth, prosperity and sustainable development in countries when companies start to think a new and look at decisions and opportunities through the lens of shared value.

Although, the created shared value approach is being embraced and applied by most global multinational corporations, there is no known study in Nigeria. Therefore a study of the current CSR practices is recommended on whether the shared value concept is already being practiced by indigenous companies in Nigeria, the influencing factors and challenges of creating shared value in turbulent environments.

REFERENCES

Afrin, S. (2013). Traditional vs strategic corporate social responsibility: In pursuit of supporting sustainable development. *Journal of Economics and Sustainable Development*, *4*(20), 153–157.

Altman, D., & Berman, J. (2011). The single bottom line. *Dalberg Global Development Advisor*, 1-13.

Amaeshi, K., Adi, B., Ogbechie, C., & Amao, O. (2006). *Corporate social responsibility in Nigeria: Western mimicry or indigenous practices?*. Research Paper Series, International Centre for Corporate Social Responsibility, Nottingham University.

Aspelund, A., Fjell, L., & Rødland, S. E. (2015). *Doing good and doing well - On the relationship between Internationalization and Social Responsibility.* Paper presented at the 18th McGill International Entrepreneurship Conference, Al-Ain, UAE.

Barney, J. B. (2001). Resource-based theories of competitive advantage: A ten-year retrospective on the resource-based view. *Journal of Management*, *27*(6), 643–650. doi:10.1177/014920630102700602

Bertini, M., & Gourville, J. T. (2012). Pricing to create shared value: Rethinking the way prices are set can expand the pie for everyone. *Harvard Business Review*, *90*(6), 96–104.

Beschorner, T. (2013). Creating shared value: The one-trick pony approach. *Business Ethics Journal Review*, *1*(17), 106–112. doi:10.12747/bejr2013.01.17

Bhattacharya, C. B., Sen, S., & Korschun, D. (2008). Using corporate social responsibility to win the war for talent. *MIT Sloan Management Review*, *49*(2), 37–44.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Bisgaard, T. (2009). *Corporate social innovation, companies' participation in solving global challenges*. Retrieved July 2010, from http://samfundsansvar.dk/file/319040/csi_corporate_social_innovation_juli_2010.pdf

Bockstette, V. (2011, Nov. 16). Create shared value with a trampoline approach. *Harvard Business Review Blog Network*.

Bockstette, V., Pfitzer, M., Smith, D., Bhavaraju, N., Priestley, C., & Bhatt, A. (2014). *Banking on shared value: How banks profit by rethinking their business.* Retrieved from http://www.fsg.org/publications/banking-shared-value

Bockstette, V., & Stamp, M. (2011). *Creating shared value: A how-to guide for the new corporate (r)evolution.* Retrieved from http://www.fsg.org/publications/creating-shared-value-how-guide-new-corporate-revolution

Bosch-Badia, M. T., Montllor-Serrats, J., & Tarrazon, M. A. (2013). Corporate social responsibility from Friedman to Porter and Kramer. *Theoretical Economic Letters*, *3*(3), 11–15. doi:10.4236/tel.2013.33A003

Brown, D., & Knudsen, J. S. (2013). *Generating value for investors and society*. The Conference Board.

Browne, J., & Nuttall, R. (2013). Beyond corporate social responsibility: Integrated external engagement. McKinsey & Company.

Camilleri, M. A. (2012). *Creating shared value through strategic CSR in tourism* (Doctoral dissertation). University of Edinburgh, UK.

Carroll, A. B. (1999). Corporate social responsibility evolution of a definitional construct. *Business & Society*, *38*(3), 268–295. doi:10.1177/000765039903800303

Carroll, A. B., & Shabana, K. M. (2010). The business case for corporate social responsibility: A review of concepts, research and practice. *International Journal of Management Reviews*, *12*(1), 85–105. doi:10.1111/j.1468-2370.2009.00275.x

Chen, S., & Bouvain, K. (2009). Is corporate responsibility converging? A comparison of corporate social responsibility reporting in the USA, UK, Australia and Germany. *Journal of Business Ethics*, *87*(1), 299–317. doi:10.100710551-008-9794-0

Christmann, P., & Taylor, G. (2006). Firm self-regulation through international certifiable standards: Determinants of symbolic versus substantive implementation. *Journal of International Business Studies*, *37*(6), 863–878. doi:10.1057/palgrave.jibs.8400231

Coca-Cola. (2015). *Coca-Cola supports retail capacity and economic development in Brazil.* Retrieved from https://sharedvalue.org/examples/coletivo-retail-program-supporting-retail-capacity-and-economic-development-brazil

Cosbey, A., Mann, H., Maennling, N., Toledano, P., Geipel, J., & Brauch, M. D. (2016). *Mining a Mirage? Reassessing the shared-value paradigm in light of the technological advances in the mining sector*. International Institute for Sustainable Development.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Crane, A., Palazzo, G., Spence, L. J., & Matten, D. (2014). Contesting the value of creating shared value. *California Management Review*, *56*(2), 130–153. doi:10.1525/cmr.2014.56.2.130

Davenport, E. (2011). *The next catalyst for change: How corporate shared value is reshaping capitalism. CMC Senior Theses. Paper 111*. Claremont College.

Delgado, M., Porter, M. E., & Stern, S. (2010). Clusters and entrepreneurship. *Journal of Economic Geography*, *10*(4), 495–518. doi:10.1093/jeg/lbq010

Denning, S. (2011). Why "shared value" can't fix capitalism. *Forbes*. Retrieved from http://www.forbes.com/sites/stevedenning/2011/12/20/why-shared-value-cant-fixcapitalism/

Denning, S. (2012). Is shared value a new mental model for innovation?. *Forbes*. Retrieved from http://www.forbes.com/sites/stevedenning/is-sharedvalue-a-new-mental-model-for-innovation/

Di Gregorio, D. (2013). Value creation and value appropriation: An integrative, multi-level framework. *Journal of Applied Business and Economics*, *15*(1), 39–53.

Dicken, P. (Ed.). (2011). *Global shift: Mapping the changing contours of world economy* (6th ed.). New York: The Guilford Press.

Donaldson, T., & Dunfee, T. W. (1999). *Ties that bind: A social contracts approach to business ethics*. Boston, MA: Harvard Business School Press.

Drucker, P. F. (1984). The new meaning of corporate social responsibility. *California Management Review*, *26*(2), 53–63. doi:10.2307/41165066

Elkington, J. (1998). *Cannibals with forks. The triple bottom line of the 21st century* (1st ed.). Oxford, UK: Capstone Publisher Limited.

Epstein, J. (2011). *So you tall this CSR? Or one of its many other names?*. Retrieved from http://www.forbes.com/sites/csr/2011/07/28/so-you-call-this-csr-or-one-of-its-many-othernames/

Ernst & Young. (2014). *Creating shared value in Africa: Local content in the oil and gas industry*. EYGM Limited.

Escudero, G. (2013). Modelos de Empresa y Etica. *Cuadernos Empresay Humanismo, 120*.

Fava Neves, M., & Dutra de Barcellos, M. (2013). *Value creation, capture and sharing model for food companies, chains and networks (VCCS Model)*. Symposium honouring Klaus Grunert, AU, Arhus.

Fjell, L., & Rødland, S. E. (2015). *CSR in international business: Creating shared value* (Unpublished Masters' Thesis). Norwegian University of Science and Technology.

Fombrun, C., Gardberg, N., & Barnett, M. (2000). Opportunity platforms and safety Nets: Corporate citizenship and reputational risk. *Business and Society Review*, *105*(1), 85–106. doi:10.1111/0045-3609.00066

Frynas, J. G. (2009). *Beyond corporate social responsibility: Oil multinationals and social challenges*. Cambridge, UK: University Press. doi:10.1017/CBO9780511581540

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Gascon, J. F. (2015). *Creating shared value: Corporate case study in developing countries*. Retrieved from https://www.mcgill.ca/isid/files/isid/gascon.pdf

Ghemawat, P. (1991). *Commitment: The dynamics of strategy*. New York: The Free Press.

Gholami, S. (2011). Value creation model through corporate social responsibility (CSR). *International Journal of Business and Management*, *6*(9), 54–57. doi:10.5539/ijbm.v6n9p148

Giddens, M. (2011). *Investment & pensions Europe: Measuring social impact*. Retrieved from http://www.ipe.com/measuring-social-impact/41198.article

Gradl, C., & Jenkins, B. (2011). *Tackling barriers to scale: From inclusive business models to inclusive business*. Retrieved from https://www.hks.harvard.edu/mrcbg/CSRI/publications/report_47_inclusive_business.pdf

Hartman, L. P., & Werhane, P. H. (2013). Proposition: Shared value as an incomplete mental model. *Business Ethics Journal Review*, *1*(6), 36–43. doi:10.12747/bejr2013.01.02

Hidalgo, C., Peterson, K., Smith, D., & Foley, H. (2014). *Extracting with purpose: Creating shared value in the oil and gas and mining sectors' companies and communities*. Retrieved from http://www.fsg.org/publications/extracting-purpose

Hills, G., Russell, P., Borgonovi, V., Doty, A., & Lyer, L. (2012). *Shared value in emerging markets: How multinational corporations are redefining business strategies to reach poor or vulnerable populations*. Retrieved from http://www.fsg.org/publications/shared-value-emerging-markets

Jean, W. A., & Yazdanifard, R. (2015). The review of shared value in contemporary CSR run by two successful companies to sustain the business in recent years. *International Journal of Management, Accounting and Economics*, *2*(9), 1122–1129.

Jenkins, B., Valikai, K., & Baptista, P. (2013). *The Coca-Cola Company's 5by20 Initiative: Empowering Women Entrepreneurs across the Value Chain*. Cambridge, MA: The CSR Initiative at the Harvard Kennedy School and Business Fights Poverty.

Jonikas, D. (2013). Conceptual framework of value creation through CSR in separate member of value creation chain. *Bulletin of Geography Socio–Economic Series*, *21*, 69–78.

Jonikas, D. (2014). Value created through CSR measurement possibilities. *Procedia: Social and Behavioral Sciences*, *156*, 189–193. doi:10.1016/j.sbspro.2014.11.169

Juscius, V., & Jonikas, D. (2013). Integration of CSR into value chain: Conceptual framework. *InzinerineEkonomika-Engineering Economics*, *24*(1), 63–70.

Kania, J., & Kramer, M. (2011). Collective impact. *Stanford Social Innovation Review*, *9*(1), 36–41.

Kearney, A. T. (2015). *Creating value by doing good*. A.T. Kearney Inc.

Kim, W. C., & Mauborgne, R. (2005). *Blue Ocean Strategy*. Boston, MA: Harvard Business School Press.

Kleemann, L., & Krieger-Boden, C. (2011). *Bridging morale and business through shared value?*. Kiel policy brief / InstitutfürWeltwirtschaftan der Universität Kiel, No. 38.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Kramer, M. R., & Tallant, K. (2014). Roundtable on shared value in education. *Stanford Social Innovation Review*. Retrieved from http://ssir.org/articles/entry/roundtable_on_shared_value_in_education

Kreckova, Z. (2015). Corporate response to concept of shared value. *European Scientific Journal*, *11*(22), 36–45.

Leandro, L., & Neffa, E. (2012). Is the integration of shared value creation (SVC) with strategy management of productive organizations an innovative approach to environmental challenges faced by companies today?. *International Journal of Business, Management*, *Economic Research Journal*, *3*(2), 484–489.

Leth, M., & Hems, L. (2014). *The potential for creating shared value in Australia*. CSV Green Paper. Retrieved from https://static.squarespace.com/static/52045752e4b0330b6437dade/t/52dce083e4b086a63887ccb5/1390207107654/CSV-Green%20Paper_Draft%20for%20Discussion.pdf

Lin, C. H., Yang, H. L., & Liou, D. Y. (2009). The impact of corporate social responsibility on financial performance: Evidence from business in Taiwan. *Technology in Society*, *31*(1), 56–63. doi:10.1016/j.techsoc.2008.10.004

Maczadlo, R. (2015). Creating competitive advantages – The European CSR-strategy compared with Porter's and Kramer's shared value approach. *ECONVIEWS*, *28*, 243–256.

Mansfield, E., Rapoport, J., Romeo, A., Samuel Wagner, S., & Beardsley, G. (1977). Social and private rates of return from industrial innovation. *The Quarterly Journal of Economics*, *91*(2), 221–240. doi:10.2307/1885415

March, J. (1991). Exploration and exploitation in organizational learning. *Organization Science*, *2*(1), 71–87. doi:10.1287/orsc.2.1.71

March, J. G., & Simon, H. A. (1958). *Organizations*. New York: John Wiley and Sons.

McWilliams, A., & Siegel, D. S. (2011). Creating and capturing value: Strategic corporate social responsibility, resource-based theory, and sustainable competitive advantage. *Journal of Management*, *37*(5), 1480–1495. doi:10.1177/0149206310385696

Mena, K. P. B., & Zelaya, N. S. L. (2013). *Creating shared value in the educational sector: The contributions of CSV to the educational sector through social impact organizations* (Master Thesis). Umea School of Business and Economics.

Michelini, L., & Fiorentino, D. (2012). New business models for creating shared value. *Social Responsibility Journal*, *8*(4), 561–577. doi:10.1108/17471111211272129

Milliman, J., Ferguson, J., & Sylvester, K. (2008). Implementation of Michael Porter's strategic corporate social responsibility model. *Journal of Global Business Issues*, *2*, 29–33.

Mitler, D., Rostorfer, D., & Ledbetter, K. (2015). *Water stewardship in Africa: The next frontier for building shared value*. University of Michigan.

Mizik, N., & Jacobson, R. (2003). Trading off between value creation and value appropriation: The financial implications of shifts in strategic emphasis. *Journal of Marketing*, *67*(1), 63–76. doi:10.1509/jmkg.67.1.63.18595

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Mohammed, M. (2013). *Conceptual framework for corporate accountability in the context of sustainability: A literature review*. Paper presented at the 5th Annual EuroMed Conference of the EuroMed Academy of Business, Montreux, Switzerland. 10.1108/EMJB-05-2013-0026

Moon, H. C., Pare, J., Yim, S. H., & Park, N. (2011). An extension of Porter and Kramer's creating shared value (CSV): Reorienting strategies and seeking international cooperation. *Journal of International and Area Studies*, *18*(2), 49–64.

Moore, C. (2014). *Corporate social responsibility and creating shared value: What's the difference?*. Retrieved from https://sharedvalue.org/sites/default/files/resource-files/CFR-047%20Corporate%20Social%20Responsibility%20White%20Paper_FINAL.pdf

Néron, P. Y. (2013). Toward a political theory of the business firm? A comment on political CSR. *Business Ethics Journal Review*, *1*(3), 14–21. doi:10.12747/bejr2013.01.03

Neves, J. M. d. N. G. V. (2013). *Creating shared value. The case of Nestlé* (Dissertation). Universidade Católica Portuguesa.

Nohria, N., & Ghoshal, S. (1994). Differentiated fit and shared values: Alternatives for managing headquarters subsidiary relations. *Strategic Management Journal*, *15*(6), 491–502. doi:10.1002mj.4250150606

Odia, J. O. (2016). Foreign direct investments, corporate social responsibility and economic development: Exploring the relationship and mitigating the expectation gaps. In M. Ojo (Ed.), *Foreign Direct Investments, Corporate Social Responsibility, and Economic Development*. IGI Global. doi:10.4018/978-1-5225-0305-7.ch015

OECD. (2016). *Collaborative strategies for in-country shared value creation: Framework for extractive projects. OECD Development Policy Tools*. Paris: OECD Publishing.

Ogrean, C. (2014). Perceptions on the strategic value of corporate social responsibility-some insights from global rankings. *Journal of International Studies*, *7*(2), 128–140. doi:10.14254/2071-8330.2014/7-2/11

Orlitzky, M., Siegel, D. S., & Waldman, D. A. (2011). Strategic corporate social responsibility and environmental sustainability. *Business and Society Review*, *50*(1), 6–27. doi:10.1177/0007650310394323

Peloza, J., & Shang, J. (2011). How can corporate social responsibility activities create value for stakeholders? A systematic review. *Journal of the Academy of Marketing Science*, *39*(1), 117–135. doi:10.100711747-010-0213-6

Peterson, K., Rehrig, M., Stamp, M., & Kim, S. (2012). *Competing by saving lives: How pharmaceutical and medical device companies create shared value in global health*. Retrieved from http://www.fsg.org/publications/competing-saving-lives-0

Petrovic-Lazarevic, S. (2008). The development of corporate social responsibility in the Australian construction industry. *Construction Management and Economics*, *26*(2), 93–101. doi:10.1080/01446190701819079

Pfitzer, M., Bockstette, V., & Stamp, M. (2013). Innovating for shared value. Companies that deliver both social benefit and business value rely on five mutually reinforcing elements. *Harvard Business Review*, *91*(9), 100–107.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Pirson, M. (2012). Social entrepreneurs as the paragons of shared value creation? A critical perspective null. *Social Enterprise Journal*, *8*(1), 31–48. doi:10.1108/17508611211226575

Porter, M. (2014). *Created shared value: Becoming a movement.* Shared Value Leadership Summit, New York, NY.

Porter, M., & Kramer, M. R. (2011). Creating shared value: How to reinvent capitalism - and unleash a wave of innovation and growth. *Harvard Business Review*, *89*(1/2), 62–77.

Porter, M. E. (1998). *Competitive advantage-Creating and sustaining superior performance* (2nd ed.). New York: Free Press.

Porter, M. E. (2000). Locations, clusters, and company strategy. In G. L. Clark, M. P. Feldman, & M. S. Gertler (Eds.), The Oxford Handbook of Economic Geography (pp. 253–274). Academic Press.

Porter, M. E., Hills, G., Pfitzer, M., Patscheke, S., & Hawkins, E. (2012). *Measuring share value: How to unlock value by linking social and business results.* Retrieved from www.fsg.org: http://www.mesacc.edu/other/engagement/2013Conf/Measuring_Shared_Value.pdf

Porter, M. E., & Kramer, M. R. (2006). Strategy and society: The link between competitive advantage and corporate social responsibility. *Harvard Business Review*, *84*(12), 78–92. PMID:17183795

Prahalad, C. K., & Hart, S. L. (2002). The fortune at the bottom of the pyramid. *Strategy Business Magazine,* 26.

Reich, R. (2007). *Supercapitalism: The transformation of business, democracy and everyday life.*. Retrieved from http://www.economist.com/node/18330445

Ringmar, E. (2005). *Surviving capitalism*. London: Anthem Press.

Rocchi, M., & Fererro, I. (2014). *Systematic shared value in finance: Expanding Porter's approach*. Working Paper No. 07. Pontificia Università della Santa Croce/University of Navarra.

Saul, J. (2011). *Social innovation: 5 strategies for driving business growth through social change*. San Francisco: Jossey-Bass.

Scherer, A. G., & Palazzo, G. (2007). Toward a political conception of corporate social responsibility: Business and society seen from a Habermasian perspective. *Academy of Management Review*, *32*(4), 1096–1120. doi:10.5465/AMR.2007.26585837

Scherer, A. G., & Palazzo, G. (2011). The new political role of business in a globalized world: A review of a new perspective on CSR and its implications for the firm, governance, and democracy. *Journal of Management Studies*, *48*(4), 899–931. doi:10.1111/j.1467-6486.2010.00950.x

Scherer, A. G., Palazzo, G., & Matten, D. (2017). The business firm as a political actor: A new theory of the firm for a globalized world. *Business & Society*, *53*(2), 143–156. doi:10.1177/0007650313511778

Scott-Kemmis, D. (2012). *Responding to change and pursuing growth: Exploring the potential of business model innovation in Australia*. Australian Business Foundation.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Spitzeck, H., & Chapman, S. (2012). Creating shared value as a differentiation strategy – the example of BASF in Brazil. *Corporate Governance*, *12*(4), 499–513. doi:10.1108/14720701211267838

Swartout, N. L (2016). *Exxon Mobil local content program*. Being presentation at the UNCTAD, Nairobi, Kenya.

Székely, F., & Knirsch, M. (2005). Responsible leadership and corporate social responsibility: Metrics for sustainable performance. *European Management Journal*, *23*(6), 628–547. doi:10.1016/j.emj.2005.10.009

Szmigin, I., & Rutherford, R. (2013). Shared value and the impartial spectator test. *Journal of Business Ethics*, *114*(1), 171–182. doi:10.100710551-012-1335-1

Vaidyanathan, L., & Scott, M. (2012). Creating shared value in India: The future for inclusive growth. *Vikalpa: The Journal for Decision Making*, *37*(2), 108–113.

Visser, W. (2006). Revisiting Carroll's CSR pyramid: An African perspective. In E. R. Pedersen & M. Hunicke (Eds.), *Corporate citizenship in developing countries: New partnership perspectives* (pp. 29–56). Copenhagen: Copenhagen Business School Press.

Visser, W. (2008). Corporate social responsibility in developing countries. In A. Crane & ... (Eds.), *The Oxford handbook of corporate social responsibility* (pp. 473–479). Oxford, UK: Oxford University Press.

Visser, W. (2010). The age of responsibility: CSR 2.0 and the new DNA of business. *Journal of Business Systems. Governance and Ethics*, *5*(3), 7–22.

Visser, W. (2013). *Creating shared value: Revolution or clever con?*. Retrieved from http://www.waynevisser.com/wp-content/uploads/2013/08/blog_csv_csr_wvisser.pdf

Visser, W., Matten, D., Pohl, M., & Tolhurst, N. (2007). *The A to Z of Corporate Social Responsibility*. London: Wiley.

Werner, W. (2009). Corporate social responsibility initiatives addressing social exclusion in Bangladesh. *Journal of Health, Population, and Nutrition*, *27*(4), 545–562. doi:10.3329/jhpn.v27i4.3401 PMID:19761088

Werther, W. B. Jr, & Chandler, D. (2011). *Strategic corporate social responsibility: Stakeholders in a global environment*. Los Angeles, CA: Sage.

Wheeler, D., Colbert, B., & Freeman, R. E. (2003). Focusing on value: Reconciling corporate social responsibility, sustainability and a stakeholder approach in a network world. *Journal of General Management*, *28*(3), 1–28. doi:10.1177/030630700302800301

Whelan, G. (2012). The political perspective of corporate social responsibility: A critical research agenda. *Business Ethics Quarterly*, *22*(4), 709–737. doi:10.5840/beq201222445

Whelan, G. (2013). Political corporate social responsibility: Some clarifications. *Business Ethics Journal Review*, *1*(10), 63–68. doi:10.12747/bejr2013.01.10

Wilburn, K., & Wilburn, R. (2014). Demonstrating a commitment to corporate social responsibility not simply shared value. *Business & Professional Ethics Journal*, *33*(1), 1–15. doi:10.5840/bpej20144216

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Windsor, D. (2013). Corporate social responsibility and irresponsibility: A positive theory approach. *Journal of Business Research*, *66*(10), 1937–1944. doi:10.1016/j.jbusres.2013.02.016

Young, G. (2012). *Strategic corporate social responsibility and small to medium businesses in Australia*. Creative Commons.

KEY TERMS AND DEFINITIONS

Corporate Social Responsibility: This refers to the continuing commitment by business to contribute to economic development while improving the quality of life of the workforce and their families as well as of the community and society at large.

Created Share Value: This is a paradigm shift in corporate social responsibility and sustainability strategy where business create economic values and values for societies through the simultaneous pursuit of economic, social and societal goals. Companies can create shared values through re-conceiving products and markets, redefining productivity in the value chain and building supportive industry clusters at the company's locations.

Shared Value: This can be defined as policies and operating practices that enhance the competitiveness of a company while simultaneously advancing the economic and social conditions in the community in which it operates.

Sustainable Development: This refers to development that meets the needs of the present generation without compromising the ability of the future generations to meet their needs.

This research was previously published in Value Sharing for Sustainable and Inclusive Development edited by Mario Risso and Silvia Testarmata, pages 122-153, copyright year 2018 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 56
Green Entrepreneurship in Transitional Economies: Breaking Through the Constraints of Legitimacy

Yang Gao
Dalian University of Technology, China

Sang-Bing Tsai
Foshan University, China & Dalian University of Technology, China

Shuo Zhang
Dalian University of Technology, China

Guodong Li
Civil Aviation University of China, China

ABSTRACT

With environmental pollution, climate change and resource scarcity being serious global issues, green entrepreneurship is increasingly seen as an approach to simultaneously address economic performance, environmental impact and social responsibility. As green entrepreneurship needs to consider both venture performance and social responsibility, it will be subject to legitimacy constraints at the institutional level. Especially for transition economies in different countries, institutional uncertainty is a key factor. Better green performance can be easily achieved if green startups have a higher level of legitimacy. However, against the background of transitional economies, the increase in institutional uncertainty will damage the promotion of political legitimacy and make the enterprises subject to political legitimacy constraints lose their green performance. Overall startups in different industries need to develop green actions under the pressure of institutional constraints, and governments also need to improve policies and regulations quickly.

DOI: 10.4018/978-1-5225-7915-1.ch056

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

INTRODUCTION

With the deterioration of global environment and the worsening energy contradiction, balancing the conflicts between economic development and environmental protection has caused great difficulties for governments, academia and industries all around the world. Multiple events, including the oil spill of British Petroleum in the Gulf of Mexico and serious PM2.5 in China, have made the governments and enterprises realize the inevitability and urgency of a green transformation. As the subject of production, enterprises play a significant role in the development of national economic and product market. However, when enterprises provide consumers with products and service bringing convenience for them, many production processes will destroy the sustainable development of ecological environment. Therefore, an important component of addressing sustainable development issues and environmental degradation will hinge on making up for and improving the lack of social responsibility of corporations (Rockström, J., Lannerstad, M., & Falkenmark, M., 2007; Lin, C.S., Chang, R.Y., & Dang, V.T., 2015). As the society's sensitivity to environmental problems, energy consumption and pollution continues to rise, these elements become the important factors threatening enterprise legitimacy. So, there is an increasing voice for corporations to develop green businesses that takes both ecological benefits and economic benefits into account, that is, GE. It is recognized by governments, ventures, customers and other stakeholders, as well as integrates business entrepreneurship and sustainable development, simultaneously considering the sustainable development of environment, economy and society (Allen & Malin, 2008; Isaak, 1997, pp.80-90). Therefore, whether enterprises with GPO can really obtain green performance and how legitimacy constraints influence the achievement of green performance in green companies have drawn the attention of business and academia.

GE refers to entrepreneurial behavior in an enterprise's green innovation of products, services and market development to generate profit while considering environmental protection (Cohen & Winn, 2007; Dean & McMullen, 2007). Green entrepreneurship theory gradually developed with the integration of entrepreneurship theory and social enterprise theory. Under the dual functions of eco-orientation and market-orientation, enterprises are not likely to be burdened by GE as it will provide vast resources for enterprise development (Hartman & Stafford, 1997; Soto-Acosta, P., Cismaru, D.M., Vătămănescu, E.M., & Ciochină, R.S., 2016). According to the definition of EO by Miller and Friesen (1983), this study believes that green entrepreneurial corporations need to own green entrepreneurial orientation (GEO), which contains green innovation, green risk taking and green proactiveness. As green entrepreneurial corporations need to undertake social responsibility, it is particularly vital for them to gain legitimacy. Suchman (1995) proposes that legitimacy refers to the overall evaluation of external stakeholders about appropriateness of corporate behavior. The content involves both social responsibility and other standards such as competitive advantage and enterprise scale. Breaking through legitimacy constraints and achieving green performance have been the main purposes of enterprises which launch green entrepreneurship activities.

Because proactive green-oriented businesses not only concern about business performance but also consider social responsibility, the relationship between GEO and green performance will be restricted by institutional environment. As an institutionally embedded binding mechanism, the study of enterprise legitimacy has attracted attention (Shirokova, G., Bogatyreva, K., Beliaeva, T., & Puffer, S., 2016). However, present research encompasses two views. The first takes strategic theory as a starting point and treats legitimacy as a strategic resource which ventures are prone to lose, as well as claims that the ultimate purpose of seeking legitimacy is to obtain mobilized resources and securing approval and

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

legitimacy from external stakeholders will be beneficial for start-ups to realize opportunity and value; this 'legitimacy—resources—business growth' model of causal relationships is widely accepted (Zimmerman & Zeitz, 2002; Lounsbury & Glynn, 2001; Navis & Glynn, 2011). Nevertheless, a large amount of scholars questioned it and indicated that legitimacy couldn't be regarded as the key resource for start-ups to overcome the disadvantage of starting anew because experienced and rational entrepreneurs are more likely to pursue more easily obtained resources in order to build their business models (Aldrich & Fiol, 1994; Zimmerman & Zeitz, 2002; Delmar & Shane, 2004). Combining the above arguments, this chapter tends towards the latter view and believes that legitimacy should exist as a limiting mechanism embedded in the institution and green-oriented entrepreneurship should not deem legitimacy as a necessary resource but take appropriate strategic action according to different contexts.

Because the causal model of 'GEO– legitimacy – resources - business growth' does not reflect the essence of legitimacy in GE, a comparative exploration about the effects on varying degrees of legitimacy on the impacts between GEO and green performance appears to be more valuable, meanwhile, this kind studies are rare. As a result, this chapter will explore the relationship between GPO and green performance and reveal the moderating effect of legitimacy. More importantly, the premise upon which it is possible to integrate legitimacy theory and green entrepreneurship theory is the existence of stable and effective systemic rules on which legitimacy evaluations depend. However, this isn't consistent with lots of transitional economies, including China. Due to the substantial institutional uncertainty created by economies, judging legitimacy guidelines produces higher heterogeneity in transition economies (Scherer, A.G., Palazzo, G. & Seidl, D., 2013). Thus, this chapter combines the situation of transition economy in China and explains the relationship among GPO, legitimacy and green performance under institutional uncertainty.

Apart from the introduction, the paper is structured along eight sections. Sections 2-4 provide a description of GE and relevant content, legitimacy and transitional economy. Section 5 is devoted on the methodologies and data for the model. Section 6 provides the results. And Section 7 provides the approaches to achieve green performance. Finally, the last section just summarizes the key issues that have arisen in this paper.

GEEEN ENTREPRENEURSHIP AND RELEVANT CONTENT

Green Entrepreneurship and Green Entrepreneurial Orientation

Green entrepreneurship (GE), also known as environmental, ecological or sustainable entrepreneurship, primarily represents the process of identifying, evaluating and utilizing economic opportunities which arise during market failure and facilitates sustainable developments of enterprises (Shane & Venkataraman, 2000; Gibbs & O'Neill, 2014). The core of GE is to discover the future market opportunity in order to develop a green market through innovation and commit to corporate social and ecological responsibility (Shepherd & Patzelt, 2011; Cohen & Winn, 2007). Because of GE's longer payback period coupled with its social responsibilities, GE often requires policies that encourage, support and are widely recognized by society, and the enterprises also play a double role in ecological construction and entrepreneurship (Ndubisi, N.O. & Nair, S.R., 2009). In addition, enterprises dedicated to GE must proactively achieve the twin objectives of marketing and ecology, making both green participation orientation and entrepreneurial orientation important (Nelson, O.N. & Sumesh, R.N., 2009; Al-Saleh, Y. & Mahroum, S.,

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

2015). Thus, in the study of GE, the GEO and the recognition of legitimacy under institutional theory of enterprises are significant factors in determining the success of GE enterprises.

GEO is derived from the concept of entrepreneurial orientation (EO). The proposition of EO is mainly to show the distinctive characteristics between enterprises and other conservative enterprises, that is, innovation, risk taking and proactiveness (Miller, D., 1983, 2011; Wales, W.J., 2016, pp.3-15). This not only illustrates unique entrepreneurial strategic position of enterprises but also represents the inherent entrepreneurial orientation of start-ups (Lumpkin, G.T.; Dess, G.G., 1996; Hall, J.K., Daneke, G.A, & Lenox M J, 2010). EO indicates the overall competitive orientation and tendency of organizational behavior in entrepreneurial enterprises which is applicable to GE. GEO embodies not only the market competition orientation of GE enterprises but also their green participation orientation (Kuckertz, A. & Wagner, M, 2010). GEO contains green innovation, green risk-taking and green proactiveness, respectively representing the tendency of GE enterprises to keep ahead of the competitors by implementing green technological innovation, make risky investment decisions in the face of uncertainty and lead the industry through upfront actions. GEO proposed in this chapter is a concept at the organizational level.

At present, although there are many studies about EO and entrepreneurial performance, the results vary widely. Some scholars indicate that EO is conducive to enhance entrepreneurial performance, and this impact is particularly obvious in the initial start-up phase and growth phase (Kreiser, P.M., 2011, pp.1025-1050; Eshima, Y. & Anderson, B.S., 2016). Others states that EO may have a negative effect or no effect on entrepreneurial performance (Stam, W, 2008, pp.97-111). The difference between EO and entrepreneurial performance stems from the entrepreneurial activity itself, which is dynamic and highly uncertain (Cope, J., 2005, pp.373-397; Schepers, J., Voordeckers, W., Steijvers, T. & Laveren,E, 2014). Whether enterprise performance is enhanced relies largely on specific entrepreneurial behaviors under different circumstances (Bruton, G., Susanna, K., Donald, S., & Wright, M., 2015). Therefore, there are few studies about whether enterprises with high GEO can realize high green performance. Meanwhile, compared with financial performance, green performance is only reflected in product, production process, customer safety and other aspects. So, the relationship between EO and green performance should be different.

Green Proactiveness Orientation and Green Performance

As an important dimension of GEO, green proactiveness orientation (GPO) represents the tendency of enterprises to be more proactive in adopting GE behaviors compared to its competitors (Miller, D. & Friesen, P.H., 1983). Green proactiveness-oriented enterprises tend to be industry leaders, examine industry trends, seize opportunities in advance, thus taking early actions to cope with change (Deng, Q. & Ji, S., 2015). GPO is a combination of initiative and behavior orientation and on behalf of the enterprises that take the initiative in order to have an effect on environment, rather than passive acceptance. It reflects a forward-looking tendency of enterprises, including accurate prediction of industry trends, avoidable production of low green-potential products, and guidance of customer acceptance about green products and consumption patterns, etc. (Cohen, B. & Winn, M.I., 2007). Thus, taking green actions before competitors, such as pushing out new green products, new service patterns, new green management modes and green technologies, along with having the foresight to examine development of the industry, can reflect the meaning and nature of GPO (Boulding, W. & Christen, M.,2001; Morris, M.H., Kuratko, D.F., & Covin, J.G., 2010).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Green performance represents a reduction in negative impact of an enterprise on the environment while achieving a balance between business and environment interests (Wagner, M. & Schaltegger, S., 2004; Huang, M. & Wang, B.). Therefore, green performance measures an enterprise in which business and environmental needs interact (Mavragani, A., Nikolaou, I.E., & Tsagarakis, K.P., 2016; Olsthoorn, X., Tyteca, D., & Wehrmeyer, W., 2001). Achieving green performance requires ventures not only to decline pollution, waste and energy consumption, and improve customer safety but also to survive and develop (Zhu, Q. & Sarkis, J., 2004; Yang, C.S., Lu, C.S., & Haider, J.J., 2013). Based on the decreasing negative impact on the environment, green performance includes multiple measurement indicators, each representing a variable (Wagner, M. & Schaltegger, S., 2004). These variables contains reduced use of water, solid waste, energy, soil contamination, toxic inputs, non-renewable resources, wastewater emissions, and emissions into the noise, air, smell/odor emissions, risk of severe accidents and landscape damage.

The main objective of proactiveness-oriented enterprises is to gain proactive advantage and a demand premium (Boulding, W. et al., 1988; Alonso-Almeida, M.D.M., Bremser, K., Llach, J., 2015). Advantages contain deep and lasting customer impressions, strong brand recognition and high cost of customers switching to other start-ups. Meanwhile, early entrants of industry will also gain a low-cost advantage from having a lead in technology, thus downshifting the learning curve (Makadok, R., 1998, pp.683-696; Lopez, L.E. & Roberts, E.B., 2002). Enterprises who take proactiveness orientation can gain significant performance advantages. Similarly, GPO inherits the nature characteristics of proactiveness orientation, reflected in taking GE actions before competitors. Choosing advance actions of green orientation as the objective will achieve the green proactive advantage and the lead in green performance.

In the study of EO, which doesn't consider green performance as a prerequisite, an enterprise that takes proactive orientation will not necessarily achieve entrepreneurial performance (Cope, J., 2005, pp.373-397). The proactive advantage of pioneers is likely to become a proactive disadvantage eventually, and the relationship between proactiveness orientation and entrepreneurial performance is not a simple linear one. However, there is a linear relationship between GPO and green performance, which won't be influenced by the behaviors or the number of the followers. Therefore, enterprises having higher levels of GPO will have better green performance improvements.

LEGITIMACY AND ITS MODERATING EFFECT

Legitimacy

Several scholars have defined legitimacy (Parsons, T., 1960; Meyer, J.W. & Scott, W.R., 1983; Scott, W.R., 1995). Suchman (1995) conducted a comprehensive review of previous and put forward the concept of legitimacy which is widely recognized in academia: legitimacy is the general perception or assumption that the activities of an entity are appropriate, proper or desirable within the socially constructed system of norms, values, beliefs, and definitions. Enterprises are confronted with the constraints of legitimacy, incorporating the restraints of sociopolitical legitimacy and cognitive legitimacy (Becker-Blease, J.R. & Sohl, J.E., 2015). Sociopolitical legitimacy refers to the level of acceptance of key stakeholders, the public and government officials about the behavior and products, and low social legitimacy will result in registration difficulties, public rejections of product standards, financing problems, etc (Palmås, K., Andersson Schwarz, J., & Larsson, S., 2014). Cognitive legitimacy refers to the level of social understanding and acceptance of start-ups, which is largely determined by the degree of external recognition

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

of new ventures and their products and services. Low cognitive performance is reflected in a low level of society-wide knowledge or difficult acceptance of products or services by the ventures, or in a low customer evaluation of products or services (Delmar, F. & Shane, S., 2004; Li, X., Wang, C., Xu, X., 2014).

Cognitive legitimacy pertains to the category of external legitimacy which is capable of being obtained by enterprises. External legitimacy is from outside an organization, in line with the support of suppliers, partners and customers for companies and the evaluations of companies by government, public media and regulators. Most existing studies emphasize legitimacy from an external perspective (Kostova, T. & Zaheer, S., 1999; Rottig, D. & ReusT, H., 2009). According to this, the study measures external legitimacy from two aspects: PL (government and regulatory agencies) and CL (suppliers, customers and partners).

The Moderating Effect of Legitimacy

In the field of entrepreneurship, it is common to discover the integration of legitimacy and opportunities. For realizing the business value of opportunities, experienced entrepreneurs tend to view commercial legitimacy (CL) significantly, regarding low CL as a key factor that leads to the difficult realization of opportunity value. This situation makes experienced entrepreneurs concentrate on CL because a higher level of legitimacy ensures a more intense spirit of innovation, and the more likely it is that a start-up will obtain the competitive advantage (Li, X. et al., 2014; Shane, S., 2000, pp.448-469; Czinkota, M., Kaufmann, H.R., & Basile, G., 2014). And in green research, compared to the value of ordinary entrepreneurship opportunities, the value of GE is more difficult to realize, because green enterprises are faced with the dual constraints of sociopolitical legitimacy and CL (Fraser, S. & Greene, F.J., 2006). Therefore, particularly for experienced entrepreneurs, constant learning behavior makes them less optimistic and focus on the evaluation of green opportunities (Kuckertz, A. & Wagner, M., 2010; Westhead, P., Ucbasaran, D., & Wright, M., 2005). As a result, when an enterprise selects GE to be ahead of its competitors, entrepreneurs should carefully think of the degree of recognition by external stakeholders because to a large extent, the level of political and commercial legitimacy will affect the realization of green opportunity value and green performance. In other words, for green entrepreneurs, various stakeholders rely on different standards and specifications to judge the legitimacy of GE, so the pressure of legitimacy will push enterprises to engage in GE more actively. Furthermore, when an enterprise perceives the level of political and commercial legitimacy goes higher, it will receive more attention and more transparent information. Thus, enterprises with higher political and commercial legitimacy own much more pressure to improve their green performance, which subsequently helps proactive green enterprises obtain green performance.

TRANSITIONAL ECONOMY AND INSTITUTIONAL UNCERTAINTY IN CHINA

Transitional Economy

'Transitional economy' refers to the transitional process from a planned economy to a market economy. Unlike developed western countries, a lot of developing countries coexists planned and market economies, government intervention and market mechanism, as well as traditional and modern economic development modes (Walder, A.G., 1995, pp.263-301; Li, Y., Peng, M. W., & Macaulay, C. D., 2013). In the situation of transitional economy, enterprises also have characteristics of ambidexterity, such

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

as continuously swaying and balancing between commercial economy and environmental protection, diversification and specialization, entrepreneurship and keeping (Oi, J.C., 1995, pp.1132-1149; Tan J., 2001, pp.359-376). The transitional economy makes firms in developing countries, including China, to show the unique features in the selection of entrepreneurial behavior, and mature western theories are no longer suitable for transitional economies. Undoubtedly, a systematic study in entrepreneurship behavior and GE behavior of a corporation in transitional economy will offer a vital theoretical contribution for entrepreneurship management and green management, and a realistic guidance for getting rid of economic crisis.

Institutional Uncertainty

Institutional uncertainty is an important feature of transitional economies (Wu, K.J., Liao, C.J., Tseng, M.L., & Chou, P.J., 2015). It is a broad concept, encompassing various forms of uncertainties within the political environment (Kelly, B., Pástor, Ľ., & Veronesi, P., 2016). Because such uncertainties are hard to measure, which means only fewer proxies can be used in systematic cross-country investigation (Brunetti, A. & Weder, B., 1998; Simón-Moya, V., Revuelto-Taboada, L., & Guerrero, R.F., 2014). From the analysis of existing empirical results, we know different scholars used a variety of indicators to measure, containing political violence, governmental instability and policy uncertainty (Barro, R. J., 1991, pp.715-721; Mauro, P., 1991, pp.681-712; Brunetti, A., Kisunko, G., Weder, B., 1997). Although stability and few political conflicts are unique advantages of China, policy instability is a severe disadvantage caused by transitional economy. Such disadvantages include existing policy gaps in some areas, unclear government definition of key issues in the policy implementation process and poorly detailed observations and recommendations of many policies (Puffer, S.M., McCarthy, D.J., & Boisot, M., 2010; Sheng, S., Zhou, K.Z., & Li, J.J., 2011). Due to scarce innovation, stability and effectiveness in some policies, it is hard to turn them into valid entrepreneurship behavior. Therefore, to some extent, policy uncertainty is representative of institutional uncertainty under the transitional economy in China.

The Moderating Effect of Institutional Uncertainty

For enterprises carrying out green entrepreneurship, transitional economy has a substantial impact. Because institutional transition breaks through the restrictions of a planned economy, adding a private economy greatly stimulates the vitality of market competition. In the fierce competition, ventures tend to pursue short-term performance goals but long-term ones, and corporation behavior tends to be conducive to business performance rather than environmental performance (Orlitzky, M., Siegel, D.S., & Waldman, D.A., 2011). When institutional uncertainty is high, policy shackles for enterprises become less strict, and companies will continue to seek for and drill loopholes and gaps of policies. Particularly when the industry standards are not clear, institutional pressure on green enterprises declines along with the power to obtain political legitimacy (PL), resulting in damaged green performance. Nevertheless, in the study of institutional theory, formal and informal institutions show a mutual substitution effect on the process of guiding economic behaviors. When formal institutions are incomplete, informal norms and values will play a stronger role (Li, Y., Peng, M.W., & Macaulay, C.D., 2013; Peng, M.W. & Heath, P.S., 1996). Thus, when institutional uncertainty is high, it's more significant for enterprises to obtain recognition from the suppliers, partners and the public (Huang, T., Wu, F.; Yu, J., & Zhang, B., 2015).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

In this context, influences of informal institutions are more vital and the facilitating roles of CL become more obvious between GPO and green performance.

The Moderating Effect of Institutional Uncertainty in Transitional Economy

Connecting the institutional theory and green entrepreneurship theory under transitional economy, this study finds out that the moderating effect of PL on the relationship between GPO and green performance becomes more negative as institutional uncertainty increases, such that the three-way interaction of GPO, PL, and institutional uncertainty is negatively related to green performance. However, the moderating effect of CL becomes more positive. That is, as a positive indicator, legitimacy is able to promote the relationship between GPO and green performance, but this conclusion will alter under the background of transitional economics. Under a high level of institutional uncertainty, CL will become a stimulus, while the promotion of PL will be restricted. In addition, this chapter analyzes the influences of institutional uncertainty on the moderating effect of legitimacy between GPO and green performance in a transitional economy. On one hand, this chapter finds that institutional uncertainty strengthens the moderating effect of CL. On the other hand, this uncertainty damages the moderating effect of PL. Considering this issue in the context of transitional economy in China, where there are few political conflicts and a stable government, the instability of policies can have a serious impact on business. Policies in many sectors are not stable due to gaps in policies. And it is difficult to implement certain standards because green start-ups must pay attention to both business performance and social responsibility, and institutional uncertainty has an even greater impact on them. In an institution environment which is highly uncertain, because of the gaps in policies and regulations, and incompletely specific green standards for implementation, pioneering GE start-ups will continue to drill policy 'loopholes' without being punished. As a result, the institutional pressure on those companies declines a lot and the impetus to obtain PL will reduce, suppressing the catalytic effects of PL between GPO and green performance. On the contrary, with the increase of institutional uncertainty, enterprises need to obtain recognition from stakeholders to achieve higher business performance. In this circumstance, the drive to gain CL will aggrandize and the power of CL exerts greater pressure on those ventures, thus making CL play a more prominent role in elevating the relationship between GPO and green performance. To a certain extent, this interprets the reason why in transitional economy in China, the enterprises find it so difficult to implement green standards, drill policy'loopholes', prefer to seek'Guanxi', and excessively focus on business performance, thus leading to the profit pursuit, malicious competition and serious product homogeneity.

DATA AND METHOD

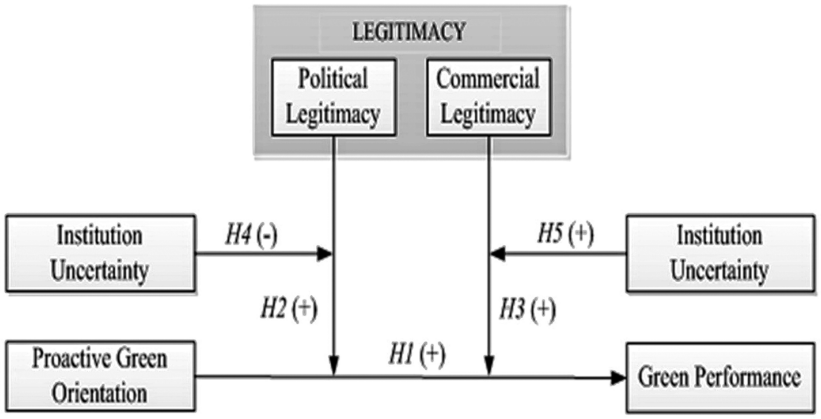
Development of Survey Instrument

According to Murphy (1996), using appropriate control variables in the study of entrepreneurial performance can avoid performance measurement prejudice. Thus, this chapter chooses enterprise size, business scale, sector, establishment time and stage of development as control variables.

On account of the extensive theoretical background in previous section, this chapter identified the following demanded measurements. All items were measured on a Likert five scale, where an evaluation

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 1. The model



of one exhibits that the statement doesn't fit the reality of the start-up to which the respondent belongs and an evaluation of five shown a high fit. Besides, the measures of EO have been mentioned in previous study. This chapter adopts the scale of proactiveness orientation from Covin and Slevin (1989) and uses three statements to measure GPO. Table 1 presents the specific statements and factor loadings of GPO, and the extraction method of Table 1 to Table 5 is Principal Component Analysis.

PL and CL belong to external legitimacy of enterprises, including the recognition of governments, suppliers, partners, regulators and customers. We select four statements from the discussion about legitimacy of Suchman (1995) and Rottig (2008) to measure PL and CL. Tables 2 and 3 present these statements and corresponding loading factors, indicating a high significance affirmative of the statements.

Institutional uncertainty and market uncertainty are main characteristics of transitional economies. Puffer et al. (2010) and Sheng et al. (2011) have carried out the thorough researches on institutional

Table 1. Rotated factor matrix for factor analysis of GPO

Factors		Cronbach's Alpha
1. We usually launch green initiatives which peers followed or reacted to.	0.848	0.806
2. We tend to be the industry 'leader', often offers new green products, new technologies or green management models before peers.	0.855	
3. Corporate executives look at future trends of industry frequently, understand opportunities for green development and take early actions to manage changes.	0.842	

Table 2. Rotated factor matrix for factor analysis of political legitimacy

Factors		Cronbach's Alpha
1. The corporation was highly praised by government departments.	0.855	0.884
2. The corporation was recognized by regulators.	0.873	
3. The government recommended us as a model enterprise frequently.	0.874	
4. The government visited our enterprise regularly.	0.842	

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 3. Rotated factor matrix for factor analysis of commercial legitimacy

Factors		Cronbach's Alpha
1. The corporation is widely recognized by customers.	0.847	0.864
2. The corporation is widely recognized by suppliers.	0.824	
3. The products of enterprise have been highly evaluated by peers.	0.882	
4. The products of enterprise have been highly evaluated by customers.	0.831	

uncertainty from the aspects of policy completeness and operability. On the basis of their results, we select five questions to measure institutional uncertainty (Table 4). Moreover, Zhu and Sarkis (2004) and Yang et al. (2013) put forward four items to evaluate green performance, which contains six questions expressed in Table 5.

Data Gathering

This chapter conducted a questionnaire survey. And our sample concentrated on data from start-ups within the last eight years due to Li and Atuahene-Gima's (2001) definition of start-ups as enterprises that have been established for no more than eight years. The survey distribution lasted six months, from February to July 2016, and the research areas contain Beijing, Shanghai, Shenyang, Hangzhou Changchun and Xiamen. These areas have various levels of development (i.e., central developed cities, coastal cities in South, and economically less active cities in North) to avoid the impacts of different degrees of regional

Table 4. Rotated factor matrix for factor analysis of institutional uncertainty

Factors		Cronbach's Alpha
1. Key policies related to business operation are incomplete.	0.786	0.854
2. Relevant industry standards are unclear.	0.766	
3. Relevant industry policies are fuzzy.	0.821	
4. There are gaps in related institutions and policies.	0.832	
5. Relevant policies are short of specific guidance and operational suggestion for implementation.	0.776	

Table 5. Rotated factor matrix for factor analysis of green performance

Factors		Cronbach's Alpha
1. Compared to peers, we release less air pollution.	0.820	0.897
2. Compared to peers, we cause less sewage.	0.797	
3. Compared to peers, we have less solid waste.	0.823	
4. Compared to peers, our cost of dealing with poisonous, harmful and hazardous materials is lower.	0.724	
5. Compared to peers, our cost of energy consumption is lower.	0.865	
6. Compared to peers, we have a lower rate of environmental accidents.	0.849	

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

economy development. Enterprises involved in this research include green construction and materials, low-carbon energy sources, eco-friendly materials, green furnishing, green process transformation, waste disposal services and training, and energy-saving equipment.

The data collection process was divided into three procedures. In the first procedure, the survey questionnaires were distributed through e-mails, and 120 responses were collected. In the second procedure, questionnaires were given to MBA students and 110 responded. In the third procedure, questionnaires were obtained onsite from mid-level and senior managers of solicited firms and from researchers completing the questionnaire face to face, with 63 responses gathered. In a word, 297 responses were collected, and 62 of which were eliminated due to incomplete or insufficient responses. A total of 235 samples were valid and utilized in the study of 22 variables, explaining the valid combination according to the requirements stated by Bentler and Chou (1987) that the sample number must be at least ten times of observed variables (Bentler, P. M. & Chou, C.P., 1987). A t-test was also conducted on enterprise size, sector, year established, ownership and business size of the three groups and no striking difference was found. As a result, they can be used in combination.

General Descriptive Analysis

After the gather of large samples, descriptive statistical analysis was carried out. On one hand, the results of a general descriptive analysis could reflect the fundamental features of sampled corporations. On the other hand, these results could also confirm the versatility and reproducibility of other findings. The results of a general descriptive analysis would help the study by providing salient characteristics of samples, thus replenishing the assessment of the research objects.

Examination of Validity

The study measured both content validity and construct validity. Content validity indicates whether the content of the scale can accurately cover the range or extent of the concept or meaning to be measured, and this can usually be measured subjectively(Zikmund, W. G., Babin, B. J., Carr, J. C., & Griffin, M., 2013) . Construct validity encompass both convergent validity and discriminant validity. Convergent validity, which can be explained by composite reliability (hereinafter referred to as CR) and average variance extracted from latent variables (hereinafter referred to as AVE). As for discriminant validity, this study referenced Fornell and Larcker (1981) and carried out tests by comparing the average root mean square values of AVE with different latent variables and the correlation coefficients of these variables.

Examination of Reliability

The reliability test refers to the degree of consistency in measurements by different measurers taken with the same instruments, reflecting the level of approximation of repeated measurements under the same conditions, that is, whether a series of projects measure the same concept or not. Generally, this test can be implemented by observing the internal consistency of the measurement instruments (Dawson, J.F. & Richter, A.W., 2006). In the Likert-scale method, the most commonly used method is the L.J. Cronbach α coefficient. Although an α coefficient value of 0.70 is on the lower boundary of the scale, it is still acceptable.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Correlation Analysis

Correlation analysis concentrates on the correlation among dependent variables, independent variables and control variables. The correlation coefficient is a commonly used measurement and the method is able to be the Pearson's product moment correlation method and the two-sided test. If the correlation coefficient among independent variables is greater than 0.75, the variables are considered too similar and collinearity might be present.

Harman's single-factor test was applied to analyze the entire questionnaire. In the absence of rotation, the explained variance of the first indicator extracted exceeded 50%. So, it could be believed that there was a severe bias in the common measurement method.

Regression Analysis

In this chapter, regression analysis was used to verify the relationship among GPO and business performance and the moderating effect of legitimacy and institutional uncertainty. The study used three factors for regression analysis. First, the determination coefficient of the model reflects the explanatory power of the regression equation for the dependent variables. This chapter used R2 to reflect the fitness of regression equation in order to avoid the influence from the number of independent variables on R2. Second, the regression model is said to be valid when the regression coefficient is not 0 at significance value of less than 0.05 or 0.01. Third, the variance inflation factor (VIF index) reflects the collinearity between independent variables. Collinearity is exhibited by a large VIF index. When $0 < VIF < 10$, multicollinearity generally does not exist.

EMPIRICAL RESULTS

Results of General Descriptive Analysis

Table 6 presents the features of the samples gathered. In summary, most enterprises have small and medium scale; the year number of enterprises were founded clustered around 3 to 8 years; the sector distribution was relatively dispersed; the proportion of companies with turnover under 5 million yuan was about 70%; enterprise ownership was primarily foreign funded; and domestic ownership was privately funded. On the premise of involving green businesses, the samples satisfied the demand of diversity and the overall descriptive statistics reflected basic features of the objects under observation, laying the foundation for further analysis. Numbers present in Table 6 is percentage (%).

Results of Validity Examination

To verify content validity, this chapter conducted a literature review. Two expert representatives were also invited to examine the research questions and determine whether they were scientific and reasonable, and each of them is from academe, business and government sectors. According to suggestions from the expert panel, this chapter adjusted some indicators to enhance the clarity, technicality and reliability of the survey tools. The questionnaire designed by this study was in line with scientific and rational demands, that is, it met the demands of content validity.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 6. Characteristics of survey samples

Enterprise Size		**Sectors**			
1-50 people	17.9	Real estate			18.5
50-100 people	43.4	Agriculture, forestry and livestock			3.0
100-300 people	17.4	Energy, environmental protection			20.2
300-500 people	20.0	Environmental transformation and training			3.8
More than 500 people	1.3	Materials			14.5
		Accommodation, catering			3.8
		Manufacturing			28.5
		Construction			7.7
Business Size		**Ownership**		**Year Established**	
1 million or less	34.0	State-owned	11.5	1 year or less	7.6
1 million 3 million	19.6	Foreign investment	40.4	1-3 years	26.8
3 million to 5 million	15.3	Private	31.1	3-5 years	24.7
5 million to 10 million	18.5	Joint venture	17.0	5-8 years	40.9
10 million to 30 million	11.5				
More than 30 million	1.1				

The questionnaire passed the demands of convergent validity test, discriminant validity and test factor analysis. Average values gained in the convergent validity test for all five factors were greater than 0.5 (Tables 1 to 5), which meets the research standards. The load factors obtained in the factor analysis are all greater than 0.5 and the proportion of the cumulative of variance explained is greater than 50% (Tables 1 to 5), successfully satisfying the research requirements. The discriminant validity test result exhibited good discriminant validity among these variables. As shown in Table 7, the diagonal values are representative of the square root of AVE, which is greater than the coefficients in the corresponding row and column.

Results of Reliability Examination

The measured alpha coefficients of Cronbach are as follows: the GPO Cronbach's alpha is 0.806, the PL Cronbach's alpha is 0.884, the CL Cronbach's alpha is 0.864 and the institutional uncertainty Cronbach's alpha is 0.854. The alpha coefficient values are between 0.80 and 0.90, indicating a good confidence level in the measured factors.

Results of Correlation Analysis

Table 7 shows the descriptive statistical terms and correlation analysis. Under a significance degree of 0.01, the four main variables in this chapter - GPO, PL, CL and green performance are obviously related to institutional uncertainty. The three major constructs of PL, institutional uncertainty and GPO exhibit significant correlation. Among the control variables, business size and number of years established and other research constructs have a general correlation.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 7. Descriptive statistics and correlation matrix

	Mean	Std. Deviation	Enterprise Size	Year Established	Sector	Business Size	Ownership	GP	GPO	PL	CL	IU
Enterprise size	3.03	1.417	N/A									
Year established	2.99	0.993	0.544**	N/A								
Sector	6.66	3.325	-0.375**	-0.194**	N/A							
Business size	2.86	1.912	0.683**	0.568**	-0.295**	N/A						
Ownership	2.54	0.907	0.292**	0.539**	-0.067	0.306**	N/A					
Green Performance	3.1887	0.96600	-0.038	-0.090	-0.039	0.014	-0.203**	0.773				
GPO	3.1319	1.10042	0.041	-0.143*	-0.085	0.091	-.153*	0.424**	0.758			
PL	2.538298	1.0035308	0.055	0.034	-0.009	0.020	.185**	-0.171**	-.305**	0.81		
CL	2.520213	.9492271	0.090	0.094	0.029	0.050	.164*	-0.112	-.327**	0.587**	0.789	
Institutional uncertainty	3.934468	0.8377595	-0.043	-0.056	-0.086	-0.043	-0.173**	0.140*	0.255**	-0.224**	-0.212**	0.737

**. Correlation is significant at the 0.01 level (2-tailed), *. Correlation is significant at the 0.05 level (2-tailed).
N=235, N/A indicates analysis not applicable; the diagonal line lists root square values of average.

Correlation analysis exhibits that the correlation coefficients among variables are all less than 0.65, according to the standards put forward by Tabachnick and Fidel (Tabachnick, B.G., Fidell, L.S., Osterlind, S.J., 2001). The possibility of the results that may be threatened by multi-collinearity is small. Single-factor method of Harman is to test common method bias. In the absence of rotation, the first extracted factor illustrates only 28.75% of the variance, which is less than the 50% common standard. A single indicator doesn't appear, and the independent and dependent variables are loaded on different indicators, suggesting there is no single indicator to illustrate multiple variances. Thus, the issue of common method bias isn't discovered.

Regression Analysis Results

When consider the control variables, this chapter uses regression analysis to judge causal relationships among dependent variables, independent variable and control variables. Before carrying out the regression analysis, threats influencing the accuracy of the results from multi-collinearity must be removed. The VIF of various regression coefficients is calculated in the process of regression analysis. The results display that the maximum VIF is 1.59, far below the critical value of 10, thus reducing the possibility of any threat from multi-collinearity.

The moderating effect of GPO on green performance and that of political and commercial legitimacy on the relationship between GPO and green performance are calculated through multivariate regression models. This chapter has established regression model 1:

$$Y=\alpha+\alpha_1X+\alpha_2X_1+\alpha_3X_2+\alpha_4X_3+\alpha_5XX_1+\alpha_6XX_2+\alpha_7XX_3+\alpha_8XX_2X_3+\alpha_9XX_1X_3+\mu_m$$

where Y represents green performance, X represents GPO, X_1 represents PL, X_2 represents CL, X_3 represents institutional uncertainties, μ_m represents error, α represents a constant, α_i represents the regression

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 8. Logistics regression analysis summary

Variable	Step 1	Step 2	Step 3	Step 4
(Constant)	0.676	0.403	0.250	0.263
Enterprise size	-0.066	-0.081	-0.009	-0.052
Year established	-0.014	0.079	0.060	0.074
Sector	-0.046	-0.024	0.013	-0.013
Business size	0.119	0.028	-0.023	-0.015
Ownership	-0.216**	-0.170**	-0.108	-0.078
GPO		0.416***	0.355***	0.294***
Political Legitimacy		-0.061	-0.058	-0.004
Commercial Legitimacy		0.089	0.068	0.052
Institutional Uncertainty		0.010	-0.001	-0.024
GPO*PL			0.224**	0.321***
GPO* CL			0.184**	0.201**
Institutional Uncertainty* GPO				0.107
Institutional Uncertainty* PL				0.030
Institutional Uncertainty* CL				-0.112
Institutional Uncertainty* CL*GPO				0.211*
Institutional Uncertainty* PL* GPO				-0.394**
Adjusted R Square	0.030	0.178	0.311	0.337
R Square Change	0.051	0.159	0.133	0.040
F Change	2.459**	11.323***	22.594***	2.794**

*p <0.05, **p < 0.01 ***p < 0.001.

coefficient and XX_n represents the interaction of two constructs (e.g., XX_1 represents the interaction between GPO and PL).

In inspecting the moderating effects, this chapter refers to the method proposed by Baron and Kenny (1986), utilizing multiple variable regression to verify our views.

In the regression model, the adopted means contains four steps:

Step 1: Only consider the effects from control variables.
Step 2: Consider the primary impacts of independent and control variables.
Step 3: Add the interaction between PL and CL, and think over the moderating effect.
Step 4: Investigate the sub-mediating effect between institutional uncertainty and legitimacy in institutional economy.

In step 2, the significant coefficient is 0.416, p <0.001, indicating that the green proactive effect has an obviously positive impact on green performance. In step 3, the significant coefficient of the interaction between GPO and PL on green performance is 0.224, p=0.007, and the significant coefficient of the interaction between GPO and CL on performance is 0.184, p=0.024, displaying that PL and CL have significant promotional effects on GPO and green performance, as shown in Figures 2 and 3. Further-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

more, after the two interactions introduced in step 3, the influence of GPO on green performance is still significant, with the significant coefficient value being 0.355 at p <0.001.

In step 4, Table 7 exhibits that the significant coefficient GPO × PL × institutional uncertainty has a value of -0.394, p=0.001, while the significant coefficient GPO × PL has a value of 0.321, p <0.001, indicating that institutional uncertainty inhibits the moderating effect of PL between GPO and green performance (Figure 4). Moreover, the significant coefficient GPO × CL × institutional uncertainty has a value of 0.211, p=0.066, while the significant coefficient GPO × CL has a value of 0.201, p=0.020, indicating that institutional uncertainty contributes to the moderating effect of CL between GPO and green performance (Figure 5).

Figure 2. The moderating effect of political legitimacy

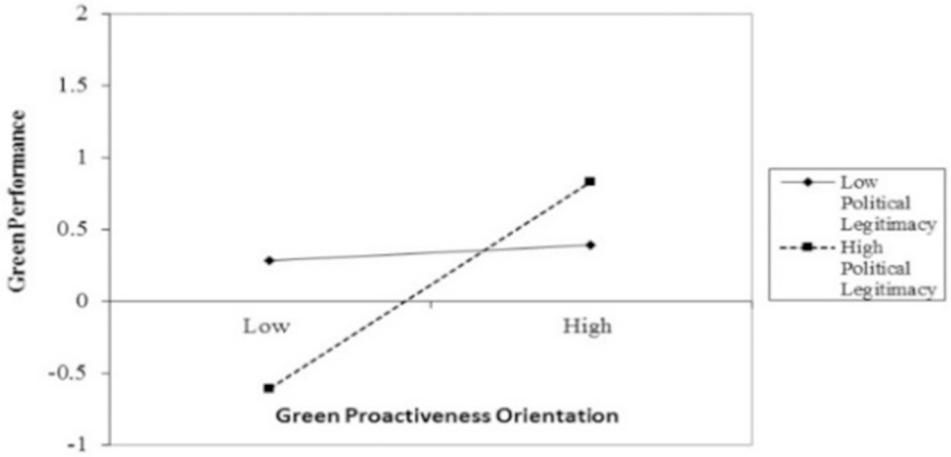
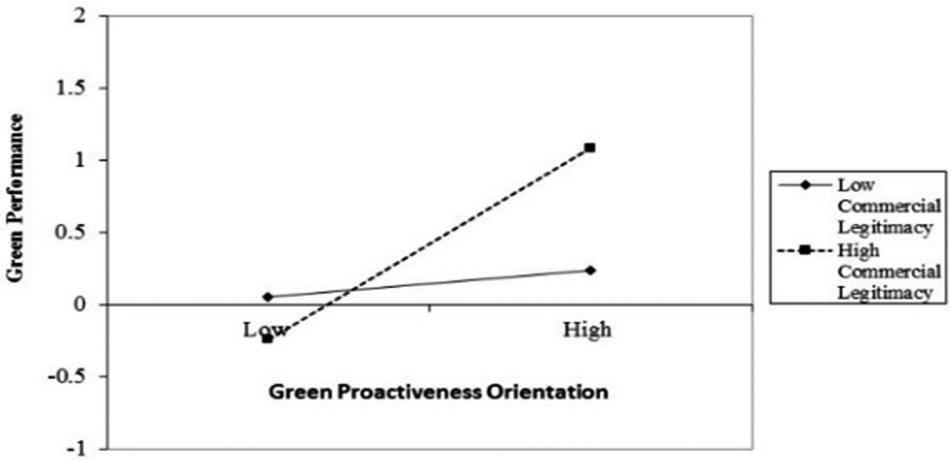


Figure 3. The moderating effect of commercial legitimacy



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 4. Sub-mediating effect between institutional uncertainty and political legitimacy

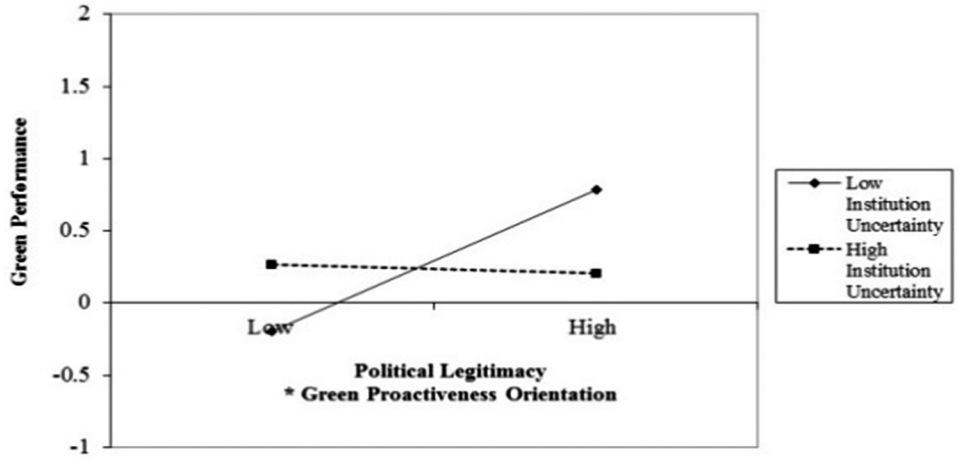
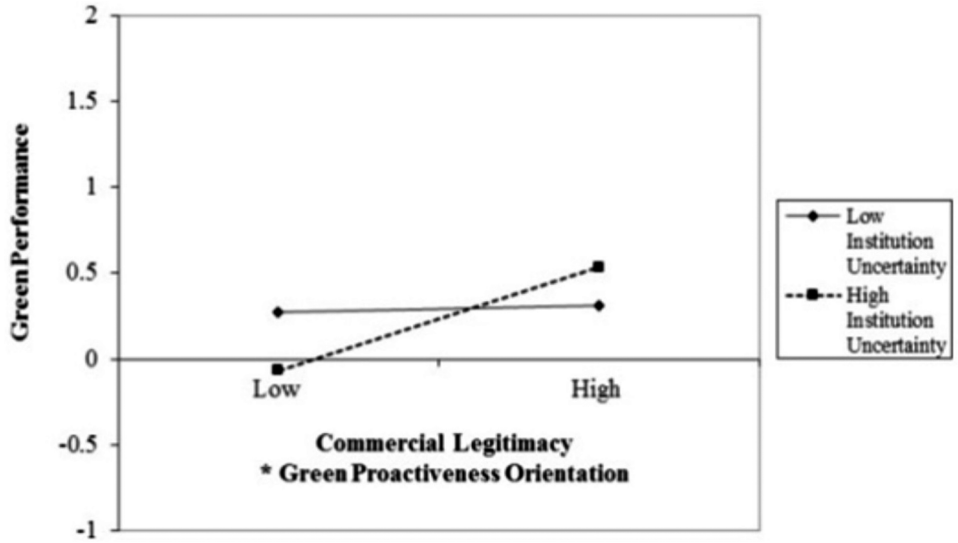


Figure 5. Sub-mediating effect between institutional uncertainty and commercial legitimacy



HOW TO ACHIEVE GREEN PERFORMANCE

Because proactive green-oriented enterprises have taken advantages of achieving green performance, this conclusion encourages both business managers and entrepreneurs in various industries to take GE actions ahead of their competitors, encompassing the early launch of new and environmental products, technology and green management models. Senior managers ought to usually look at the future industry trends, know green development opportunities and act early in order to respond to changes. Compared to their peers, these actions are beneficial for enterprises to obtain the lead in emission, energy efficiency and safety.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

As for green ventures in various industries, proactiveness is correct, however, the constraints of external legitimacy shouldn't be ignored. Pioneering green enterprises must not only manage their perception of governments and regulators but also attach great importance to the evaluations made by their suppliers, partners and customers. The two legitimacies are both institutional restricts and positive drives to proactive green enterprises in obtaining green performance. Nevertheless, for the governments, the lower the legitimacy of green start-ups, the more likely they will carry out non-green business activities. So, this kind of enterprises should gain the focus of green supervision and inspection.

For some western developed countries, the institutional context is relatively stable. As a result, enterprises that develop GE activities must focus on the constraints of government and market simultaneously, which is useful for green ventures to seek for achieving green performance. In contrast, in a mount of developing countries, the high level of institutional uncertainty lead to poor PL restricts. Numerous companies will excessively pursue CL, resulting in vicious competition and homogeneous products. Therefore, this provides a warning for some governments: Apart from promoting institutional standards as soon as possible, increasing the strengths of moral propaganda, the government also ought to accelerate the embedment of green standards into society through extensive publicity, so that the social norms of informal institution can participate in promoting operations of green enterprises.

CONCLUSION

This chapter reviewed entrepreneurship theory, green entrepreneurship theory, legitimacy theory and transitional economy theory. And this chapter also verified the relationship between GPO and green performance empirically, the moderating effect of institutional legitimacy between the two and the influences of institutional uncertainty on the moderating effect of legitimacy. Our conclusion provides another perspective on GE, not only in systematically integrating institution theory and entrepreneurship theory but also enriching the entrepreneurial scenes, which contribute to green entrepreneurship theory, situation theory and legitimacy theory.

In addition, this chapter finds out that there is a positive correlation between GPO and green performance. It also confirms that an enterprise engaging in GE actions ahead of its competitors is able to gain the advantages in green performance, encompassing the gains in pollution emissions, energy costs and unexpected incidents. Besides, this chapter concludes that both political and commercial legitimacy play a promoting role in achieving green performance of proactive green-oriented enterprises. That is to say, the pressure exerted by legitimacy restrict is also a powerful force, and institutional restrict is a positive variable: green ventures need to not only gain recognition from government and regulators but also concentrate on the evaluations from suppliers, partners and customers. These two legitimacies are both institutional restrict and positive powers for proactive green enterprises to obtain green performance. Considering the transitional economy in China, institutional uncertainty would strength the promoting effects of CL between GPO and green performance while impairing that of PL. For GE needs to balance the relationship between business performance and social responsibility, it will be subject to the influences of institutional legitimacy. And the institutional uncertainty existing in transitional context can have an effect on the impacts of institutional legitimacy on green enterprises. This chapter sufficiently proves that when institutional uncertainty is high, Chinese green companies will tend to seek for'Guanxi', drill policy 'loopholes' and pursue profit and malicious competition. As a result, institutional uncertainty under the context of transitional economics will inhibit the relationship between GPO and green perfor-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

mance, even aggravating market uncertainty and making green strategies become no longer suitable for developing countries. Therefore, the findings will be vital warnings for the governments.

Conclusions of us enrich the entrepreneurship theory. Unlike the findings about the relationship between proactiveness orientation and entrepreneurial performance, a unique perspective emerged from the study that supports a particular conclusion - GPO and green performance have a significant positive correlation. Different from the causal relationship of 'legitimacy—resources—business growth', this chapter treated legitimacy as an institutionally embedded binding mechanism and explored how different levels of legitimacy affect the relationship between GPO and green performance. This chapter also added the factor of a transitional economy and revealed the influence of institutional uncertainty on the moderating effect of legitimacy on the relationship between GPO and green performance. This conclusion enriched entrepreneurship research scenarios, expanding and improving the universality of green entrepreneurship theory and institution theory.

REFERENCES

Al-Saleh, Y., & Mahroum, S. (2015). A critical review of the interplay between policy instruments and business models: Greening the built environment a case in point. *Journal of Cleaner Production*, *109*, 260–270. doi:10.1016/j.jclepro.2014.08.042

Aldrich, H. E., & Fiol, C. M. (1994). Fools rush in? The institutional context of industry creation. *Academy of Management Review*, *19*(4), 645–670.

Allen, J. C., & Malin, S. (2008). Green entrepreneurship: A method for managing natural resources? *Society & Natural Resources*, *21*(9), 828–844. doi:10.1080/08941920701612917

Alonso-Almeida, M. D. M., Bremser, K., & Llach, J. (2015). Proactive and reactive strategies deployed by restaurants in times of crisis: Effects on capabilities, organization and competitive advantage. *International Journal of Contemporary Hospitality Management*, *27*(7), 1641–1661. doi:10.1108/IJCHM-03-2014-0117

Anderson, B. S., Kreiser, P. M., Kuratko, D. F., Hornsby, J. S., & Eshima, Y. (2015). Reconceptualizing entrepreneurial orientation. *Strategic Management Journal*, *36*(10), 1579–1596. doi:10.1002mj.2298

Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, *51*(6), 1173–1182. doi:10.1037/0022-3514.51.6.1173 PMID:3806354

Barro, R. J. (1991). A cross-country study of growth, saving, and government. In *National saving and economic performance* (pp. 271–304). University of Chicago Press.

Becker-Blease, J. R., & Sohl, J. E. (2015). New venture legitimacy: The conditions for angel investors. *Small Business Economics*, *45*(4), 735–749. doi:10.100711187-015-9668-7

Bentler, P. M., & Chou, C. P. (1987). Practical issues in structural modeling. *Sociological Methods & Research*, *16*(1), 78–117. doi:10.1177/0049124187016001004

Boulding, W., & Christen, M. (2001). First-mover disadvantage. *Harvard Business Review*, *79*(9), 20–21.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Brunetti, A., Kisunko, G., & Weder, B. (1997). *Institutions in transition: reliability of rules and economic performance in former socialist countries* (Vol. 9708). World Bank Publications.

Brunetti, A., & Weder, B. (1998). Investment and institutional uncertainty: A comparative study of different uncertainty measures. *Weltwirtschaftliches Archiv*, *134*(3), 513–533. doi:10.1007/BF02707928

Bruton, G., Khavul, S., Siegel, D., & Wright, M. (2015). New financial alternatives in seeding entrepreneurship: Microfinance, crowdfunding, and peer-to-peer innovations. *Entrepreneurship Theory and Practice*, *39*(1), 9–26. doi:10.1111/etap.12143

Cohen, B., & Winn, M. I. (2007). Market imperfections, opportunity and sustainable entrepreneurship. *Journal of Business Venturing*, *22*(1), 29–49. doi:10.1016/j.jbusvent.2004.12.001

Cope, J. (2005). Toward a dynamic learning perspective of entrepreneurship. *Entrepreneurship Theory and Practice, 29*(4), 373-397.

Cottrell, T., & Sick, G. (2002). Real options and follower strategies: The loss of real option value to first-mover advantage. *The Engineering Economist*, *47*(3), 232–263. doi:10.1080/00137910208965035

Covin, J. G., & Slevin, D. P. (1989). Strategic management of small firms in hostile and benign environments. *Strategic Management Journal*, *10*(1), 75–87. doi:10.1002mj.4250100107

Czinkota, M., Kaufmann, H. R., & Basile, G. (2014). The relationship between legitimacy, reputation, sustainability and branding for companies and their supply chains. *Industrial Marketing Management*, *43*(1), 91–101. doi:10.1016/j.indmarman.2013.10.005

Dawson, J. F., & Richter, A. W. (2006). Probing three-way interactions in moderated multiple regression: Development and application of a slope difference test. *The Journal of Applied Psychology*, *91*(4), 917–926. doi:10.1037/0021-9010.91.4.917 PMID:16834514

Dean, T. J., & McMullen, J. S. (2007). Toward a theory of sustainable entrepreneurship: Reducing environmental degradation through entrepreneurial action. *Journal of Business Venturing*, *22*(1), 50–76. doi:10.1016/j.jbusvent.2005.09.003

Delmar, F., & Shane, S. (2004). Legitimating first: Organizing activities and the survival of new ventures. *Journal of Business Venturing*, *19*(3), 385–410. doi:10.1016/S0883-9026(03)00037-5

Deng, Q., & Ji, S. (2015). Organizational Green IT Adoption: Concept and Evidence. *Sustainability*, *7*(12), 16737–16755. doi:10.3390u71215843

Doganova, L., & Karnøe, P. (2015). Clean and profitable: entangling valuations in environmental entrepreneurship. *Moments of Valuation: Exploring Sites of Dissonance*, 229-48.

Dowling, J., & Pfeffer, J. (1975). Organizational legitimacy: Social values and organizational behavior. *Pacific Sociological Review*, *18*(1), 122–136. doi:10.2307/1388226

Eshima, Y., & Anderson, B. S. (2016). Firm growth, adaptive capability, and entrepreneurial orientation. *Strategic Management Journal*.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Fisher, G., Kotha, S., & Lahiri, A. (2016). Changing with the times: An integrated view of identity, legitimacy, and new venture life cycles. *Academy of Management Review*, *41*(3), 383–409. doi:10.5465/amr.2013.0496

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *JMR, Journal of Marketing Research*, *18*(1), 39–50. doi:10.2307/3151312

Fraser, S., & Greene, F. J. (2006). The effects of experience on entrepreneurial optimism and uncertainty. *Economica*, *73*(290), 169–192.

George, G., Robley Wood Jr, D., & Khan, R. (2001). Networking strategy of boards: Implications for small and medium-sized enterprises. *Entrepreneurship & Regional Development*, *13*(3), 269–285. doi:10.1080/08985620110058115

Gibbs, D., & ONeill, K. (2014). Rethinking sociotechnical transitions and green entrepreneurship: The potential for transformative change in the green building sector. *Environment & Planning A*, *46*(5), 1088–1107. doi:10.1068/a46259

Hall, J. K., Daneke, G. A., & Lenox, M. J. (2010). Sustainable development and entrepreneurship: Past contributions and future directions. *Journal of Business Venturing*, *25*(5), 439–448. doi:10.1016/j.jbusvent.2010.01.002

Hartman, C. L., & Stafford, E. R. (1997). Green alliances: Building new business with environmental groups. *Long Range Planning*, *30*(2), 184–149. doi:10.1016/S0024-6301(96)00111-2

Huang, M., & Wang, B. (2014). Evaluating green performance of building products based on gray relational analysis and analytic hierarchy process. *Environmental Progress & Sustainable Energy*, *33*(4), 1389–1395.

Huang, T., Wu, F., Yu, J., & Zhang, B. (2015). Political risk and dividend policy: Evidence from international political crises. *Journal of International Business Studies*, *46*(5), 574–595. doi:10.1057/jibs.2015.2

Isaak, R. (1997). Globalisation and green entrepreneurship. *Greener Management International*, 80-90.

Kelly, B., Pástor, Ľ., & Veronesi, P. (2016). The price of political uncertainty: Theory and evidence from the option market. *The Journal of Finance*, *71*(5), 2417–2480. doi:10.1111/jofi.12406

Kostova, T., & Zaheer, S. (1999). Organizational legitimacy under conditions of complexity: The case of the multinational enterprise. *Academy of Management Review*, *24*(1), 64–81.

Kreiser, P. M. (2011). Entrepreneurial orientation and organizational learning: The impact of network range and network closure. *Entrepreneurship Theory and Practice*, *35*(5), 1025–1050. doi:10.1111/j.1540-6520.2011.00449.x

Kuckertz, A., & Wagner, M. (2010). The influence of sustainability orientation on entrepreneurial intentions—Investigating the role of business experience. *Journal of Business Venturing*, *25*(5), 524–539. doi:10.1016/j.jbusvent.2009.09.001

Lankoski, L. (2000). *Determinants of environmental profit: An analysis of the firm-level relationship between environmental performance and economic performance*. Helsinki University of Technology.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Li, H., & Atuahene-Gima, K. (2001). Product innovation strategy and the performance of new technology ventures in China. *Academy of Management Journal*, *44*(6), 1123–1134. doi:10.2307/3069392

Li, X., Wang, C., & Xu, X. (2014). Rethinking new ventures cognitive legitimacy: An experimental study. *Systems Research and Behavioral Science*, *31*(3), 437–446. doi:10.1002res.2281

Li, Y., Peng, M. W., & Macaulay, C. D. (2013). *Market–political ambidexterity during institutional transitions*. Academic Press.

Lieberman, M. B., & Montgomery, D. B. (1988). First-mover advantages. *Strategic Management Journal*, *9*(S1), 41–58. doi:10.1002mj.4250090706

Lin, C. S., Chang, R. Y., & Dang, V. T. (2015). An integrated model to explain how corporate social responsibility affects corporate financial performance. *Sustainability*, *7*(7), 8292–8311. doi:10.3390u7078292

Lopez, L. E., & Roberts, E. B. (2002). First-mover advantages in regimes of weak appropriability: The case of financial services innovations. *Journal of Business Research*, *55*(12), 997–1005. doi:10.1016/S0148-2963(01)00200-4

Lounsbury, M., & Glynn, M. A. (2001). Cultural entrepreneurship: Stories, legitimacy, and the acquisition of resources. *Strategic Management Journal*, *22*(6-7), 545–564. doi:10.1002mj.188

Lumpkin, G. T., & Dess, G. G. (1996). Clarifying the entrepreneurial orientation construct and linking it to performance. *Academy of Management Review*, *21*(1), 135–172.

Makadok, R. (1998). Can first-mover and early-mover advantages be sustained in an industry with low barriers to entry/imitation? *Strategic Management Journal*, *19*(7), 683–696. doi:10.1002/(SICI)1097-0266(199807)19:7<683::AID-SMJ965>3.0.CO;2-T

Maurer, J. G. (1971). *Readings in organization theory: Open-system approaches*. Random House.

Mauro, P. (1995). Corruption and growth. *The Quarterly Journal of Economics*, *110*(3), 681–712. doi:10.2307/2946696

Mavragani, A., Nikolaou, I. E., & Tsagarakis, K. P. (2016). Open Economy, Institutional Quality, and Environmental Performance: A Macroeconomic Approach. *Sustainability*, *8*(7), 601. doi:10.3390u8070601

Meyer, J. W., & Scott, W. R. (1983). Centralization and the legitimacy problems of local government. *Organizational Environments: Ritual and Rationality, 199*, 215.

Miller, D. (2011). A reflection on EO research and some suggestions for the future. *Entrepreneurship Theory and Practice*, *35*(5), 873–894. doi:10.1111/j.1540-6520.2011.00457.x

Miller, D., & Friesen, P. H. (1983). Strategy-making and environment: The third link. *Strategic Management Journal*, *4*(3), 221–235. doi:10.1002mj.4250040304

Morris, M. H., Kuratko, D. F., & Covin, J. G. (2010). *Corporate entrepreneurship & innovation*. Cengage Learning.

Murphy, G. B., Trailer, J. W., & Hill, R. C. (1996). Measuring performance in entrepreneurship research. *Journal of Business Research*, *36*(1), 15–23. doi:10.1016/0148-2963(95)00159-X

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Navis, C., & Glynn, M. A. (2011). Legitimate distinctiveness and the entrepreneurial identity: Influence on investor judgments of new venture plausibility. *Academy of Management Review*, *36*(3), 479–499.

Ndubisi, N. O., & Nair, S. R. (2009). Green entrepreneurship (GE) and green value added (GVA): A conceptual framework. *International Journal of Entrepreneurship*, *13*, 21.

Nelson, O. N., & Sumesh, R. N. (2009). Green entrepreneurship and green value added. *J. Int. J. Entrep*, *13*, 21–31.

Oi, J. C. (1995). The role of the local state in Chinas transitional economy. *The China Quarterly*, *144*, 1132–1149. doi:10.1017/S0305741000004768

Olsthoorn, X., Tyteca, D., Wehrmeyer, W., & Wagner, M. (2001). Environmental indicators for business: A review of the literature and standardisation methods. *Journal of Cleaner Production*, *9*(5), 453–463. doi:10.1016/S0959-6526(01)00005-1

Orlitzky, M., Siegel, D. S., & Waldman, D. A. (2011). Strategic corporate social responsibility and environmental sustainability. *Business & Society*, *50*(1), 6–27. doi:10.1177/0007650310394323

Palmås, K., Andersson Schwarz, J., & Larsson, S. (2014). The liability of politicalness: Legitimacy and legality in piracy-proximate entrepreneurship. *International Journal of Entrepreneurship and Small Business*, *22*(4), 408–425. doi:10.1504/IJESB.2014.064269

Parsons, T. (1964). *Structure and process in modern societies*. Academic Press.

Peng, M. W., & Heath, P. S. (1996). The growth of the firm in planned economies in transition: Institutions, organizations, and strategic choice. *Academy of Management Review*, *21*(2), 492–528.

Puffer, S. M., McCarthy, D. J., & Boisot, M. (2010). Entrepreneurship in Russia and China: The impact of formal institutional voids. *Entrepreneurship Theory and Practice, 34*(3), 441-467.

Rockström, J., Lannerstad, M., & Falkenmark, M. (2007). Assessing the water challenge of a new green revolution in developing countries. *Proceedings of the National Academy of Sciences of the United States of America*, *104*(15), 6253–6260. doi:10.1073/pnas.0605739104 PMID:17404216

Rottig, D., & Reus, T. H. (2009, August). Institutional distance, organizational legitimacy, and the performance of foreign acquisitions in the United States. In Academy of Management Proceedings (Vol. 2009, No. 1, pp. 1-6). Academy of Management.

Ryszko, A. (2016). Proactive Environmental Strategy, Technological Eco-Innovation and Firm Performance—Case of Poland. *Sustainability*, *8*(2), 156. doi:10.3390u8020156

Schaltegger, S. (2002). A Framework for Ecopreneurship. *Greener Management International*, *38*(38), 45–58. doi:10.9774/GLEAF.3062.2002.su.00006

Schepers, J., Voordeckers, W., Steijvers, T., & Laveren, E. (2014). The entrepreneurial orientation–performance relationship in private family firms: The moderating role of socioemotional wealth. *Small Business Economics*, *43*(1), 39–55. doi:10.100711187-013-9533-5

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Scherer, A. G., Palazzo, G., & Seidl, D. (2013). Managing legitimacy in complex and heterogeneous environments: Sustainable development in a globalized world. *Journal of Management Studies*, *50*(2), 259–284. doi:10.1111/joms.12014

Scott, W. R. (1995). *Institutions and organizations* (Vol. 2). Thousand Oaks, CA: Sage.

Shane, S. (2000). Prior knowledge and the discovery of entrepreneurial opportunities. *Organization Science*, *11*(4), 448–469. doi:10.1287/orsc.11.4.448.14602

Shane, S., & Venkataraman, S. (2000). The promise of entrepreneurship as a field of research. *Academy of Management Review*, *25*(1), 217–226.

Sheng, S., Zhou, K. Z., & Li, J. J. (2011). The effects of business and political ties on firm performance: Evidence from China. *Journal of Marketing*, *75*(1), 1–15. doi:10.1509/jmkg.75.1.1

Shepherd, D. A., & Patzelt, H. (2011). The new field of sustainable entrepreneurship: Studying entrepreneurial action linking what is to be sustained with what is to be developed. *Entrepreneurship Theory and Practice*, *35*(1), 137–163. doi:10.1111/j.1540-6520.2010.00426.x

Shirokova, G., Bogatyreva, K., Beliaeva, T., & Puffer, S. (2016). Entrepreneurial orientation and firm performance in different environmental settings: Contingency and configurational approaches. *Journal of Small Business and Enterprise Development*, *23*(3), 703–727. doi:10.1108/JSBED-09-2015-0132

Silajdžić, I., Kurtagić, S. M., & Vučijak, B. (2015). Green entrepreneurship in transition economies: A case study of Bosnia and Herzegovina. *Journal of Cleaner Production*, *88*, 376–384. doi:10.1016/j.jclepro.2014.07.004

Simón-Moya, V., Revuelto-Taboada, L., & Guerrero, R. F. (2014). Institutional and economic drivers of entrepreneurship: An international perspective. *Journal of Business Research*, *67*(5), 715–721. doi:10.1016/j.jbusres.2013.11.033

Singh, J. V., Tucker, D. J., & Meinhard, A. G. (1991). Institutional change and ecological dynamics. *The new institutionalism in organizational analysis*, 390-422.

Soto-Acosta, P., Cismaru, D. M., Vătămănescu, E. M., & Ciochină, R. S. (2016). Sustainable Entrepreneurship in SMEs: A Business Performance Perspective. *Sustainability*, *8*(4), 342. doi:10.3390u8040342

Stam, W., & Elfring, T. (2008). Entrepreneurial orientation and new venture performance: The moderating role of intra-and extraindustry social capital. *Academy of Management Journal*, *51*(1), 97–111. doi:10.5465/AMJ.2008.30744031

Starr, J. A., & MacMillan, I. C. (1990). Resource cooptation via social contracting: Resource acquisition strategies for new ventures. *Strategic Management Journal*, 79–92.

Stevens, C. E., Xie, E., & Peng, M. W. (2015). Toward a legitimacy-based view of political risk: The case of Google and Yahoo in China. *Strategic Management Journal*.

Suchman, M. C. (1995). Managing legitimacy: Strategic and institutional approaches. *Academy of Management Review*, *20*(3), 571–610.

Tabachnick, B. G., Fidell, L. S., & Osterlind, S. J. (2001). *Using multivariate statistics*. Academic Press.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Tan, J. (2001). Innovation and risk-taking in a transitional economy: A comparative study of Chinese managers and entrepreneurs. *Journal of Business Venturing*, *16*(4), 359–376. doi:10.1016/S0883-9026(99)00056-7

Vandaie, R., & Zaheer, A. (2014). Surviving bear hugs: Firm capability, large partner alliances, and growth. *Strategic Management Journal*, *35*(4), 566–577. doi:10.1002mj.2115

Wagner, M., & Schaltegger, S. (2004). The effect of corporate environmental strategy choice and environmental performance on competitiveness and economic performance: An empirical study of EU manufacturing. *European Management Journal*, *22*(5), 557–572. doi:10.1016/j.emj.2004.09.013

Walder, A. G. (1995). Local governments as industrial firms: An organizational analysis of Chinas transitional economy. *American Journal of Sociology*, *101*(2), 263–301. doi:10.1086/230725

Wales, W. J. (2016). Entrepreneurial orientation: A review and synthesis of promising research directions. *International Small Business Journal*, *34*(1), 3–15. doi:10.1177/0266242615613840

Wang, C. L., & Ahmed, P. K. (2007). Dynamic capabilities: A review and research agenda. *International Journal of Management Reviews*, *9*(1), 31–51. doi:10.1111/j.1468-2370.2007.00201.x

Waylen, G. (2014). Informal institutions, institutional change, and gender equality. *Political Research Quarterly*, *67*(1), 212–223. doi:10.1177/1065912913510360

Westhead, P., Ucbasaran, D., & Wright, M. (2005). Experience and cognition: Do novice, serial and portfolio entrepreneurs differ? *International Small Business Journal*, *23*(1), 72–98. doi:10.1177/0266242605049104

Wiklund, J., & Shepherd, D. (2003). Knowledge-based resources, entrepreneurial orientation, and the performance of small and medium-sized businesses. *Strategic Management Journal*, *24*(13), 1307–1314. doi:10.1002mj.360

Wu, K. J., Liao, C. J., Tseng, M. L., & Chou, P. J. (2015). Understanding innovation for sustainable business management capabilities and competencies under uncertainty. *Sustainability*, *7*(10), 13726–13760. doi:10.3390u71013726

Yang, C. S., Lu, C. S., Haider, J. J., & Marlow, P. B. (2013). The effect of green supply chain management on green performance and firm competitiveness in the context of container shipping in Taiwan. *Transportation Research Part E, Logistics and Transportation Review*, *55*, 55–73. doi:10.1016/j.tre.2013.03.005

Zhu, Q., & Sarkis, J. (2004). Relationships between operational practices and performance among early adopters of green supply chain management practices in Chinese manufacturing enterprises. *Journal of Operations Management*, *22*(3), 265–289. doi:10.1016/j.jom.2004.01.005

Zikmund, W. G., Babin, B. J., Carr, J. C., & Griffin, M. (2013). *Business research methods*. Cengage Learning.

Zimmerman, M. A., & Zeitz, G. J. (2002). Beyond survival: Achieving new venture growth by building legitimacy. *Academy of Management Review*, *27*(3), 414–431.

This research was previously published in Green Production Strategies for Sustainability edited by Sang-Binge Tsai, Bin Liu, and Yongian Li, pages 184-209, copyright year 2018 by Engineering Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 57
Customer Satisfaction in the Consumption of Green Products

Violeta Sima
Petroleum-Gas University of Ploiești, Romania

Ileana Georgiana Gheorghe
Petroleum-Gas University of Ploiești, Romania

ABSTRACT

This chapter aimed to identify those factors that determine the green consumer satisfaction, having as the emerging point the consumer behavior definition and the sustainable development concept. The authors propose a new approach of the dimensions of the evaluation model for customer satisfaction including a new one, called The Green Dimension. An important goal was identifying the drivers of the consumer purchasing. The authors identified three main areas of the green dimension of customer satisfaction. They are related to Company, Product/service, and Price. Then some considerations regarding an integrated approach of strategic mix from a 'green' perspective have been presented. According to research from Boston Consulting Group, in order to obtain a Green Advantage, companies should enhance their strategic mix taking into considerations green planning, green processes, green product, and green promotion. The authors added two more elements, namely people and eco-efficiency, resulting "The Green Strategy Mix".

INTRODUCTION

Green Economy involves the use of natural resources, energy, new technologies, and cleaner production methods in order to promote economic growth and create new jobs. To implement this concept, new models for sustainable consumption and production should be developed, which does not force the ecosystem.

In order to operationalize the Green Economy concept, the three aspects of sustainable development (environmental, economic and social) should be incorporated, to obtain a multi-dimensional outcome changing consumption patterns will require a multi-prong strategy focusing on demand, meeting the basic needs of the poor, and reducing wastage and the use of finite resources in the production process.

DOI: 10.4018/978-1-5225-7915-1.ch057

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

In order to implement the green economy at the national level, it is required close involvement of consumers and producers, along with the implementation of the main measures proposed and adopted at the national and international governing bodies.

The green economy requires changing consumer habits.

In order to assess consumer satisfaction, it is important to know the degree to which they are willing to pay extra for green products and services. This chapter is a theoretical approach to this problem.

The authors identified three main areas of the green dimension of customer satisfaction. They are related to Company, Product/Service, and Price.

The objective of this study is to highlight the links between green satisfaction and the three mentioned elements but also the transformations they bring in consumption patterns.

Background

The concept of satisfaction has been a subject of study for many researchers. However, satisfaction is still difficult to be defined, as Oliver asserted in 1997 in his book, "Satisfaction: A Behavioural Perspective on the Consumer" (p. 13). Thus, although satisfaction seems to be a widely-known concept, when a definition is required it is difficult to obtain.

The subject of this thesis is to reveal multiple senses of customer satisfaction emphasizing the Green Dimension (Sima & Gheorghe, 2009).

Customer satisfaction is subject to study not only for scholars but also for companies. The purpose of this analysis is very pragmatic, namely to determine its maximizing in order to increase customer loyalty. To achieve this, it is essential to identify key factors which determine customer behaviour.

Although in the literature of specialty there is widely accepted the opinion that satisfaction represents a response to consumption related experiences (Yi, 1990; Anderson, Fornell & Lehmann, 1994; Oliver, 1997; Giese, & Cote, 2000), it has a wide range of definitions and assessment ways (Peterson & Wilson1992; Giese, & Cote, 2000).

A customer who has achieved a high level of satisfaction will be tempted to repeat the purchase, thus becoming loyal. The final effect will be the customer retention (Zairi, 2000). Moreover, he will be prompted to provide positive recommendations to other potential customers. On the contrary, a dissatisfied customer will give up in the future buying the product or service or even he will return it. Another possibility to reduce dissonance is also searching for information that confirms the high value of the product or service (Kotler, 2000).

In the research studies for satisfaction more operationalizations of satisfaction were used (Westbrook, & Oliver, 1981; Hausknecht, 1990; Peterson, & Wilson, 1992; Wirtz, & Lee, 2003). Thus, Hausknecht (1990) listed 34 measures, including measures of behaviour (namely, behaviour registrations, such as a number of complaints about the main product) and self-report measures (namely, survey items, such as rating scales).

Also, the marketing studies showed that customer satisfaction depends on the specific psychological construction such as reliability, quality, customer loyalty, commitment, word-of-mouth and image, and customer profitability. It has been shown that quality and reliability are required by satisfaction, which in turn is necessary for customer loyalty and customer profitability (Yi, 1990; Anderson et al., 1994; Oliver 1997; Verhoef, 2001; Hennig-Thurau, Gwinner & Gremler, 2002).

The meaning of the concept is context-specific satisfaction (Giese & Cote, 2000).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

As a result of a learning process which can be developed only in the presence of a permanent client, who asks repeatedly for a particular product, brand or company, in order to meet a specific need, as a form of attachment to the benefits provided by the company, static vision of the satisfaction resulted from the client-producer relationship, has been replaced gradually and improved by cumulative satisfaction paradigm.

Satisfaction refers to the fact that a particular feature of a product or the product itself offered a "pleasurable level of consumption-related fulfilment, including levels of under or over fulfillment" (Oliver, 2006).

According to Rust and Oliver, "consumer satisfaction can be seen as the consumer's fulfilment response" (1994).

In 2001 Parker and Matthew referred to the existence of two complementary approaches to the concept of consumer satisfaction, namely satisfaction as a process and respectively satisfaction as a result of consumption experiences.

In 1977 and two years later, in 1979, Olson and Oliver asserted that in terms of process, customer satisfaction can be defined as an assessment of the significance of what was received and what was expected. Vavra, in 1997, emphasized that perceptual, psychological and assessment processes determine consumer satisfaction.

Consumer satisfaction, as a result, can be defined as a final state resulting from the consumption experience. This condition may be the result obtained without comparing expectations (Oliver, 2006) or a cognitive state obtained as a result of comparing the expected and actual performance or cost comparison of rewards and anticipated consequences (1997).

In marketing literature two main groups of models evaluation of consumer satisfaction can be identified:

- Models that put in relation the concept of customer satisfaction with concepts such as quality, value, and loyalty behaviour complaints. These models have an essential role at the level of organizational policy. Thus, they provide the strategic context for designing a marketing research on consumer satisfaction.
- Models based on the constructs of the customer satisfaction concept such as the discrepancy between expectations and actual results, attribution, equity, affect, and regret. These models allow proper operationalization of measurements of customer satisfaction providing appropriate constructs.

In order to measure consumer satisfaction with a broad range of organizations, indexes have been developed. Thus, at the national level, customer satisfaction index (CSI) is used in order to measure how companies and organizations are able to satisfy customer needs. The CSI Model is also used for comparing the services and products within a sector. Most countries have developed their own customer satisfaction indexes. The first such model was the national Swedish customer satisfaction barometer (SCSB), developed in 1989. It has included 31 major industries in Sweden. This model used perceived value as a single measure of customer expectations (Fornell, 1992). In 1992, in Germany, Deutsche Kundenbarometer (DK) was introduced, which in 1994 also included 31 industries.

In USA American Customer Satisfaction Index (ACSI) is being used since 1994. This model takes into account both the field of production as well as the field of public area. Thus, seven economic sectors, nearly 40 industries, 200 private sector companies and two local public services are taken into account.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Customer satisfaction index is calculated by taking into account proportional role of three categories of variables, namely: overall satisfaction, satisfaction expectations and satisfaction with the organization "ideal".

A model used to assess customer satisfaction is European Customer Satisfaction Index (ECSI) Model. This is an econometric model that links customer satisfaction index with a set of causal latent variables (such as customer expectations and customer perceptions about quality and value), being based on the verified theory of consumer behaviour modelling. It aims to determine the perceived quality and the company image to customers and customer loyalty.

Kristensen et al. (2000) described it as "a structural equation model with unobservable latent variables ... that link customer satisfaction to its determinants and, in turn, to its consequence, namely 'trust' and 'repurchase intention".

Customer satisfaction study aims at four main aspects, namely:

1. Identifying the means of measuring customer satisfaction;
2. Finding the ratio of the number of satisfied clients and the total number of customers;
3. Identifying key indicators for the satisfaction assessing;
4. Finding the evolution of the level of customer satisfaction.

In order to answer those questions, the relationship between actual performance and desired performance must be considered. The Bender Model (1991) and The Rapp Model (1995), cited by Schneider, emphasized five dimensions to be considered when assessing customer satisfaction:

1. Technical quality of the product;
2. Reputation quality;
3. Service quality;
4. Quality of personal relationships;
5. Price perception.

According to Meyer-Waarden (2004), satisfaction is an essential element for modelling customer purchasing behaviour, based on three categories of variables:

1. Cognitive variable;
2. Affective variables;
3. Co-native variables.

In the beginning, pro-environmental models have started from the premise that between environmental knowledge and concern about this there is a direct linear relationship, leading to pro-environmental actions as a consequence (Kollmuss & Agyeman, 2002).

Ottman (1993) has defined "environmental consumerism" as a reaction of the consumers, who, noting environmental problems, increasingly buy more eco-friendly products, gradually abandoning classic products. The stated purpose was to protect "themselves and the planet".

Thus, marketers should address this category of products similarly to the target market (Ottman, 2006) because consumers look for them, especially (Pickett, 2008).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Consumers claim to be well informed about the benefits of the products they intend to purchase. In doing so, marketers must consider this aspect in establishing the communication strategy and use instruments which best matching with the beliefs and behaviour of consumers, determining thus interest for the product (Kilbourne, 1995).

Ottman (1993) defined green consumers as "those who actively seek and support those products satisfy their needs that are having less impact on the environment". Besides that, Macdonald, S. et al. (2006) said that all consumers are potential green consumers, because when a consumer has the opportunity to choose between two products that satisfy the same need, he will prefer to buy green products.

If gender is taken into account, it was found that there is no a "significant relationship between women and men and green behaviour" (Kreidler & Joseph, 2009). However, there are studies which showed that women are generally more concerned about the environment are more willing to buy green products (Mainieri et al., 1997).

If the geographic region is taken into consideration, it is demonstrated on the basis of consumer surveys that across Europe consumers express concern for the environment. Thus, they look for eco - friendly products and services, being at the same time willing to pay more for environmental features. This obvious serious concern of the European consumers for green products has led to 90% of European multinationals to adopt programs of environmental sustainability (Peattie & Crane, 2005).

People can be induced to adopt green consumption model if additional benefits, cost effective or environmentally friendly solutions are offered (Ottman, 1993).

In marketing literature is shown by research (Pickett, 2008) that product perception is influenced by situational variables and social reference groups. Also, there are studies which showed that many of the consumers perceive organic products having a high price and low quality (Mendleson, 1994; Ginsberg, and Bloom, 2004).

Gupta, S.et. al. (2009) referred to the „green buying behaviour". Thus, he showed that the concern for the environment and about pollution, willingness to recycle, and to pay more for environmentally friendly products form this behaviour. Many studies on this topic have been performed starting from the analysis of the willingness of the consumer to pay more for green energy (Wiser, 1998; Hansla et. al., 2007).

Marketers may contribute to change consumer behaviour by emphasizing benefits and desired features of the products in the messages communicated by the producing companies to their potential customers. In relational marketing „long term benefits" of the product are submitted, leading to attract and retain consumers for long periods (Antonies & Raaij, 1998).

Thus, consumer behaviour can be shaped by emphasizing relative advantages of eco-friendly products in comparison with those products which create environmental damages (Peattie, 2001).

Related to this, Ottman (1993) stated that consumers can be the emotionally motivated to get involved because they want to differentiate themselves from other members of society or in their groups.

Another issue taken into consideration by the American scientist J. Ottman is the period of life when certain purchasing and consumption behaviours are induced. Thus, she stated that "habits are decided early in life" (1993). The conclusion is that consumers will take more favorable to environment decisions if environmental education will start early.

Instead, Peattie (2001) believes that to form such habits, companies should be those that should get involved. Thus, in the early stages of forming purchasing habits, they should use some systems to reward customers.

Mass media is another factor that can contribute decisively to the formation of buying habits. This, as a stakeholder (Ottman, 1993) and opinion promoter, can effectively convey environmental information.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

However, in practice consumers tend to become suspicious in some cases when companies put too emphasis on the environment in their communication systems.

The label is another factor to be taken into account in substantiation of the decision to purchase (Chase & Smith, 1992). The label may highlight specific environmental information that can contribute to an attitude of buying an eco-friendly product.

In other words, we can say that a system of an environmentally friendly communicating system can lead to a favorable attitude to green products (Baldwin, 1993).

It follows from the above that the companies need to pay great importance to develop long-term strategies (Darling et al., 2009).

There are a number of studies have shown that environmental issues have become important issues for the population. This, also, led to changes in purchasing and consumption behaviour. Thus, consumers become more aware of environmental issues, giving more time for the prospection stage, seeking, primarily those energy efficient products. These behavioural patterns suggest the intention of engaging in a green consumer behaviour (Roberts, 1996; Kalafatis et al., 1999). However, the explanation may come from increased energy prices.

Factors which consumers take into account in substantiation the purchasing decision, ultimately support marketers when they design the marketing mix. Thus, if environmental factors are considered, sustainability goals can be more easily pursued. In order to achieve these objectives criteria of compatibility of the ecosystems with production systems should be considered. In this respect, Fuller stated that „Customers need to learn to base purchasing decisions not only on how well the products meet the individual needs but also on how these products affect the natural environment" (1999).

Regarding the evaluation of the substantiation of the decision to purchase, Ottman (1993) stated that the products or services are evaluated not only in terms of "performance and price," but also on the "social responsibility of manufacturers."

Consumers tend to repeat purchase in those cases where post-purchasing evaluation gives them satisfaction (Wood & Neal, 2009).

Thus, the concept of customer loyalty is related to environmental concerns and decisions having an impact on them.

IMPLICATIONS OF THE SUSTAINABLE DEVELOPMENT IN CONSUMER BEHAVIOUR

Sustainable Development: Frame for Sustainable Consumption

Sustainable development offers a frame for communities for an efficient use of the resources, in order to create new commercial activities, to protect and improve the life quality, to create new commercial activities which consolidate their economy. It can help to create a healthy community, which can sustain even the actual generation, and the next one. The concept of the environmental degradation unplumbed from the economic growth by eco-efficiency promotion and by interpretation of the high standards of environmental protection as a challenge to innovation, new markets and new business development, if we take into consideration the fact that a healthy environment is essential to ensure the welfare and quality of life.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

There are increasingly more voices claiming that production and consumption of goods would become sustainable if consumption of raw materials would be reduced. Consumption should be reported to the ecological potential of the environment. Sustainable non-inflationary growth thus became one of the economic objectives of the European economic model. An economy which would meet these conditions is called "dematerialized." To that context, consumer behavior gets a more important role in this economic model (Beatley, 2000).

Lester R. Brown argued that the economy is part of the environment, showing that considering that the environment is part of economy generated a destructive economic model. He showed that if China would adopt the American lifestyle, demand for oil would increase by 80 million barrels per day, and paper consumption would exceed the global production capacity. Extrapolating this reasoning, he says that this economic model based on fossil fuel consumption is not suitable for any other developing countries, nor for the world. Eco-economy is presented as an optimistic alternative model. Thus, the main concern of the theoreticians in economics consists in integrating the ecological principles. Brown shows that the seeds of this new sustainable economic model can be seen even today, as new wind turbines, solar panels, electric cars or networks of bike trails, which are becoming increasingly visible in the big cities. This new economic model should be integrated into ecosystem so that allowing further economic and social development (Brown, 2001).

Sustainability principle designates the gear of three dimensions – ecology, economy and social sphere. Mixing up the consumer behavior with the ecological dimension of sustainability is very important. Economic development and social welfare are possible in long-term, only in a well-established frame which involves nature as a vital element. The economic and social aspects are important in order to make ecology becoming feasible: ecological manufacturing and consumption are elements that can be realized only if the consumer is able to afford them and if both are realized under acceptable social guidance. 30-40% of the environmental problems are based directly or indirectly on some prevailing consumption models (Using UBA, 1997, p. 1).

In this context, new strategies must propose a way for the sustainable development:

- Quality and preservation of the environment and natural resources essential elements of the sustainable development;
- Management of the manufacturing flow, so that, taking into consideration the finite character of resources, to facilitate and encourage reuse and recycle at an optimum level, in order to avoid loss and depletion of natural resources;
- Modification of the planned society concordant to the confined character of the natural resources, so that their consumption or use to be not made in another's detriment, so that exploitation by a generation of the natural resources to not confine consumption possibilities of the future generations.

The global expansion of environmentalism is ascertained in the current period. The objectives envisaged aim, on the one hand, to improve the efficiency of production processes, using, and recycling of consumer goods and, on the other hand, further progress in global governance policies. This means greening of the corporate codes of conduct, international environmental law increasingly tougher or stronger cultural norms of "appropriate" consumption (Dauvergne, 2008). However, the current pace of implementation of these policies is considered too slow and the real involvement, too sporadic to prevent the negative effects of the excessive consumption.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

According to Dauvergne (2008), the expenditures for environmental rehabilitation and human health are increasingly larger and require immediate action. In this regard, measures are required at the legislative level, both on the production and market. These measures have already begun to generate changes in customer behavior and society in general. But for this environment-oriented behavior could be generalized globally improvement of communication is required.

The regulatory policy tools must be chosen so that they outcrop a matched mix of their, adapting them to specific application situations. They include:

- Persuasion policy, which assumes promotion of the ecological technologies and research, awareness and education and use of market mechanisms;
- Information transfer policy encompasses tools for social communication - education, mass-media and public relation – informational systems affordable for the public.

Traditional policies pursuing minimization of the environment harmfulness, policies having as main goals demand satisfaction with a minimum input are added, in manufacturing area, production policies with a minimum output of wasted resources and, also changes in the demand profile.

Nowadays, urban environment became more and more crowded especially by increasing the frequency of the transportation activities. Urbanities specialists are highly concerned with problems of the territorial use. Planning of the territory use needs to be closely correlated with regulatory for activities of the transportation services, which must accurately reflect costs of the needs of environment rehabilitation and social costs of maintaining or development of the transportation infrastructure.

A more deepened knowledge of the premises of consumption structuring for other goods and services, is, also, necessary, as a response to the multitude of needs expresses by different consumers' categories. For instance, option for replacing an old product with a new one can be underlined by many motivations – that the old one can't be mended, that the new one has superior properties, that there is a use for periodic shopping. The emergency of the consumerism era, in occidental countries, was possible just as a complexity of the consumption behavior of modern people and his striving for innovation (Stanciu, 2006).

The paper is a consumer good, which manufacturing depends on, essentially of the exploitation of wooded lands. Paper consumption clearly reflects the level of civilization and economic development for a country. But the industry of cellulose and paper is not only the biggest wood consumer in the world but, also the third industry in the world in respect of the financial results, being, at the same time among the first ten most polluting industries. Therefore, in the next 50 years, the demand for cellulose and paper is expected to increase with a hundred percent, according to The National Institute of Statistics of Romania, 2004. But, on the other hand, there are still over a billion of illiterate people and over 100 millions of children who don't yet benefit of primary school education.

Generally, encouraging of goods and services demand, mass-media and advertising industries play a decisive role. Mainly, advertising industries affect consumers' motivations, having a decisive role for consumption structuring and modelling of the concepts regarding goods and services. Some recent studies of the consumption habits sustain that manufacturing response for some consumption needs can become more sustainable, by encouraging the taking up some services destined to contribute to the raising of sustainability of the goods already purchased, instead to encourage purchasing of new goods. These kinds of practices lead to diminishing pressure of the extractive industries to the environment that can lead to a new conceptualization of the life quality increasing. Also, some recent analyses of companies

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

affirmed that consumers' loyalty for a brand seems to be more encouraged by a bid for services destined to extend the life of the goods in use and less by encouraging of the purchasing new products.

Sustainable consumption and manufacturing models represent important determinants of the environmental problems at every level, from the local level to the global level. For this reason, Changing Consumption Patterns was a main object in Agenda 21 (The World Conference in Rio de Janeiro, 1992). Sustainable consumption represents a very wise area, requesting an interdisciplinary approach. The change of the consumer behavior is a process involving many social groups: ménages, which represent the biggest group of consumers, authorities, economy, educational institutions, NGOs and many others.

In September 2015, the United Nations adopted the Agenda 2030 for Sustainable Development which established a comprehensive framework for eradicating poverty and achieving sustainable development by 2030, based on the Millennium Development Goals (MDGs), adopted in 2000. Thus, the 2030 Agenda includes an ambitious set of 17 Goals for Sustainable Development (SDG). Among them, goal no.12 aims to "ensure sustainable consumption and production patterns". Paragraph 28 of the 2030 Agenda states the clear commitment of signatory countries on the implementation of fundamental changes in the how societies produce and consume goods and services. Thus, the involvement of all categories of stakeholders, namely, international organizations, governments, business sector and other non-state actors and individuals is required. Each of them must be involved in changing the unsustainable patterns of production and consumption. The involvement must target both technical plan, and the financial sectors. Developed countries must assume the role of leading this movement. At the same time, protecting economies in developing countries should be considered. In this regard, new investments must be carried out. They must contribute to "strengthen developing countries' scientific, technological and innovative capacities" of these weaker economies, to enable their evolution towards more sustainable consumption and production patterns. (United Nations, Transforming our world: the 2030 Agenda for Sustainable Development, retrieved on January, the 10th, 2016, from https://sustainabledevelopment.un.org/post2015/transformingourworld)

EU leads the efforts for a sustainable world. The EU has already adopted the leading position in terms of efforts for a sustainable world. In this context, the EU was committed carrying forward this agenda, both internally (e.g. through the future EU initiatives such as the strategy for circular economy, designed to tackle more sustainable patterns of production and consumption), and through its external policies, by supporting implementation efforts in other countries, especially those with the most urgent needs. The most important EU's Contribution to the Millennium Development Goals for the 2004-2014 period, in terms of ensuring environmental sustainability, consist of:

- Connecting more than 74 million people to improved drinking water;
- Connecting 27.5 million people to sanitation facilities;
- Protecting 1.9 million km2 of forest;
- Continuing conservation of 1.1 million km2 of protected areas.

A change of the consumers' behavior means primarily a fundamental transformation of the values and life style. The change of the thinking and acting kind of the consumers can't be imposed by the authorities. The emergence of new and durable traditions in consumers' behavior requests a wise informing and consulting campaign. As regards of the consumer, goods and transportation ways must become more transparent, the price of the ecological true need to be clearly expressed and those alternatives for the environment protection must be as soon as possible shown.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Ways to Ensure a Sustainable Consumption

- Development by companies of products and services that maximize social value and minimize environmental effects. This requires strengthening the role of research and development function at the micro level.
- Education in this regard and influencing consumer choice of goods and services. Important roles in this regard can play promoting and raising awareness of consumer options. Companies can encourage consumers to choose environmentally friendly products and services and to consider the sustainable way to use them.
- Changing of the demand's characteristics and elements related to the dominant lifestyle, especially in developed countries - decreasing the quantity of purchased goods and services.

Areas of Activity of the Sustainable Consumption

Question about the concrete measures for the implementation of the sustainable behaviour regarding consumption appears only in a second stage. A very important role was allotted for areas as:

- Avoiding of the waste products accumulation;
- Energy and water consumption;
- Mobility;
- Feed;
- Reuse of the objects.

In order to attain a sustainable growth, material consumption of the industrialized countries must be diminished. This is possible because of the fact that in the last period goods having a low content of raw material were introduced in market, for the automobile industry, for the equipment industry and for that of the wrapper. There are motives for which a decrease of the material and energy consumption doesn't necessarily lead to a diminution of the total consumption. Thus, increasing total quantity of the used merchandise cancel savings obtained in technology of their realization. Secondly, motivation for producers to realize ecologic goods is related mainly with economic interest, which operationalizes the new sustainable technologies. The classic case is represented by the fridge with low energy consumption, but more expensive than the conventional one. Another solution for the sustainable consumption consists of realization of goods having long term of working. This is only a part of the new approach, which imposes a new vision to merchandise, according consumers' needs.

There are many problems: it is not clearly how the consumers are prepared to accept prizes of the ecologic goods. A strict legislation in this area imposes serious pressures to the economic agents.

They began to understand that not only attention paid to different goods separately seen. This imposes a new approach, named metabolic, which approach the whole anthropic system.

Also, they began to understand that the attention paid to different goods separately seen is not sufficient.

Some specific studies showed the ecologic impact of the services, building the concept of services efficiency meaning to offer a maximum result for consumers by use a minimum quantity of raw materials and energy. The most important feature of this concept consists of the fact that in our days, satisfaction is generated not only by the products but even by services which they provided. In other words, products offered represent only tools for services obtaining.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The 12th goal of Agenda 2030 aims to "encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle". In this context, colleges and universities could become very important actors. Thus, it would be appropriate for them to upgrade their curricular areas by introducing disciplines and developing specializations able to confer appropriate competencies for their graduates, especially in developing countries.

Reducing waste is another issue that has been also taken into account at UN summit in September 2015. In this regard, a proposed measure consists in the rationalization of inefficient fossil fuel subsidies.

Restructuring taxation and gradual reduction of harmful subsidies are expected mentioned as methods for implementing these measures. Each country must take into account the specificities of the national economy. UN document clearly stipulates "minimizing the possible adverse impacts on their development in a manner that protect the poor and the affected communities".

Implications for the Elementary Processes Which Define Consumer Behaviour

All the same, consumer behaviour is influenced by numerous variables acting tightly. Consumers' behaviour is influenced by many factors:

1. Directly observable influences:
    a. Demographic factors
    b. Economic factors
    c. Factors specific for the marketing mix
2. Endogenous influences:
    a. Perception
    b. Information/learning personality
    c. Motivation
    d. Attitude
3. Exogenous influences:
    a. Family
    b. Membership group
    c. Reference group
    d. Social class
    e. Culture
    f. Sub-culture

In the last two decades, social analyses focused on goods and services consumption of the occidental people. These were significantly changed in terms of a general sense of the message, leaving pro-consumerist messages in favour of those anti-consumerist.

Some papers published after 2000, underlined a new criticism current in the area of consumption patterns in the occidental area, highlighting more clear tendencies of some social categories, to engage in activities less oriented to consumption. Some authors, as Zavestoski (2002), Schor and Holt (2000) or Hamilton and Mail (2003) was concerned even to initiate market studies for anti-consumeristic attitude or for return to some extremely simple consumption practices, protective with maintaining the environmental ecologic equilibrium. There are analysts of the consumption patterns like Lunt & Livingstone

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

(1992) or Humphery (1998), who study a new orientation of the consumers – to limit satisfaction of the consumption needs by different good and services markets, as a consequence of the high critic attitudes.

Perception

The most important feature of perception is the fact that is selectivity, as being complementary to needs, because of the consumers' features.

A useful concept is just a difference indistinguishable, for instance, in cases of price increasing motivated by different factors, such as green tax. If the increasing of price doesn't exceed the difference just indistinguishable, it is possible that demand for a specific good to be not affected.

"An environmentally sustainable economy — an eco-economy — requires that the principles of ecology establish the framework for the formulation of economic policy and that economists and ecologists work together to fashion the new economy. Ecologists understand that all economic activity, indeed all life, depends on the earth's ecosystem — the complex of individual species living together, interacting with each other and their physical habitat." (Brown, 2001)

The Need for Comprehensive Regulations

The ecological manufacturing and sustainability can gain a certain influence on consumers' decisions, but the price still represents the key variable. All researchers agree on this. Nobody will pay, for instance, fourfold for a fridge just for its less energy consumption. Central administrations need to establish specific regulations, to recommend minimal prices for the unfriendly goods for the environment, in order to make certain the fact that they are not cheaper than those being friendly for the environment. These could increase consumers trust.

In the context of the 12th goal of the 2030 Agenda, mentioned above, the implementation of a 10-year framework program on sustainable consumption and production is envisaged. Developed countries are asked to take the lead of these programs.

Currently, the use of renewable energy resources, ecological agriculture and implementation of an intelligent management of urban waste must be major objectives for both environmental policies as well as those relating to the quality of life.

Feelings and Emotions Consideration

There is a real potential in this area, for instance that demonstrated by the success of some brands in the cosmetic industry. Companies should recognize opportunities and gains generated by the sustainable goods and shouldn't only pertain to risks and costs.

Another example in this area is represented by the fact that some studies demonstrated that those advertisings which highlight the fact that the good had in sight don't encompass children' work are irritating for consumers because they assume a priori that manufacturing is correctly from the point of view of the policies. Furthermore, terms like children exploitation have negative connotations and can cause damages to the positive experience of goods or its purchasing, irrespective of context.

In marketing terms, it is vital, the fact that green goods meet their goals, this making consumer fell that he does the right things.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Selection of the consumers' perceptions is much influenced by their attitudes in the moment of their reception.

Consumers' expectations are closely linked to the process of perceptual selection, implying them percept goods and their performances from the point of view of the benefits they expect to obtain. Market researches show that consumers consider first personal benefits and not these for the environment. For instance, in a supermarket consumers don't wonder first: Do I the right thing buying this? But: If I will buy this, it will be good for me? Thus, they are ready to pay more for this kind of goods. And only after that, they consider that the good must be manufactured in ecological conditions.

Reasons can play an essential role, too, in the perceptual selection, being known the fact that people perceive good related their needs and desires. An intense need determines a person to ignore some perceptions and select only those are related to this satisfaction.

Information

Perception is first, related to the awareness/learning process, which represents an ensemble through people know goods.

In awareness process, specialists pay attention to information sources.

Researches upon consumers' behaviour and attitudes in last decades showed a real interest in problems of environmental harmfulness. But there is still a long distance from attitude to their transformation in practices. In real life, consumers almost don't possess information about present and future effects of consumption decisions to environment or to other people.

In the same time, consumers manifest their decisions in a world where merchandise already are in last processing stage a major change being hard to obtain. The observed changes in consumer behaviour can be seen only in tight areas; they must be supported by strong awareness campaigns in order to become dominant market behaviour being significant for producers. But there is another dike: market is already saturated with advertising messages that increase chances that these campaigns be fast forgotten.

Generating important changes will occur only after a radical change of consumers' attitude. This requests a redesigning of prices policies in order that non-harmful for the environment goods to be chosen and opposite policies to be punished. These request other policies for consumers' information. A study performed in 1990 by Winkler and Voller identified a correlation between consumers' attitude and environmental impact of goods. This correlation was revealed related domestic energy consumption which decreased in those countries where ecological attitude increased, Holland, Germany, Denmark and Sweden.

Goal no.12 of the 20130 Agenda refers the issue of "the relevant information and awareness for sustainable development and lifestyles in harmony with nature". These should be available by 2030 for people everywhere.

Attitude

Attitude was accepted more and more as a multidimensional concept, as a syndrome of constant reactions against social objects (WBCSD, 1996).

An interesting fact is that, in fact, consumers are not concerned directly with reducing energy consumption, but in a specific choice about buying daily goods. Consumers take decisions when they use

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

or discard concrete goods. This means that concrete manifestations of these mental attitudes need to be analysed.

Globally, specific studies identified phenomena of take-over consumption models from developed countries by the developing countries; there is a problem regarding this because first habits related goods having most important impact against environment (cars, steel, and electricity), whilst consumption models for less harmful goods are less convincing. Though, solution consists of modelling consumption attitudes.

Care for environment protection is confronted with interest for personal satisfaction obtaining.

There are researches showing that people have familiar attitudes towards environmental consciousness in terms of factors related to awareness and action, environmental friendliness and willingness to act to act environmentally friendly (Mostafa, 2007; Tuna & Özkoçak, 2012).

Awareness of environmental issues grows day by day. This led to an increased demand for green products. Nowadays globalization is a key feature of the business environment. The technology and information boom represent, also current features of its. These elements have contributed to increase awareness of environmental issues and to generate a favourable attitude toward environmentalism, causing consumers' inclination to purchase green products. But, although the environmental concerns play an important role on consumer intention to buy green products, they are not the only determining factor for purchase (Phau & Ong, 2007; Agyeman, 2014). There are many factors which have been identified as influencing this process, namely, company's environmental reputation (Schwepker & Cornwell, 1991), credibility of environmental advertising (Thøgersen, 2000), environmental knowledge (Mostafa, 2006), and perceived product price and quality (D'Souza et al., 2007).

Investments for Sustainability

Transparency and accessibility of goods and producers are essential both for consumers and stakeholders. Many companies accomplish increasingly sustainability criteria. A specific degree of this criteria knowledge can determine consumers of the goods they offer to identify themselves with these companies' values.

In order to achieve its stated objective of ensuring sustainable consumption and production patterns, the Agenda 2030 takes into account, too, supporting countries developing to strengthen scientific and technological capacities to evolve towards more sustainable consumption and production.

Motivation

Motives have a broad multidimensional character, being built between biologic and social, between internal manifestations and knowledge, between subjective necessity and values as a reference system, between objects and their linkages with people. Because of these, they can't be reduced only at a determinant factor. In order to design an efficient marketing policy, it is important to concern that motives are learnt and they have stability in time, being hardly changeable.

Effective Behaviour

Effective behaviour is not an autonomous process though it can be studied relatively independent; it is a specific resultant of a system constituted by the above-mentioned elementary processes.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

There are numerous studies on green consumption behaviour. Wu and Chen (2014) have attempted to translate several descriptive variables in such a model. Thus, a positive relationship between attitude and perceived benefit and a negative relationship between perceived risk and attitude were highlighted. This result shows that consumers' evaluation of green consumption is affected by uncertainty; role of perceived benefits is much greater than that of perceived risk, which confirms results of previous research (Rohm & Swaminathan, 2004). Also, positive relationships between normative beliefs and moral obligation and respectively, subjective norm were highlighted. Another significant positive relationship was emphasized on control strength and control belief and behavioural control, supporting the findings of Ajzen's (1991; 2002) that availability of time and financial resources influence the green consumption behaviour, which makes consumers to practice green consumption as they are more confident of their resources. The findings of Cheng, Lam, and Hsu (2006), Baker, Al-Gahtani, and Hubona (2007), and Cronan and Al-Rafee (2008) regarding the significant positive relationship between attitude, subjective norm, and behavioural control and behavioural intention were also supported by Wu and Chen (2104). Also, a significant positive relationship was revealed between behavioural intention and behavioural control, respectively real behaviour, confirming the conclusions of Mostafa (2007) and Norman and Conner (2005).

Avant-Gardist Demand

As consumers become more informed and more educated, increasingly more of them are beginning to realize the impact that their consumption habits have on the environment. On the other hand, green marketing began to gain importance both in theory and in business (Ryan, 2014).

According to Obermiller and Spangenberg (1998) and Marques and Almeida (2013), the consumers' skepticism about the green features is no different compared to general skepticism towards the features usually communicated by marketers.

There are practical demonstrations of the fact that avant-gardist demand establishes trends which involve most of the consumers. In this respect, female consumers play a decisive role as follows they manifest much more responsibility and involvement in buying acts. They stand on utility, longevity and social or ethical standard.

ECOLOGICAL CONSCIOUSNESS

The ecological consciousness has complex character multidimensional. Thus, consumers should be informed about several aspects as follows.

Consumers must know the environmental consequences of their consumption behaviour. At the same time, they must understand the consequences of their behaviour as a result of attitudes towards environmental issues and products. The first effect consists of changing the consumption patterns; behaviour resulting from their ecological attitude will contribute to solving environmental problems and increasing the quality of life.

In the current conditions, the environmental awareness as a form of social consciousness plays an important role. Thus, ecological consciousness must contribute to building the ecological culture of human personality. Ecological culture requires deep knowledge of the laws of nature and society development,

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

of the interdependence between man and the environment, of the awareness of the need to protect nature and to use the natural resources as rationally and efficiently as (Uhl, 2004; Schendler, 2009).

In summary, ecological consciousness can be defined as a form of social consciousness reflecting the correlation between society and nature, the actions of man over nature and consequences of these actions, as well as the substantiation of the ways and means of environmental protection.

Ecological consciousness comprises two distinct components, namely: a theoretical component and another one with practical character. The theoretical part of the ecological consciousness is a system of ideas, concepts and theories about the forms of interaction between society and nature. These ideas and theories expand and deepen the spiritual basis of the ecological design that reflects the character and the purpose of the environmental activity. Ecological consciousness with practical character is formed spontaneously as a result of practical activities of the people. It is the primary form of perception by a man of his place and his role in relation to the environment. These components are reflected in the multidimensional nature of the ecological consciousness (Gray, 1985).

The Dimensions of the Ecological Conscience of Consumers

- Informative Dimension
- Cognitive Dimension
- Operative Dimension

THE GREEN DIMENSION OF THE MODEL OF CUSTOMER SATISFACTION

Drivers of the Green Dimension of the Model of the Assessment of Consumer Satisfaction

Reality has shown that proactive, long-term, visionary strategies, companies bring more benefits for companies than those based on classical management based on traditional resources. The companies concern for the environment represents, from this perspective, an opportunity. Thus, an organization will gain a competitive ecological advantage over the competition ecological if it is "better" than this, in terms of environmental issues, at least in a specific area.

The companies' interest for environment first appeared in campaigns for social responsibility inspired by the multinationals model. The adoption of "green" strategies has been boosted, too, by environmental regulations in certain areas.

In the current context, economic organizations are evaluated not only in terms of economic performance, but also in relation to their contributions to economic and social development of the community. Thus, the concept of social responsibility (SR) emerged. WBCSD World Business Council Sustainable Development) defined corporate social responsibility as "the Continuing Commitment by business to contribute to economic development while improving the quality of life of the workforce and Their Families as well as of the community and society at large" (WBCSD Business Solutions for a sustainable world). Thus, SR aims to help companies to become actively involved in local community life, enabling them to assume roles as global citizens and local neighbours in a fast-changing world. Such programs have become, genuine marketing tools designed to bring image benefits for their proposers. Corporations acquire "human face" is more than just products and services (Sima & Gheorghe, 2007).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

"Greener means cheaper." Investment in "green products" is manifested as an eco-trend in business. Some players have already intuited this trend and began to pay attention to this segment.

Companies that make the step to launch organic products want to achieve consumer awareness by associating their image with clean products, but they also look for new customers.

People want an ecological approach to everyday life, but they seek, primarily, personal gain, which can be transposed into incentives and facilities.

On the one hand, green customers and the public generally are more aware of the ecological behaviour of organizations and to their social involvement.

On the other hand, organic products and environmental activities are not easily accepted by a large part of the audience, especially by the one who does not have a strong and clear ecological awareness.

The degree of concern for the environment has increased significantly so that environmental problems have come to represent now an essential factor in making consumer decisions.

The items presented above have led us to take into account a new category, in modeling and evaluation of customer satisfaction, which the authors have called Green Dimension. (Figure 1).

ECSI model was the starting point. In relation to the determinants of ECSI model, green dimension can be justified at least by a few elements namely:

- In terms of image, the green dimension can be expressed in the concept of Corporate Social Responsibility. CSR activities of a company provide benefits at two levels: the social level and the company level. The social benefits are related to the welfare and the public interest. In terms of benefits of the company, at least four issues are to be mentioned, namely:
  - Possibility of differentiation over the competition and achieving brand loyalty. There are studies which have shown that when consumers have to choose between similar products, their preferences are turning to those brands perceived as being "responsible". Thus:
    - 70% of European consumers believe that the responsibility of a company is important in the decision to buy a product or service (MORI 2000);

Figure 1. A new model of the assessment of customers' satisfaction
Source: Sima, 2010.



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

        - 86% of Americans were inclined to change a brand in favour of another similar, but involved in a social cause (2004 Cone Corporate Citizenship Study).
    - Improving the company reputation.
    - Currently, companies' success depends directly on the trust given them by the authorities, media, partners and the community in which it operates.
    - On the other hand, if a company demonstrates its responsibility to the community, the related to reputation benefits have immediate consequences. Thus:
        - 61% of opinion leaders around the world are willing to recommend the products of a responsible company (The Insightpoll.com Opinion Elite Panel, 2004);
        - 84% of Americans believe that social responsibility is important when they think about the companies they agree to see operating in their community (2004 Cone Corporate Citizenship Study).
    - Increased sales and market share of the company.
    - Attracting and retaining valuable employees.
- In terms of perceived value, The Green Dimension may be considered in many respects. Thus, in Romania, Daedalus Consulting and Green Report conducted the first quantitative Romanian research on environmental issues. The result of the survey was published in February 2008 and showed a high willingness of Romanian people to pay more for green products. Compared to values at international level, almost 90% of Romanian citizens have expressed willingness to pay more for environmentally friendly products. After Romania, according to the TGI survey the highest availability was recorded in Brazil, India and Mexico. Countries that were not subjected to the rigors of environmental discipline are top ranking. This result can be explained by the fact that those countries, not having the costs experience of these measures, have a higher receptivity to them. Thus, a few results are noticeable:
    - Over 73% of respondents are willing to pay more for organic food.
    - Over 49% of respondents are willing to pay more for renewable energy.
    - Over 36% of respondents are willing to pay for products with biodegradable compounds. (Daedalus Consulting, Green Thinking, prepared for Green Report, 2008)
- In terms of customer expectations, The Green Dimension can be primarily expressed by their expectations about the energy efficiency of products, meaning that they seek products operation of which does not require high energy consumption. Also, customers have expectations regarding low emission of pollutants. A good example is the case of passenger cars, for which the level of the paid taxes is inversely proportional to the emissions level. It appears, therefore, that customer expectations related to green product features are primarily determined by the pragmatic attitude of the new consumer.
- Regarding perceived quality of the green products, the green dimension can be recognized in the low polluting level of the eco-friendly products, due to the use of new production technologies.

Specific Issues of the Green Dimension for Customers Satisfaction

People seek personal benefit rather than an ecological approach to the everyday life. Beyond awareness, the ecological approach should be assumed by consumers (Sima, Gheorghe, 2009).

The question arises is: How strong is consumer interest in environmental issues?

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Based on the results recorded in The 2009 BBMG Conscious Consumer Report: Redefining Value in a New Economy, Raphael Bemporad, co-founder of BBMG, said that brands would be able "to close the green trust gap" if they would take into account new customer expectations, which evaluates acquisitions "based on both value and value" (BBMG Conscious Consumer Report: Redefining value in a new Economy, June 2009, p.34). Thus, they have to provide performance products that match consumers' goals; with acceptable prices that for them.

According to Sivesan, Achchuthan and Umanakenan (2013) there is a significant positive relationship between green marketing practices are positively and customer satisfaction. The green customer satisfaction is strongly influenced by the quality of the product (Johnson & Ettlie, 2001).

Taking into account the above, we can identify three specific levels of customer satisfaction green dimension, namely (Figure 2):

- Company
- Product/Service
- Price

The Company Level

Consumers reward those brands which are based on the best practices of the company.

In addition to the classical requirements such as economic performance, quality management and communication policies, a modern assessment of a company is also considering specific issues such as the organization's involvement in the social life of the community. Modern organization as a legal entity - has primarily, duties to society.

Customer satisfaction is considered by Scott M. Smith as "a reflection of the expectations and experiences that the customer has with a product or service".

Evaluation of products and services is actually made following customer expectations. They are found in the rules of performance that reflects accepted environmental standards set by the business

Figure 2. Tree of customer satisfaction for the green dimension
Source: Adapted after Sima & Gheorghe, 2009.



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

environment, other companies, industries, and even organizational and national culture. The most effective strategic approach seems to belong to those companies that have adopted social responsibility and sustainable development as a business philosophy. Integrating social and sustainability principles in their operation provides long-term value for the shareholders through practices that are, in fact, satisfactory to all stakeholders. Social Responsibility was developed by taking into account environmental and social opportunities as business opportunities. In this respect, the strategic capacity of organizations is adapted in order to efficiently exploit such opportunities.

The new consumer is increasingly more concerned about his image that reflects the image of his suppliers. Therefore, their reputation becomes, in turn, increasingly more important to the consumer. Thus, elements which are subject to social responsibility activities such as concern for health and safety as well as customer requests, ensuring environmental conservation, supporting philanthropy, come to be positioned in the core of companies concern. The result of such strategic approach is to eliminate barriers to communication with the customer, such as mistrust, negative perceptions, lack of information, low availability, leading, ultimately, to increase sales of environmentally sensitive products. The importance of each factor varies by product, industry and geographic area.

The 2009 BBMG Conscious Consumer Report: Redefining Value in a New Economy has found that 77% of American consumers agree that "can make a positive difference by purchasing products from socially or environmentally responsible companies".

There are differences between proactive and reactive companies, in terms of performance. These differences are starting to decrease as the environmental education becomes more important. This highlights the role of governments. They can support cooperation between companies and provide educational programs to help companies in understanding the benefits of involvement in environmental protection. This is especially true in the case of small and medium enterprises in developing countries, which should encourage and reward innovation at all levels (El Dief & Font, 2010).

The Product/Service Level

Consumers are looking for "green" features of the products and services.

Climate changes seem to be those that have drawn attention to environmental issues to the greatest extent. At the same time, rising energy prices is another factor that appears to significantly influence the buying decision. Thus, the consumers are getting more and more interested, firstly, in products of high energy efficiency classes. At the same time the low level of environmental damage may represent an important factor in the decision of purchasing. The conclusion is that, firstly, the personal benefits are tracked and only after that the ones affecting the environment.

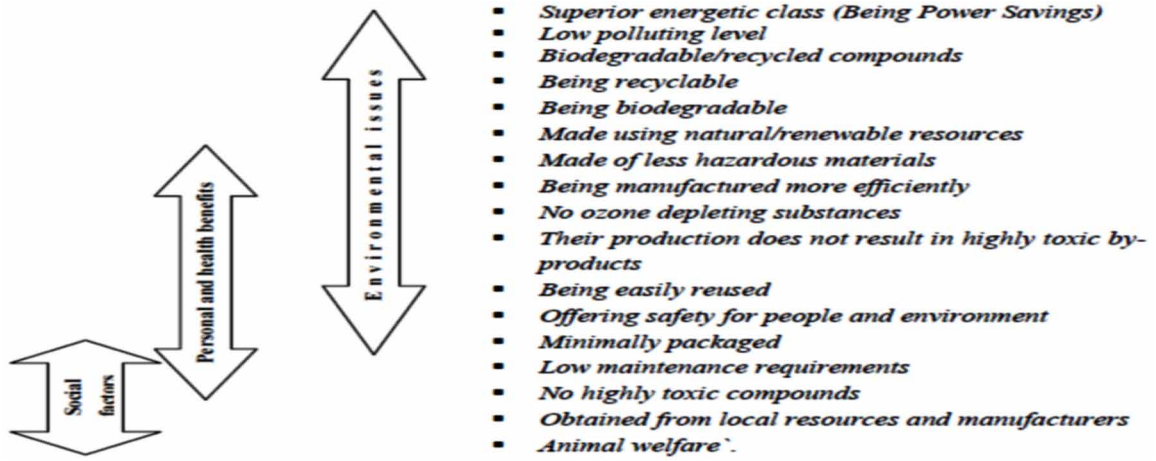
The most popular and demanded "green products" are:

- Organic food
- Renewable energy

But in addition, other important ecological features of the products / services may be considered to represent important factors in purchasing decisions: "superior energetic class, low maintenance requirements, low polluting level, biodegradable/recycled compounds, no highly toxic compounds, being easily reused, recyclable or biodegradable etc." (Sima & Gheorghe, 2009).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 3. Green satisfaction sources
Source: Sima & Gheorghe, 2009.



Thus, in terms of involvement in purchasing decisions, environmental issues can be classified into three categories, namely: environmental issues, personal benefits and social factors (Figure 3).

The Price Level

At this level, the main issue is about consumers' willingness to pay more for "green products/services".

There are numerous studies conducted all over the world that show the green procurement volume is increasing, but the question that arises is: Are the consumers willing to pay more for green?

A McKinsey survey of 1,000 consumers in Europe and the United States performed in 2012, showed that many people would pay more, but only up to a point (Miremadi et. al., 2012). The study took into account acquisitions in the automotive, building, electronics, furniture, and packaging categories. Between 70 and 80 percent of the respondents said they would pay an additional 5 percent for a green product if it is at the same level of performance as a non-green alternative. But as the premium increase first, willingness to pay decreases.

The "historical" reluctance to pay a bonus for ecological products is reduced as consumers associate the responsibility for protecting the environment to their health and other direct benefits.

The core of this internal belief system is ecological value.

Ecological value can be explained by the implicit or explicit philosophy of desired value and it may be placed as a behavioral variable within the system of values.

The Green Strategy Mix: A New Holistic Approach

Two international studies, conducted in 2009 (Sustainability in the 2009 Recession and Green Brands Survey 2009) showed that the recession has not lowered the interest in 'green' products or services, quite the contrary. Worldwide consumers associate ecologic products with the idea of reducing consumption and saving, despite the fact that the main barrier for purchasing of these products is the perception that their price would be higher than that of the classic ones.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

In January 2009, the Boston Consulting Group presented the results of a study entitled "Capturing the Green Advantage for Consumer Companies". The aim of this study was to discover if and how consumer attitudes towards green products and services has been affected by the economic crisis. The conclusion was that during the crisis, consumers remained interested in organic products. Determinants of this behavior were represented by the benefits that eco-friendly products have, on the one hand, upon the environment and, on the other hand, at the personal level. As a conclusion, BCG advised companies on how to respond to consumer expectations regarding environmental protection being, at the same time, able to reach, their business targets.

It should be noted that the study was conducted in a gray period, characterized globally by uncertainties, among others, regarding the appropriateness of investing in a new environmental strategy.

As a concrete result of the study a best practice guide for the company was drawn up.

In this guide guidance for companies was offered, divided into four categories, based on which companies can meet consumer requirements on environmental protection and their business objectives. The four categories are Planning, Process, Product, and Promotion.

From our point of view, "the green products and services are designed, manufactured, priced and promoted by people for people" (Sima & Gheorghe, 2009). This approach has led us toward a holistic approach to green satisfaction, according to which people and their double the role of producers and consumers should be in the same time considered.

Some analysts say that for companies, there is only one thing which is more important than environmental initiatives, namely the ability to communicate it to consumers.

Thus, in terms of green strategy, we consider that a fifth element can be added, namely the People.

Another observation we had regard was that the eco-efficiency represent a production principle requested by the green products. It refers to less polluting production systems used to produce goods and services which have a lower environmental impact, which better corresponding with customer needs, being, thus, more competitive.

Starting from this, the authors, also, integrated Eco-Efficiency into a strategy mix that they named "The Green Strategy Mix" (5P+EE) (Figure 4).

- Planning Strategy
- Processes Strategy
- Product Strategy
- Promotion Strategy
- People Strategy
- Eco-Efficiency Strategy (Sima & Gheorghe, 2009)

The first four was highlighted by the Boston Consulting Group into a recent study, aiming to assess green attitudes and shopping behaviors. They call them The Four Ps of Green Advantage.

Being "green" has become a business plan itself. Producers attempt to differentiate the competition and gain a large share of the market. There is a "green" competition, in which each company tries to move forward, aiming to move forward having regarded the continuous growth of the customer preferences for 'green' products.

Nowadays, producers, not just consumers, seem to show a wave of interest in the environmental aspects of the business, because they realized that eco-environmental production methods can be profitable. So we can say that in a comprehensive approach, the strategic mix can be improved.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 4. The 'Green Strategy Mix'
Source: Adapted after Sima & Gheorghe, 2009.



Given the continued growth of customer preferences for 'green' products, the existence of a product having a less impact on the environment, in the company's portfolio, it is often better in terms of quality and marketing.

Being "green" has become a business plan itself.

Solutions and Recommendations

Four main determinants of population's attitude towards the green dimension can be identified:

1. Phenomena with negative environmental effects;
2. Activities to protect environment;
3. Willingness to save and motivation for it;
4. Willingness to pay extra for green products and justification for it.

Phenomena With Environmental Impact

According to the above-mentioned study conducted by Daedalus Consulting in Romania in 2008, atmospheric pollution and deforestation are considered to have the highest environmental impact (Over 84% of respondents placed this issues on the first and second place). Respondents considered that pollution can be greatly influenced by each of us.

These two results seem to be in a relationship of interdependence that can be verified in future research through correlation analysis.

Genetically modified foods are ranked third, nearly of the above mentioned two categories.

Regarding how respondents considered that they might influence each of these phenomena, it can be observed that in all cases the population is considered largely unable to act.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Activities for Environment Protection

As regards activities for the environmental protection, there is a clear correlation between the activities about which respondents say they have performed over the past 12 months and those who declare that they intend to undertake in the next 12 months.

There is also an increase of approximately 10% of those who declare that they intend to be involved in such activities in future, which may suggest a tendency to declare rather act or to reflect the behavioural changes induced by the economic recession.

Willingness to Save and Justification for It

Regarding products that respondents say they save, the most name energy (over 70%). On the second place, they considered water (60%).

Regarding the reasons for showing this kind of attitude, most respondents stated that they try to reduce costs (85%) and only 13% say they care about the environment.

This shows serious problems in society and requires a deep study in order to identify determinants of this behaviour to improve.

"Green Products" and Willingness to Pay More for Them

The products were grouped into three categories:

1. Organic food;
2. Renewable energy;
3. Products with biodegradable compounds.

Organic foods are outlined of these, almost three-quarters of the respondents (73.1%) saying they were willing to pay higher amounts. About a half (49.1%) were willing to pay more for renewable energy and almost a third (36.3%) for products with biodegradable components.

And this result matches to the behavioural pattern mentioned above, showing that for Romanian people care for the environment not prevail, but rather care for them.

A mismatch occurs when respondents are asked to respond if they are willing to pay more for "green products". On this question, nearly two-thirds affirmative answer, and if we add them those who are in partial agreement, we achieve a percentage of over 84%. This response comes, however, contradict the results mentioned above. Thus, this it seems to support, too, the conclusion that the people of Romania are well in words, but less than in facts.

FUTURE RESEARCH DIRECTIONS

All of these above-mentioned elements determine a model of an ecological community, including:

- **Resource Ecology:** Identifying local resources that can be ecologically exploited;

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- **Activity Ecology:** Directing investment towards non-polluting activities (ecological agriculture, "clean" technologies, ecological services, ecological tourism, etc.) and writing and implementation of local development projects that take into account ecological constraints;
- **Ecological Behavior:** Building awareness within the local community regarding the serious long-term consequences of non-ecological behavior (development of ecological citizenship);
- **Ecological Culture:** The introduction of ecology information in school curricula, as a support for the formation of ecological culture.

Given the above, we believe that an investigation should be conducted in order to help us to shape and measure the consumer green behavior. The ultimate goal is to develop a system of indicators which may be used to measure the green satisfaction of the consumers, namely, Green Dimension Index.

The starting point of this research will be the model shown in figure 5.

CONCLUSION

Operationalizing studying of the needs, values, behaviours, psychology or aspirations of goods and services consumers is a laborious and complex process because every chapter of people consumption as well as market dynamic of every good or service follow specific laws and there are necessary separate investigations for every good or consumption chapter, in order to explain or forecast general or sequential behaviour of the consumers.

Nowadays, there is no exhaustively understood of consumption components or of real motivations for adopting specific consumption practices, even in this area there already are accumulated many studies, observations and methodical researches.

But it was never possible an investigation totally satisfying in respect of the rationality of the consumers, so much the less in respect of the unconsciousness impulses lying the effective consumption

Figure 5. Model for green dimension index evaluation
Source: Enhanced after Sima & Gheorghe, 2015.



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

behaviour. Anyway, the social and economic theory of consumption made important steps in respect of the delimitation between rational and emotional motivations of goods and services purchasing.

Changes dynamic in goods and services markets was very high in the last two decades. In those countries having market economies, where profile if demand rapidly changed, these lead to a rapidly change of the offer parameters and default changes of some elements of the research methods and techniques of the consumption patterns.

Adoption of some sustainable practices of consumption involves the use of correlated goods and services which answer to the satisfaction of basic needs, under conditions of minimization of the natural resources exploitation, avoiding resources waste and polluting emissions, along an entire life-cycle, so that these don't affect life chances of future generations.

Desirable changes of some features of the consumption patterns as follow as new exigency imposed to manufacturing processes involve:

- Promotion of the examination of those consumption patterns which block sustainable development, as well as of the modalities of changing this behaviour, at the global level, endorsing especially those people having a consumerist life style.
- Identification of the most efficient policies and tools for break-up the unsustainable consumption/ manufacturing patterns, including by information dissemination and ecological alert.
- Performing a more equitable distribution of developing resources inside and between countries.

REFERENCES

Agyeman, C. M. (2014). Consumers' buying behavior towards green products: An exploratory study. *International Journal of Management Research and Business Strategy*, *3*(1), 189.

Ahmad, A. & Thyagaraj, K. S. (2015). Consumer's Intention to Purchase Green Brands: The Roles of Environmental Concern, Environmental Knowledge and Self Expressive Benefits. *Current World Environment*, 10(3), 879-889.

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179–211. doi:10.1016/0749-5978(91)90020-T

Ajzen, I. (2002). Residual effects of past on later behavior: Habituation and reasoned action perspectives. *Personality and Social Psychology Review*, *6*(2), 107–122. doi:10.1207/S15327957PSPR0602_02

Anderson, E.W., Fornell, C., & Lehmann, D.R. (1994). Customer satisfaction, market share and profitability: Findings from Sweden. *Journal of Marketing*, *58*, 53-66.

Antonies, G., & Raaij, V. W. (1998). *Consumer Behavior: A European Perspective*. West Sussex, England: John Wiley & Sons Ltd.

Baker, E., Al-Gahtani, S., & Hubona, G. (2007). The effects of gender and age on new technology implementation in a developing country: Testing the theory of planned behavior (TPB). *Information Technology & People*, *20*(4), 352–375. doi:10.1108/09593840710839798

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

BBMG. (n. d.). The 2009 BBMG Conscious Consumer Report: Redefining Value in a New Economy. Retrieved from http://bbmg.com/

BCG.com. (2008). Creating People Advantage Summary. Retrieved from http://www.bcg.com/impact_expertise/publications/files/Creating_People_Advantage_Summary_May_2008.pdf

Beatley, T. (2000). *Green Urbanism: Learning from European Cities* (p. 17). Washington: Island Press.

Bemporad, R. & Baranowski, M. (2010). *Marketing to Conscious Consumers: Identify, Engage and Leverage Your Most Passionate Customers*. John Wiley & Sons.

Brown, L. R. (2001). *Eco-Economy* (1st ed.). W. W. Norton & Company.

Chase, D., & Smith, T. K. (1992). Consumers keen on green but marketers don't deliver. *Advertising Age*, *63*(29), 2–4.

Cheng, S., Lam, T., & Hsu, C. H. C. (2006). Negative Word-of-Mouth Communication Intention: An Application of the Theory of Planned Behavior. *Journal of Hospitality & Tourism Research (Washington, D.C.)*, *30*(1), 95–116. doi:10.1177/1096348005284269

Conner, M., & Norman, P. (Eds.), (2005). *Predicting Health Behaviour: Research and Practice with Social Cognition Models* (2nd ed., pp. 170–222). Maidenhead: Open University Press.

Consulting, D. (2008). Green Thinking, prepared for Green Report. Retrieved from http://www.green-report.ro/dynamic/studii/sondaje/daedalus-consulting-green-thinking-sondaj-pe-teme-de-mediu-printre-romani---9288.htm

Cronan, T. P., & Al-Rafee, S. (2008). *Factors that influence the intention to pirate software and medi*a. *Journal of Business Ethics*, *78*(4), 527–545. doi:10.100710551-007-9366-8

Darling, R. J., Heller, V. L., & Tablada, D. M. (2009). Positioning a firms initial market offering: A strategic application of a consumer-oriented model. *European Business Review*, *21*(6), 516–530. doi:10.1108/09555340910998814

Dauvergne, P. (2008). *The Shadows of Consumption: Consequences for the Global Environment*. Cambridge, MA: The MIT Press.

DSouza, C., Taghian, M., & Khosla, R. (2007). Examination of Environmental Beliefs an its Impact on the Influence of Price, Quality and Demographic Characteristics with respect to Green Purchase Intention. *Journal of Targeting*. *Measurement and Analysis for Marketing*, *15*(2), 69–78. doi:10.1057/palgrave.jt.5750039

El Dief, M., & Font, X. (2010). The determinants of hotels marketing managers green marketing behaviour. *Journal of Sustainable Tourism*, *18*(2), 157–174. doi:10.1080/09669580903464232

Fornell, C. (1992, January). A national customer satisfaction barometer: The Swedish experience. *Journal of Marketing*, *56*(1), 6–21. doi:10.2307/1252129

Giese, J. L., & Cote, J. A. (2000). *Defining customer satisfaction*. Academy of Marketing Science Review. Retrieved from www.amsreview.org/articles/giese01-2000.pdf

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Ginsberg, J. M., & Bloom, P. N. (2004). Choosing the right green marketing strategy. *MIT Sloan Management Review*, *46*(1), 79–84.

Gray, J. (1985). *Ecological Beliefs and Behaviour*. London: Greenwood Press.

Gupta, S., & Ogden, D. T. (2009). To buy or not to buy? A social dilemma perspective on green buying. *Journal of Consumer Marketing*, *26*(6), 376–391. doi:10.1108/07363760910988201

Hamilton, C., & Mail, E. (2003). *Downshifting in Australia: A Sea-Change in the Pursuit of Happiness*. Australia Institute, Canberra.

Hausknecht, D. R. (1990). *Measurement scales in consumer satisfaction/dissatisfaction*. Journal of Consumer Satisfaction. *Dissatisfaction and Complaining Behavior*, *3*, 1–11.

Hennig-Thurau, T., Gwinner, K. P., & Gremler, D. D. (2002). U*nderstanding relationship marketing outcomes: An integration of relational benefits and relationship quality. Journal of Service Research*, *4*(3), 230–247. doi:10.1177/1094670502004003006

Humphery, K. (1998). *Shelf Life: Supermarkets and the Changing Cultures of Consumption*. Melbourne: Cambridge University Press.

Johnson, M. D., & Ettlie, J. E. (2001). Technology, customization, and reliability. *Journal of Quality Management*, *6*(2), 193–210. doi:10.1016/S1084-8568(01)00037-2

Kalafatis, S. P., Pollard, M., East, R., & Tsogas, M. H. (1999). Green marketing and Ajzens theory of planned behavior: A cross-market examination. *Journal of Consumer Marketing*, *16*(5), 441–460. doi:10.1108/07363769910289550

Kilbourne, W. E. (1995). Green Advertising: Salvation or Oxymoron? *Journal of Advertising*, *24*(2), 7–19. doi:10.1080/00913367.1995.10673472

Kollmuss, A., & Agyeman, J. (2002). Mind the Gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research*, *8*(3), 239–260. doi:10.1080/13504620220145401

Kotler, P. (2000). *Marketing Management* (10th ed.). New Jersey: Prentice-Hall.

Kreidler, N. B., & Joseph, M. S. (2009). *How green should you go? Understanding the role of green atmospherics in service environment evaluations*. International Journal of Culture. *Tourism and Hospitality Research*, *3*(3), 228–245.

Kristensen, K., Martensen, A., & Grønholdt, L. (2000). Customer satisfaction measurement at post Denmark: Results of application of the European Customer Satisfaction Index methodology. *Total Quality Management*, *11*(7), 1007–1015. doi:10.1080/09544120050135533

Lunt, P. K., & Livingstone, S. M. (1992). *Mass Consumption and Personal Identity: Everyday economic experience*. Buckingham, U.K.: Open University Press.

Mainieri, T., Barnett, E. G., Valdero, T. R., Unipan, J. B., & Oskamp, S. (1997). Green buying: The influence of environmental concern on consumer behavior. *The Journal of Social Psychology*, *137*(2), 189–204. doi:10.1080/00224549709595430

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Marques, C. P., & Almeida, D. (2013). A Path Model of Attitudinal Antecedents of Green Purchase Behaviour. *Economia e Sociologia (Evora, Portugal)*, *6*(2), 135–144.

McDonald, S., & Oates, C.J. (2006). Sustainability: Consumer Perceptions and Marketing Strategies. Business Strategy and the Environment, 15, 157-170.

Mendleson, N. (1994). Environmental marketing business partnering at AFC developing strategic, Environmental Marketing: Critical Success Strategies for Reaching the Green Consumer. *Proceedings of The 1994 Conference* (pp. 87-103).

Meyer-Waarden, L. (2004, October 27-28). in Brătianu, C., Lixăndroiu D., Pop Nicolae Al. (Eds.), (2006). Business Excellence. *Proceedings of the International Conference on Business Excellence ICBE*, Braşov, România.

Miremadi, M. (2012). How much will consumers pay to go green. Retrieved from http://www.mckinsey.com/insights/manufacturing/how_much_will_consumers_pay_to_go_green

Mostafa, M. M. (2007). A hierarchical analysis of the green consciousness of the Egyptian consumer. *Psychology and Marketing*, *24*(5), 445–473. doi:10.1002/mar.20168

Mostafa, M. M. (2007). Antecedents of Egyptian Consumers Green Purchase Intentions. *Journal of International Consumer Marketing*, *19*(2), 97–126. doi:10.1300/J046v19n02_06

Obermiller, C., & Spangenberg, E. R. (1998). Development of a Scale to Measure Consumer Skepticism Toward Advertising. *Journal of Consumer Psychology*, *7*(2), 159–186. doi:10.120715327663jcp0702_03

Oliver, R. L. (1997). *Satisfaction: A behavioral perspective on the consumer*. New York: McGraw Hill.

Oliver, R. L. (2006). *Customer satisfaction research. The handbook of marketing research*. California: Sage.

Ottman, J. A. (1993). *Green Marketing: Challenges & Opportunities for the New Marketing Age*. Chicago: NTC Publishing Group.

Ottman, J. A., & ... . (2006). *Avoiding GreenMarketing Myopia*. *Issue of Environment*, *48*(5), 22–36.

Peattie, K. (2001). Golden Goose or Wild Goose? The Hunt for the Green Consumer. *Business Strategy and the Environment*, *10*(4), 187–199. doi:10.1002/bse.292

Peattie, K., & Crane, A. (2005). Green Marketing: Legend, myth, farce or prophesy. *Qualitative Market Research*, *8*(4), 357–370. doi:10.1108/13522750510619733

Peterson, R. A., & Wilson, W. R. (1992). Measuring customer satisfaction: Fact and artefact. *Journal of the Academy of Marketing Science*, *20*(1), 61–71. doi:10.1007/BF02723476

Phau, I., & Ong, D. (2007). An Investigation of the Effects of Environmental Claims in Promotional Messages for Clothing Brands. *Marketing Intelligence & Planning*, *25*(7), 772–788. doi:10.1108/02634500710834214

Pickett, B. J. (2008). Pro-environmental products: Marketing influence on consumer purchase decision. *Journal of Consumer Marketing*, *25*(5), 281–293. doi:10.1108/07363760810890516

PSBresearch. (2009). Retrieved from http://www.psbresearch.com/green_2009.htm#top

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

PSBresearch. (n. d.). Retrieved from http://www.psbresearch.com/green_JWT.htm

Roberts, J. (1996). Green consumers in the1990s: Profile and implications for advertising. *Journal of Business Research*, *36*(3), 217–232. doi:10.1016/0148-2963(95)00150-6

Rohm, A., & Swaminathan, V. (2004). A typology of online shoppers based on shopping motivations. *Journal of Business Research*, *57*(7), 748–757. doi:10.1016/S0148-2963(02)00351-X

Rust, R. T., & Oliver, R. L. (1994). Service quality: insights and managerial implications from the frontier. In R. T. Rust & R. L. Oliver (Eds.), *Service Quality: New Directions in Theory and Practice* (pp. 1–19). London: Sage. doi:10.4135/9781452229102.n1

Ryan, T. (2014). Green Intentions: An Exploratory Study on Advertising and the Environmental Movement. *Journal of Research for Consumers*, 26, 13.

Schendler, A. (2009). *Getting green done: Hard truths from the front lines of the sustainability revolution*. New York, NY: Public Affairs.

Schor, J. B., & Holt, D. B. (Eds.). (2000). *The Consumer Society Reader*. New Press.

Schwepker-Jr, C. H., & Cornwell, T. B. (1991). An Examination of Ecologically Concerned Consumers and their Intention to Purchase Ecologically Packaged Products. *Journal of Public Policy & Marketing*, *10*(2), 77–101.

Scott, M. S. (2007). How to Measure Customer Satisfaction: Satisfaction Measurement and Theory. Retrieved from http://www.aboutsurveys.com/how-to-measure-customer-satisfaction-satisfaction-measurement-and-theory/

Sima, V. (2010). Motivations for a Systemic Approach of the Innovative Strategies for a "Green" Product. *Petroleum-Gas University of Ploieşti Bulletin*, *12*(3), 104–111.

Sima, V., & Gheorghe, I. (2009). Eco-Efficiency – A Romanian Perspective. *Proceedings of the 11th IBIMA Conference, Creating Global Economies through Innovation and Knowledge Management* (pp. 1642-1650).

Sima, V., & Gheorghe, I. (2009). The Green Strategy Mix – A New Marketing Approach, *Proceedings of the 13th IBIMA Conference on Knowledge Management and Innovation in Advancing Economies, Analyses & Solutions* (pp. 1344-1347).

Sima, V., & Gheorghe, I. G. (2007). The Corporate Social Responsibility – a Modern Marketing Concept. *Annals Of The Oradea University*, *Fascicle of Management and Technological Engineering*, *6*(14), 2592–2596.

Sima, V., & Gheorghe, I. G. (2009). The Opportunity for a Reconsideration of the Dimensions of the Assessment Model of the Customers Satisfaction. *Communications of the IBIMA*, *9*, 64–68.

Sima, V., & Gheorghe, I. G. (2009). The 'Green Dimension' of Customer satisfaction. *Proceedings of the 11th IBIMA Conference, Creating Global Economies through Innovation and Knowledge Management* (pp. 1638-1641).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Stanciu, M. (2006). Metode de cercetare a modelelor de consum. Studii şi Cercetări Economice, 42.

TGI surveys. (n. d.). Retrieved from http://www.tgisurveys.com/knowledgehub/reports/KMR_TGI_Green_Values.pdf

Hansla, A., Gamble, A., Juliusson, A., & Gärling, T. (2007). The relationships between awareness of consequences, environmental concern, and value orientations. *Journal of Environmental Psychology*, *28*(10), 1–9.

Thøgersen, J. (2000). Psychological Determinants of Paying Attention to Ecolabels in Purchase Decisions: Model Development and Multinational Validation. *Journal of Consumer Policy*, *23*(3), 285–313. doi:10.1023/A:1007122319675

Tuna, Y., & Özkoçak, L. (2012). The First Step to Communication with Environmentally Responsible Consumer: Measuring Environmental Consciousness of Turkish Consumers. *Online Journal of Communication and Media Technologies*, *2*(3), 145.

Uhl, Ch. (2004). *Developing Ecological Consciousness: Path to a Sustainable World*. Rowman & Littlefield Publisher, Inc.

United Nations. (n. d.). Transforming our world: the 2030 Agenda for Sustainable Development. Retrieved from https://sustainabledevelopment.un.org/post2015/transformingourworld

Unpublished doctoral dissertation or master's theses:

Vavra, T. G. (1997). *Improving Your Measurement of Customer Satisfaction: A Guide to Creating, Conducting, Analyzing, and Reporting Customer Satisfaction Measurement Programs*. ASQ Quality Press.

Verhoef, P. C. (2001). *Analysing customer relationships: Linking relational constructs and marketing instruments to customer behavior* [Unpublished doctoral dissertation]. Erasmus University, Rotterdam.

WBCSD. (1996). A Changing Future for Paper. Retrieved from http://pubs.iied.org/pdfs/X136IIED.pdf

WBCSD. (n. d.). Corporate social responsibility. Retrieved from http://www.wbcsd.org/work-program/business-role/previous-work/corporate-social-responsibility.aspx

Westbrook, R. A., & Oliver, R. L. (1981). Developing better measures of consumer satisfaction: Some preliminary results. In K. B. Monroe (Ed.), *Advances in consumer research* (8th ed., pp. 94–99). MI: Association for Consumer Research.

Wirtz, J., & Lee, M.C. (2003). An examination of the quality and context-specific applicability of commonly customer satisfaction measures. *Journal of Service Research*, *5*, 345–355. doi:10.1177/1094670503005004006

Wiser, R. H. (1998). Green power marketing: Increasing customer demand for renewable energy. *Utilities Policy*, *7*(2), 107–119. doi:10.1016/S0957-1787(98)00005-8

Wood, W., & Neal, D. T. (2009). The habitual consumer. *Journal of Consumer Psychology*, *19*(4), 579–592. doi:10.1016/j.jcps.2009.08.003

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Wu, S.-I. & Chen, J.-Y. (2014). A Model of Green Consumption Behavior Constructed by the Theory of Planned Behavior. *International Journal of Marketing Studies*, *6*(5), 128.

Yi, Y. (1990). A critical review of consumer satisfaction. In V. A. Zeithaml (Ed.), *Review of marketing Chicago* (pp. 68–123). American Marketing Association.

Zairi, M. (2000). Managing customer satisfaction: A best practice perspective. *The TQM Magazine*, *12*(6), 389–494. doi:10.1108/09544780010351670

Zavestoski, S. (Ed.). (2002). *Anti-Consumption Attitudes: Psychology & Marketing, Special Issue*. New York: Wiley.

ADDITIONAL READING

Belk, R. W. (1995). Studies in the New Consumer Behavior. In D. Miller (Ed.), *Acknowledging Consumption: A Review of New Studies* (pp. 58–95). London: Routledge.

Belk, R. W., Devinney, T., & Eckhardt, G. (2005). Consumer Ethics Across cultures. *Consumption Markets & Culture*, *8*(3), 275–289. doi:10.1080/10253860500160411

Berry, L., Carbone, L. P., & Haeckel, St. H. (2002). Managing the Total Customer Experience. *Sloan Management Review*, (Spring): 85–89.

Burkart, K. (2012). *How to define the "green economy*, retrieved at 2013-23-11 from http://www.mnn.com/green-tech/research-innovations/blogs/how-do-you-define-the-green-economy

Cato, M. S. (2009). *Green Economics: An Introduction to Theory, Policy and Practice*. London: Earthscan.

Graedel, T. E., & Allenby, B. R. (2003). Industrial Ecology (2nd ed.). Upper Saddle River, NJ: Prentice Hall.

Grant, J. (2007). *The Green Marketing Manifesto*. John Wiley & Sons.

Gustafasson, A., Johnson, M. D., & Roos, I. (2005). The effects of customer satisfaction, relationship commitment dimensions and triggers on customer retention. *Journal of Marketing*, *69*(October), 210–218. doi:10.1509/jmkg.2005.69.4.210

Kennet, M., & Courea, E. P. (2011). *Handbook of Green Economics*. The Green Economics Institute.

King, A., & Lenox, M. (2002). Does it really pay to be green? *Journal of Industrial Ecology*, *5*(1), 105–117. doi:10.1162/108819801753358526

Kotler, Ph. (1969). Behavioral models for analyzing buyers, in Dimensions of consumer beahviour, New York: Meredith Corporation.

Lanktree, C., & Briere, J. (1991, January). Early data on the Trauma Symptom Checklist for Children (TSC-C). *Paper presented at the meeting of the American Professional Society on the Abuse of Children*, San Diego, CA, USA.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Milani, B. (2005). *What is green economics?* Retrieved from www.greeneconomics.net

Mintzer, M. (1992). Confronting Climate Change, Risks, Implications and Responses. Cambridge: Cambridge University Press.

Moisander, J. (2007). Motivational complexity of green consumerism. *International Journal of Consumer Studies*, *31*(4), 404–409. doi:10.1111/j.1470-6431.2007.00586.x

National Institute of Statistics of Romania. (2004). Tendinţe Sociale.

Neff, J. (2009). Green-marketing revolution defies economic downturn. *Advertising Age*, *80*(14). Retrieved from http://ecoamerica.typepad.com/blog/2009/04/greenmarketing-revolution-defieseconomic downturn.html

Peattie, K., & Charter, M. (2003). Green Marketing. In M.J. Baker (Ed.), The Marketing Book (5th ed., pp. 726-756). Butterworth-Heinemann.

Peattie, K., & Crane, A. (2005). Green marketing: Legend, myth, farce or prophesy? *Qualitative Market Research*, *8*(4), 357–370. doi:10.1108/13522750510619733

Porter, M. E., & Van der Linde, C. (1995). Toward a New Conception of the Environment-Competitiveness Relationship. *The Journal of Economic Perspectives*, *9*(4), 97–118. doi:10.1257/jep.9.4.97

Porter, M. E., & van der Linde, C. (1995). Green and competitive. *Harvard Business Review*, *73*(5), 120–134.

Salzman, M., & O'Reilly, A. (2010), *10 Trends in Mindful Consumption*. Retrieved from http://www.thenewconsumer.com/2010/10/29/10-trends-in-mindful-consumption/

Sima, V., & Gheorghe, I. (2008). Eco-Efficiency – A Romanian Perspective. *Proceedings of The 11th IBIMA Conference, "Creating Global Economies through Innovation and Knowledge Management"* (pp. 1642-1650).

Sima, V. & Gheorghe, I. G. (2014, May 20). Analyze of environmental performance in Romania based on Environmental Performance Index. *Proceedings of International Conference "Sustainable Energy Use and Management,"* Targu-Jiu, Romania (pp. 16-19).

Tse, D. K., & Wilton, P. C. (1988). Models of consumer satisfaction: An extension. *JMR, Journal of Marketing Research*, *25*(2), 204–212. doi:10.2307/3172652

Umweltbundesamt. (1997). *Nachhaltige Konsummuster und postmaterielle Lebensstile*, Berlin

Voigt, K. (2006). Business Sees Green in Going Green. CNN Report.

Wier, M., & Anderson, L. M. (2003). Demand for Organic foods: Attitudes, Values and Purchasing Behaviors. *Newsletter from Danish Research Center Farming.*, *2*, 1–3.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

KEY TERMS AND DEFINITIONS

Green Behavior: A pro-environmental behaviour, people being good administrator of natural resources.

Green Customer Satisfaction: A state which results from the green consumption experience, including: green product satisfaction, companies reputation and image satisfaction, and less harmfulness satisfaction.

Green Dimension: A new category proposed in order to model the customers' satisfaction. The main elements need to be had in sight are: superior energetic class, renewable energy, low polluting level, products with biodegradable compounds, organic food.

Green Product: An ecological product. It's manufacturing process and its use does not generate negative environmental effects.

Green Strategy Mix: A strategic system which integrates Planning Strategy, Processes Strategy, Product Strategy, Promotion Strategy, People Strategy, and Eco-Efficiency Strategy.

Sustainable Consumption: A consumption model which seeks to preserve resources for future generations to be able to satisfy their needs.

Sustainable Development: A concept 'that meets the needs of the present without compromising the ability of future generations to meet their own needs' (Brundtland Commission, 1987, Report of the World Commission on Environment and Development, United Nations). It includes economic development, social development and environmental protection.

This research was previously published in Socio-Economic Perspectives on Consumer Engagement and Buying Behavior edited by Hans Ruediger Kaufmann and Mohammad Fateh Ali Khan Panni, pages 59-92, copyright year 2017 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 58
Perception of Romanian Consumers on Ecological Products

Violeta Sima
Petroleum-Gas University of Ploieşti, Romania

Ileana Georgiana Gheorghe
Petroleum-Gas University of Ploieşti, Romania

ABSTRACT

This chapter aimed to investigate perceptions and attitudes of Romanian consumers about organic products, in order to study the connection between knowledge and attitudes of consumers and their place in purchase decision-making system to understand their behavior toward organic food. In the first part, after a brief introduction, the authors tried to perform a review of the literature in the field, starting from the presentation of the concept of green or ecological consumption behavior and the notions related to it. A synthetic scheme of the drivers of the green market was proposed as a conclusion of this introductory part. The main concern is about consumption of the ecological products in Romania. The authors identified a number of 17 relevant studies performed in Romania in order to help them substantiate their work. They took into account two issues, namely, Ecological Non-Food Products and Ecological Food Products.

INTRODUCTION

During the last years significant changes occurred within the trinomial including economic environment, ecological environment and social environment.

The economic environment together with the social one - represented in the new patterns of consumption - have influenced the ecological environment - represented by the environmental dimension of the consumption of goods and services.

Sustainable Consumption represents “that form of consumption which uses goods and services that respond to basic needs, enhancing the quality of life, improving resource efficiency and minimizing

DOI: 10.4018/978-1-5225-7915-1.ch058

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

emissions of waste and pollutants over the life cycle, so as not affect the future generations' lives" (Sima, V., Gheorghe, I. G., 2015).

In this context, the followers of eco-economic and eco-social models attempt to make their mark on consumerist tendencies, aiming to determine the orientation of both economic operators and population, towards more pronounced ecological and eco-social consumption patterns.

We can assume that the model of green economy begins to require and determine changes in consumer habits. The sustainable consumption models or the green consumption patterns began to dictate market trends.

A change of the consumers' behavior means primarily a fundamental transformation of the values and life style. Changing the thinking and action of consumers cannot be imposed by the authorities. The emergence of new and durable traditions in consumers' behavior requests a wise informing and consulting campaign.

The objective of this chapter is to investigate perceptions and attitudes of the Romanian consumers on ecological products, in order to study the connection between knowledge and attitudes of consumers and their place in purchase decision-making system to understand their consumption behavior.

BACKGROUND

The issue of organic products and how they are perceived in the market have become topics of general concern for researchers worldwide. The end of the twentieth century and beginning of XXI century were marked by a growth of the concerns in this area worldwide. Thus, new concepts have emerged and have been developed, such as: eco-attitude, sustainable consumption patterns, green behaviour, green attitude, green intention, green purchase, eco-consumer, eco-products (with many divisions), green market.

A large number of studies on green or ecological consumption behaviour found that consumers who concern more on environmentally friendly are characterised by a specific *eco-attitude*. This concept contains notions related to:

- Ecological Citizenship
- Environmental Citizenship
- Green Citizenship
- Ethical Investment
- Social Economy
- Sustainable consumption patterns
- Green Purchase
- Green Purchase Intention
- Green Purchase Behavior
- Green Purchase Attitude
- Eco–Consumer
- Eco-Products
- Green Market.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Ecological Citizenship, Environmental Citizenship, Green Citizenship

In a study published in 1994, Polonsky emphasized that citizens should be more involved at the individual level, in environmental issues, stressing that this is not only the problem of businesses and governments.

In the specialized literature Andrew Dobson is considered as playing a decisive role in defining these concepts, combining political discourse with economic theory (Hayward, 2006).

Ecological Citizenship refers to the orientation towards nature, given mainly two aspects, namely (Dobson, 2003):

- An action way that aims at valuing and protecting the natural environment;
- Awareness of the environmental balance of the activity at the individual level (individual ecological footprint).

In terms of theoretical discourse, there is a consensus regarding the need for an active environmental citizenship model. It is accepted that the transition to the sustainable society imposes in addition to institutional restructuring, changes at individual level of their convictions, attitudes and behaviour (Carter, 2007).

The concept of *environmental citizenship* was introduced by Environment Canada.

Environmental citizenship represents a way to build the sustainable society by determining people to move towards public environmental good, by giving up the traditional methods of stimulating the market dynamics.

According to Bell, McGillivray, Donald and Pedersen (2013) Environmental citizenship imposes individual responsibilities - a green lifestyle, direct participation in environmental decision making and holding businesses to account – and individual rights - access to environmental information, access to justice in environmental matters and clean and healthy environment.

Dobson (2004) makes a distinction between environmental citizenship and ecological citizenship. He argues that the environmental citizenship can be understood in the context of the relationship between rights and obligations at social-governmental level, having in sight a management-based approach. The ecological citizenship refers to the relationship between rights and obligations at the individual level.

Seyfang (2006) has highlighted relationships between ecological citizenship, local organic food networks and sustainable consumption, starting from the hypothesis that ecological citizenship represents an "an innovative new force" able to lead to sustainable consumption by involving local organic food networks.

In Dobson's opinion (2007), a distinction must be made between attitudes and behaviors. Thus, he considers that attitudinal changes are deeper - manifesting on long term - than behavioral changes – manifesting on short term. Dobson argued that the behavioral changes, caused by environmental citizenship considerations, take longer than those determined by classical fiscal stimulus.

A form of ecological citizenship is *the ethical investment*. The notion of *ethical investment* is widely used in the UK (Carter, Huby, 2004). It defines the type of investment that determines the implementation of the strategies for social responsibility.

According to Graham (2005), the concept of green citizenship includes both the environmental citizenship and the ecological citizenship as Dobson defined them in 2003.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Graham considered that the social economy is a framework for developing green citizenship, because the features of specific organizations offer the best possibility for citizens to express their environmental orientation. The social economy gives opportunities to the people to act on governance models, production and consumption, which directly affects their livelihood at individual and community level.

Sustainable Consumption Patterns

Considering the theory and practical reality, we can say that a new green model of consumption emerges, based on certain sustainable types of production. According to this model, consumers prefer to purchase green products because they can satisfy several eco-needs at the same price. This will determine the manufacturers to rethink classical products (Sima, 2014). But, consumers do not buy these products especially, because they will become more thoughtful and will look for obtaining certain advantages. Thus, they will consider the possibility to rent or share the products with other customers.

According to Sima and Gheorghe (2015) people should shift to a new model of consumption specific to the green economy. This sustainable consumption model is shaped by two main features, namely long term thinking and technological innovation. Taking responsibility for the current actions is important for keeping of the best possible development opportunities of future generations. Technological innovations aim to develop new products or new manufacturing methods, new technologies in order to meet the above mentioned needs.

Sustainable consumption patterns require a multi-level approach (Sima and Gheorghe, 2015):

- The administrative level. The correlation of the demographic policies with the economic, educational, and social ones is important. This may contribute to achieving an optimal balance between resources and needs of the population.
- The business level. Companies should assume more responsibilities in the environmental field. In their development strategies should be found more often specific goals, such as generating innovation and creating green jobs, implementing healthier and less polluting production processes, using the principles of eco-efficiency.
- The civil society level. Ecological citizenship should be promoted.

Green Purchasing

The concept of green purchasing can be found in theory as Environmentally Preferable Purchasing (EPP). It considers purchasing mostly of those products which generate less negative effects or, preferably, positive effects on human health and environment compared to similar traditional products.

Specifically, green purchasing refers to the entire production chain, from raw material acquisition, continuing with manufacturing, packaging, and distribution. But, also, operation, maintenance, and removal of the products are taken into account. Thus, this concept is related to other concepts, such as recyclable or reusable products, energy conservation and natural resources preservation.

Straughan and Roberts, in 1999, and Cornelissen et al., in 2008, showed that buying green products (Green Purchase Intention) is positively correlated with environmental concerning, i.e. Green Behavior.

In our opinion, the main advantages of green purchasing consist in:

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

1. Costs reducing and improving the environmental condition.
2. Developing of the markets for recycled materials.
3. Promotion of eco products (less toxic products) in order to protect health and safety of employees.
4. Energy saving and green products promoting.

Green Purchase Intention, Green Purchase Behavior, Green Purchase Attitude

These notions began to emerge in theory after 1990.Thus, since 1991, Schwepker-Jr. and Cornwell highlighted the importance of communication about environmental issues in order to determine buying green.

Yam-Tang and Chan, in 1998, and Fraj and Martinez, in 2006, revealed a direct link between concern for the natural environment and green purchasing behavior. A similar conclusion results from the study of Haron et. al. (2005), which states that sustainable consumption, can be correlated with awareness of the environmental issues.

There are studies (Chan, 2001, Beckford et al., 2010) demonstrating that Green Purchase Behavior is strongly determined by Green Purchase Intention.

Eco–Consumer

An eco-consumer can be defined as a person who is aware of environmental issues and obligations, and who supports its causes. He is willing to pay more for purchasing an eco-product compared to a classic one with similar features (Reitman, 1992).

Some researchers distinguish two categories of green behavior, namely, behaviors related to reduction of consumption of energy resources and green purchasing decisions and behaviors. Regarding the first category, it is about lowering use of private cars, reducing the temperature of the heating devices or reducing the consumption of water and electricity). In such cases, consumers are not obliged to additional expenses, but often changing of personal habits is imposed. But there are cases when green purchasing behaviors are followed rapidly by additional costs. In the second category purchasing of new equipment for home heating, purchasing and installation of insulation materials, energy-efficient household purchasing, substitution of classical lighting systems with CFL or LED systems etc. are included (Shabani, N., Ashoori, M., Taghinejad, M., & Beyrami, H., 2013).

In order to improve the efficiency of organic products marketing, green consumer segmentation is required. For this purpose, the traditional segmentation variables are used, namely, geographic, demographic, psychological and behavioral variables. One of the most often mentioned variables takes into account the ecological behavior theory. Thus, five types of green consumers have been identified.

In a study conducted in 1993, five categories of green consumers were identified, taking into account the behavioral, attitudinal and demographic variables. The five categories are (Iyer and Banerjee, 1993):

- **The True-Blue Greens:** They manifest the highest level of environmental awareness, being very willing to change their buying and consumption behavior;
- **The Green-Back Greens:** They are also committed to take green decisions, but not to the same extent as those in the first category;
- **The Sprouts:** They admitted that a change of the behavior is needed, but they are just started this journey;

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- **The Grousers:** They let environmental responsibility on behalf of companies;
- **The Basic Browns:** They do not wonder about the difference between behavioral patterns or do not even care.

In 1990 the Natural Marketing Institute (NMI) market has performed a segmentation of the green consumers market, considering more than 100 criteria. Five categories resulted:

- **The "LOHAS" Group (16%):** They have very innovative visions relating to the environment and society, generally, are always looking to find new possibilities to do more and do not care that they have to pay extra;
- **The "Naturalists" (25%):** They are the ones who are primarily concerned about themselves and their families health and wellbeing and then about the environment protection;
- **The "Conventionals" (23%):** They are interested in solving environmental problems, but they want a pragmatic approach, following return on of their actions;
- **The "Drifters" (23%):** They are not too concerned about the environment. Although they accept that there are problems, they prefer to postpone them, aiming firstly to obtain a more favorable social image;
- **The "Unconcerned" (14%):** They are the least interested in environmental issues. Their purchasing decisions are based mainly on price, value, quality and comfort (Molyneaux, 2007).

Applying the principles of social economy generates obligations to the business environment. Thus, companies must increase the degree of transparency. It is their responsibility to show clearly and correctly characteristics of the products offered, highlighting their environmental characteristics. The task for marketers is to identify green consumers. A correct and effective communication is the tool that can help in achieving this objective. (Rex and Baumann, 2006, Mintz, 2011).

Eco-Products, Ecological Products, Green Products

Green products refer to products presenting the highest ecological / environmental criteria and concerns, according to the EU eco labeling schemes or other similar protective instruments and initiatives (e.g. EMAS, Energy Star, Carbon Neutral etc). Green products also refer to non-food products which respect the highest ecological / environment criteria during their entire life cycle, according to the EU eco-labeling schemes or other similar initiatives to environmental labels (such as Blue Angel, Energy Star, EU energy labels or Carbon Neutral).

In terms of food products, promotion of green products will reduce the environmental impact caused by the production and consumption of non-organic products, since consumers will identify them and they will prefer them to other products. As a result, more and more real "green" will be produced and consumed, and thus increasingly fewer "non-green" goods will be cultivated and consumed. It is obvious that this will change models / patterns of production and consumption and environmental pressure will be minimized.

Ecological products have to meet certain evaluation criteria, such as weight reduction, product longevity, ease of disassembly, reusable components, recyclable package materials, energy efficiency, resource recycling, and conservation. The evaluation criteria depend on the product area.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Most studies have shown that most of the people consider that green product prices are higher than those of similar conventional products. However, an increasing number of people are willing to buy these organic products (Bhate and Lawle, 1997).

Therefore, it is found that clients have expectations about that all products should meet environmental safety without reducing their quality. This means that, in terms of product quality, eco-consumers have high expectations from the business. The producers of green products must be concerned about the products quality and their environmental benefits. Meanwhile, in order to obtain the best possible image in the market, they need to consider an as effective as communication of these concerns to customers. D'Souza, Taghian and Lamb, 2006).

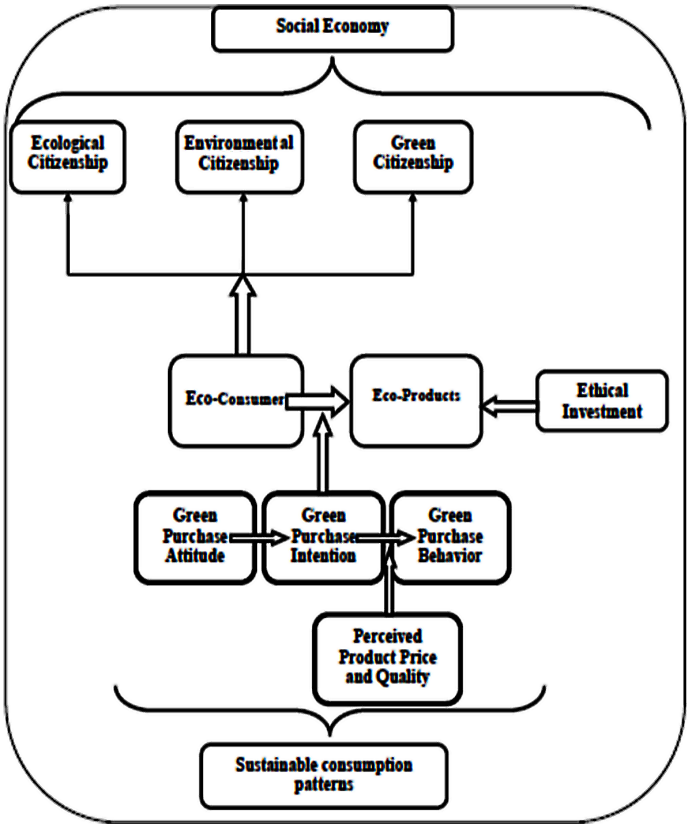
Consumers look for personal benefits in chosen products and, consequently, in the green products, too.

Most often mentioned 'green products' are:

- Organic food
- Renewable energy.

But, besides these, we identified some important green issues for products/services: superior energetic class, low maintenance requirements, low polluting level, biodegradable/recycled compounds, no highly toxic compounds, being easily reused, recyclable or biodegradable etc.

Figure 1. The Drivers of Green Market
Source: Proposed by the Authors



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Thus, Sima and Gheorghe (2009) identified three types of green issues:

- Environmental issues, which appear having less resonance with consumers than other factors in the 'ethical space'
- Personal and health benefits offered by more sustainable products
- Social factors, like animal welfare, which weigh in more heavily with mainstream consumers than broader environmental factors such as carbon footprint, according to some recent research.

Customers are increasingly drawn to businesses, products and services that are green, organic, natural, clean, and sustainable (Sima and Gheorghe, 2009):

- Organic retail sales have grown
- Green buildings are forecast to grow
- Growth of sales of organic food products with antioxidants, fiber, no preservatives
- Natural and mineral water and nonfizzy drinks have grown.

Green Market

Green market features arise from specific relationship between supply and demand. The demand starts from the eco-consumer and the supply is provided by the manufacturer of eco-products.

CONSUMPTION OF THE ECOLOGICAL PRODUCTS IN ROMANIA

Motivation

The ecological products have demonstrated that they are positively distinguishable from the classical ones. Thus, supporting the eco-markets development should be based on the knowledge of demand for organic products. Promoting of permanent education about responsible consumption is essential.

This analysis is justified by the following considerations:

- In recent years at the level of the world market and of the Romanian one, an increasing demand for organic products was recorded.
- Knowledge of the ratio between imports and exports of organic products in Romania is important for the analysis of the specific market.
- Knowledge of the factors influencing consumption of organic products constitutes a key - element in order to formulate the marketing - mix of these products:
    - The development of products which correspond as much as possible to the requirements and expectations of the Romanian eco-consumers;
    - Development and implementation of an appropriate pricing strategy, especially given the fact that there is a perception that organic products have higher prices than similar classical products.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- Concerning promotion, a decisive role could play consumer education and their correct and transparent information on the potential advantages and disadvantages of organic products compared with similar classical ones.
- The distribution of organic products should take account of certain issues such as:
  - With regard to food products, they do not have preservatives, additives, which require providing certain conditions of storage and transport.
  - The packages must be also recyclable.

Objectives

Recent studies based on statistical data and market research have shown that, currently, the market for organic products show an upward trend in Europe and globally. In Romania ecological agriculture represents a niche market that is not exploited enough, but which has a great development potential. In this context the role of the consumer is crucial for trends and perspectives for future development of environmental markets.

Our demarche has envisaged understanding of some certain issues:

- Knowing how consumers define ecological products;
- The advantages offered by the organic products;
- Knowledge of the main factors which stimulate consumption of organic products;
- Knowledge of the main factors impeding consumption of organic products;
- Description of the profile of the consumer of ecological products.

Studies About Consumption of the Ecological Products in Romania

We have identified a number of 17 relevant studies performed in Romania in order to help us substantiate our work. These studies aimed to identify the main determinants of green purchasing decisions of eco-products, knowledge of the factors influencing green consumption and determining increase the role of green orientation. Their conclusions were a starting point for our work (table no. 1).

Ecological Non-Food Products

Green began to be increasingly fashionable not just on the food market, but also on the market of non-food products. Both retailers and discounters make plans related to organic products and both food and non-food. Thus, in early 2012, the Cora retailer launched the first organic cotton textiles line. Other examples are: the automotive market (Dacia is developing a hybrid engine; it's about Dacia Hamster Hybrid Electricway), the tourism sector (hotels such as Saturn Vega and Meitner), and also, the real estate sector. Thus, the Ozone Homes Company, part of the South Pacific Construction already sells green houses with diminished utility bills up to 35%.

Also, ecological furniture of solid wood is well represented in Romanian exports. Cosmetics market also reflects the transformation of ecological culture in Romania. Creams with parabens are now replaced with olive oil creams. Romanian consumers adapt to novelty. They got to the border between "fad" and "it should be conscious". Beyond this border the market will increase due to the growing interest for healthy lifestyles.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 1. Brief presentation of the studies about consumption of the ecological products in Romania

No.	References	Period	Method	Results
1	Green Thinking. (2008). Daedalus Consulting Public Study Prepared for: Green Report	2008	• Quantitative research • Sample consisting of 1003 people	• In terms of willingness to pay more for "green products", the organic foods were most often mentioned, probably because they have the most direct impact on human health.
2	Popa, M., Popa, Al., Drăghici, M., Miteluț, A. (2008). Preliminary research on the situation at national and European level in the production and marketing of ecologic food products on the determinants of eating behavior and methods of investigation used/	2008-2011	• Exploratory research • Qualitative and quantitative market studies: • Four focus group interviews, • 55 in-depth interviews, • Visits to outlets in 20 locations • A survey research, using questionnaires - sample consisting of 1350, of which 1252 completed questionnaires	• Development of a complex behavior pattern of the consumer of food ecological products, enabling the development of specific methods and marketing tools for a possible international niche market for Romanian food eco-products. • Drafting a guide of best practices for business development of the agri-food producers.
3	Popa, Al., Hubbard, C., Gorton, M. & Du, F., Consumer perception about ecological products in Romania and China	March 2009	• Qualitative research • Four focus groups • Semi-structured interview • Interview participants: buyers and un buyers	• The ecological products were defined as products without pesticides / fertilizers and without "ingredients" (additives or preservatives). • The ecological products have been associated with health. • In terms of attraction, the ecological products are considered as being less attractive and having some "defects". • The ecological products are considered as expensive, luxury, addressing to a small part of the population. • An interesting finding is the lack of confidence in this product labels. • The main features of the ecological products market are: a poor supply, a reduced variety and a poor accessibility. • The profile of the customer of organic products: well informed, high educated, with knowledge about organic products and diets and about their impact on health, with a monthly income above average, less interested in the environment and animal welfare, being more concerned about his health and his family health (particularly, about his children health).
4	Boldureanu, G.,Consumer behavior of Romanian Ecological Products	09-14 March 2009	• Sample consisting of 64 people • Oral face-to-face interview in a supermarket in Iasi	• The high prices of organic products and a very small number of producers in Romania are the main determinants of the very low dimensions of the specific market. • Price is a very important criterion in consumer purchase decision. • There is a low degree of consumer information about the importance of environmental criteria in purchasing decisions of organic goods.
5	Dinu, V., Schileru, I., & Atanase, A., Attitude of Romanian Consumers Related to Products' Ecological Labelling	April 2009	• Analytical report of the Europeans' attitudes towards the issue of sustainable consumption and production	• Romanian consumers have a low level of understanding of their environmental impact. This leads to a low level of social pressure on companies to transform their products or procedures. The conclusion is that there are necessary measures to raise public awareness on these issues.
6	- The First Phase of the "Promoting Green Products" project (LIFE+08/INF/RO/0005) - Green Pro, a project funded by European Commission through LIFE + Program	July 2010 -October 2010	• 1140 questionnaires filled in shops and commercial areas by randomly selected people all over Romanian territory.	• The results showed clearly that people need help in order to identify green products and understand their benefits.
7	Pál, Z., Considerations Regarding the Relation between Final Consumers' Knowledge and Attitudes toward Organic Foods and their buying Behavior	2011?	• Sample consisting of 431 people, but 24 questionnaires were eliminated because they were uncompleted. • - The sampling method was empirical, however, considering certain details obtained from previous research. These research showed that the people who show stronger interest towards these products are young, married and with children, with high income and high education level.	• A favorable attitude toward organic food leads to stronger purchase intention. • In addition to basic elements of the theory of planned behavior, the subjective knowledge owned by consumers has a positive impact on the intention to buy organic products. • In absence of clear information, especially from certification, consumers form their own image about how an organic product should be.
8	Kane, K. & Chiru, C. & Ciuchete, S. G., Exploring the Eco-attitudes and Buying Behaviour of Facebook Users	July 2011 -August 2011	• An online, unrepeated survey • Sample consisting of 421 Facebook users. • The snowball sampling technique was used.	• "Facebook represents an effective and innovative environment that could build the necessary links between green attitudes and consumers' hearts and minds."
9	Research Report. Image organic food products (ECO) on the Romanian market and Moldavian	December 2011 - January 2012	• Quantitative research • Sample consisting of 225 people, structured according to the main demographic criteria • Face-to-face interview	• The main perceived qualities of ECO foodstuffs which should be considered in the promotion strategies are: a reduced content of artificial chemicals, a better tasting, a better quality and the fact that they are healthier than the usual ones. • Also, labeling and appearance are factors which influence the purchase decision and should be considered in the marketing strategies of ECO products.

continued on following page

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 1. Continued

No.	References	Period	Method	Results
10	Pastiu, C. A., Green Purchase Intentions of Romanian Consumers	2012*	• Probabilistic quantitative research • Sample consisting of randomly selected 110 students from the "1 Decembrie 1918" University of Alba Iulia	• The Green Purchase Intention is influenced by the knowledge level of organization's *green image*, *perceived price* of the product, and perceived quality of the product. The most important are product quality and price, being followed by the production company image. • There is a trend of consumers to buy and consume organic products. Branding and companies' efforts to shape a green image contributed to the increase of using these types of products.
11	Simionescu, M.,A Profile of Romanian Highly Educated Eco-Consumers Interested in Product Recycling. A Statistical Approach	2012*	• Sample consisting of 500 people with high education from Romania • The method used for data collecting is the questionnaire	• The well-educated eco-consumer, interested in recycling is a determinant factor of the economic efficiency in Romania.
12	The Second Phase of the "Promoting Green Products" project (LIFE+08/INF/RO/0005) - Green Pro, a project funded by European Commission through LIFE + Program	March 2012 – May 2012	• Sample consisting of 1055 people • The Second Phase of the "Promoting Green Products" project	• The proportion of consumers who consider themselves fully informed about the environmental impact of products used by them has increased significantly. • The numbers of people who take into account the environmental impact when they buy different products increased. • The reliability of buyers for environmental information found on labels has increased significantly.
13	The Third Phase of the "Promoting Green Products" project (LIFE+08/INF/RO/0005) - Green Pro, a project funded by European Commission through LIFE + Program	February 2013 – May 2013	• Sample consisting of 1066 people • The Third Phase of the "Promoting Green Products" project	
14	Tănase, L. D., Roşca, M. I. & Jurcoane, Al., The Perception on Ecological Products - A Research on the Urban Consumer	*	• Three focus groups consisting of 25 buyers were interviewed. • The segmentation criterion of the buyers was the products certification: certified organic products, uncertified organic products and both certified and uncertified organic products.	• There is a difference between those who buy certified green products and those who buy uncertified green products in terms of the trust in the seller. Those who buy certified products are more educated and do not trust the sellers while the others focus more on the direct relationship they develop with the seller – producer, having not confidence in the current certification label.
15	Dinu, T. A., Stoian, E., Micu, M. M., Condei, R., Niculae, I., Study regarding consumption of organic products in Romania	2013*	• Quantitative research about organic products consumption • Sample consisting of 488 respondents	• The study showed an increasing interest of consumers for "healthy" products, so this should lead to an increase in the Romanian organic products market.
16	Roman, T., Bostan, I., Manolică, A., & Mitrica, I., Profile of Green Consumers in Romania in Light of Sustainability Challenges and Opportunities	2014*	• Quantitative research • The tool used was the questionnaire • Sample consisting of 150 respondents • A quota sampling method was used, using two variables: sex and age.	• Green marketing practices have recently increased, leading to the fact that consumers largely know about the concept of green consumption. It can be argued that an increase of the level of information and of the degree of influence to adopt such behavior, are possible. • Although there is a willingness to adopt a behavior with a much lower environmental impact, there is the issue of a price too high of the organic products and of the lack of information about them. This lead to an inadequate behavior towards the environment. • The best "green" customers are young well educated women with children, with high incomes.
17	Voinea, L., Popescu, D.V. and Negrea, M.T., Good Practices in Educating and Informing the New Generation of Consumers on Organic Foodstuff	March - May 2014	• Exploring marketing research • The tool used was the questionnaire • A pilot survey designed to test the questionnaire • Sample consisting of 62 people	• Among the new generation of Romanian consumers there is a favorable image of the ecological food products, especially based on the provenance from the ecological agriculture, certified by the logo • "eco"/ "bio"/ "organic".

* For these studies the authors were not able to clarify the data on which research was conducted.
Source: based on authors` own literature studying

A study conducted in 2008 (Green Thinking, Daedalus Consulting Public Study Prepared for: Green Report) showed that among non-food ecological products renewable energy and biodegradable products were those for which people were willing to pay on average 11% more. 90% of Romanian consumers claimed to have the willingness to pay more for environmentally friendly products, ahead of countries like Germany, USA and UK. These results were explained by the fact that those countries, being subjected to the rigors of environmental discipline, they have experience of higher costs. Therefore they exhibit a lower receptivity to these products.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

An ecologic label is a helpful tool for producers in order to communicate as effectively. Eco-label procedures and conditions of use are clearly regulated. Thus, in Romania, as in the EU, there are specific criteria for each product category (Dinu, Schileru and Atanase, 2012).

A study published in 2014 showed that in terms of organic products bought by Romanian people, green light bulbs stand out, being purchased by 81% of respondents. These are followed by natural cosmetics (60%) and energy efficient appliances (43%). Romanian people are less interested in recyclable packaging (24%), rechargeable batteries (13%). However, quite numerous people said they are not aware of any ecologic product.

Considering the relationship between concern for environmental issues and purchasing behavior, the natural assumption is that a proactive attitude towards caring for the environment should determine it. However, the study results mentioned above showed otherwise. This was demonstrated by regression analysis, which showed that concern for the environment does not explain satisfactorily the adoption of an ecologic purchasing behavior, but other factors should be considered.

Analysing the relationship of the Romanian consumers with ecological products, three issues were highlighted, namely:

1. They have confidence in this type of products because natural ingredients are used for their manufacture - is most often the cosmetics case;
2. They consider beneficial to health;
3. They perceive them as having higher prices than the similar classical ones.

Reasons for Romanian consumers to buy ecological products are, in order, the following:

1. The ecological products are considered healthier compared to the classic similar ones;
2. The use of ecological products reduce costs on long term, as they are more energy efficient than the similar classic ones - is most often the energy efficient appliances case or the fuel-efficient cars case;
3. The ecological products have a positive impact on the environment;
4. Purchasing ecological products represents a modern trend.

Demographic variables occupy an important place among observable influences acting on consumer behavior (Cătoiu and Teodorescu, 2004). Thus, identifying the relationship between green behavior and demographic variables is essential. Four demographic variables were considered most often, namely, age, gender, education level and income.

In terms of age, there are several studies that have stated that, generally, young people show a higher tend to adopt environmentally responsible behavior. Regarding the buying and consumption behavior of ecological non-food products, it was highlighted that young people are more likely to unplug electrical appliances when they are not in use.

Regarding gender, Romanian consumer behavior is similar to that of consumers abroad. Thus, women appreciate more than men the green values, being more willing to adopt green purchasing behavior. They are willing to give up the use of certain products only for environmental reasons, they have a value system in which the environment is important, and they are more willing than men to buy less polluting products, such as cars with small capacity engine.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Regarding the level of education, the results of the studies carried among Romanian consumers are similar to those of studies conducted abroad. Thus, as the level of education is higher, the probability of adopting an ecologic consumption and buying behavior is more. This behavior can be attributed to a growing awareness and level of demands with increasing the level of education.

In terms of income, the results of the studies carried among Romanian consumers are somewhat contradictory. Thus, there are many studies (Green Thinking, 2008, Popa, Popa, Drăghici and Miteluţ, 2009, Tănase, Roşca and Jurcoane, 2012, Kane, Chiru and Ciuchete, 2012, Roman, Bostan, Manolică and Mitrica, 2015) showing that people who have a high income are more willing to adopt an ecologic behavior. But there are studies that say that any connection cannot be done between the two variables. The study published in 2014 (Roman, Bostan, Manolică, and Mitrica, 2015) showed a significant positive correlation between income and tend to reduce plastic bag use. However, this correlation failed to clarify whether this behavior was prompted by concern for the environment or just for financial reasons.

Ecological Food Products

Nowadays almost every product has an eco-version, whether we are talking about foodstuffs, cosmetics, baby products, clothing, appliances, electronics, automobiles or homes. Since 1 July 2010, the ecological products manufactured in the EU are identified by the organic logo "Euro-leaf".

A study published in 2009 (Popa, Popa, Drăghici and Miteluţ) aimed, among other things, to evaluate the respondents perception about three concepts, namely, natural, ecologic (organic) and traditional agricultural foodstuff. The answers show that the concepts are somewhat confusing for respondents. Thus, organic foods were defined as being characterized by the following attributes: no chemicals in their composition, use of green fertilizers, a certain process for their obtaining, natural, produced from a clean environment, without effects on the environment, certification, without genetic modifications, obtained from organic farms, other attributes ("expensive", "quality").

The Ministry of Agriculture officially designated the use of the word "ecologic".

Regarding whether respondents had information about organic products, in the above mentioned studies it was found that the majority was represented by people who knew nothing or had little information about organic products, totalizing almost 60%.

As regards the availability of information about ecological products, it was found that over 80% of the surveyed people consider that this kind of information is accessible or very affordable.

By age, the age group between 18 and 25 years, representing almost a half of respondents (48.8%), believe that information is accessible to very easily accessible. At the opposite end, are those aged under 18 and over 56 years. Under 0.5% of them believe that information about ecological products is accessible.

Although, in terms of the interest in consumption of ecological products, it is important or very important for more than a half of the respondents, in terms of consumption of organic products, over 90% of respondents said they had consumed such products.

The consumption of the ecological products could increase, first, whether the price of these products would become comparable to that of the similar non-ecological ones and, secondly, whether consumers would really be convinced that they have environmentally friendly features.

Organic food products have a positive image as compared with conventional similar for two-thirds of the respondents (67.8%). Most often nominated makers forming this positive image are (Voinea et al., 2015):

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- The fact that they come from organic farming
- The fact that they that are certified ("eco" / "bio" / "organic") (87.1%),
- The fact that they that have additional nutrients having a positive impact on health (protein, vitamins, minerals, essential fatty acids, fiber),
- The fact that they that have added low-substances that have a negative impact on it - salt, sugar, saturated fat (in the processed food) (both 79%),
- The fact that they that shows greater food security (72.6%), and
- The fact that they that have superior organoleptic properties (66.1%).

The „AE" logo is the specific national logo for organic products. This, together with the EU logo can be used aiming a better viewing of the products obtained from organic farming.

The study published in 2009 showed that only a quarter of respondents knew this logo and its significance.

According to Voinea et al. (2015), organic food can be grouped by their origin and technological processing:

- primary unprocessed plant products of plant origin;
- unprocessed animal products;
- processed products for human consumption, prepared from one or more ingredients of plant origin and / or animal origin."

In a study on organic foods, conducted between 2008 and 2011, and funded by the FP7 program - Area 2.2.1. - Consumers, which had the general objective: understanding the consumer behavior and his preferences as a major factor in the competitiveness from the food industry and the impact of nutrition on health and well-being of European citizens, under 33% of respondents said that at least partially, they had good knowledge about organic foods, percentage who has far surpassed those that consider they had little knowledge about the organic products (over 44%).

The yield of ecological production is on average with 20% less than that of conventional agriculture. This is, moreover, why the eco product price is at least 30% greater than that of conventional ones.

In a study published in 2008 (Green Thinking, Daedalus Consulting Public Study Prepared for: Green Report) it is shown that, in terms of willingness to pay more for green products, organic foods receive the largest number of mentions, probably because they have the most direct impact on personal health. Thus Romanian consumers were willing to pay on average 17% more for organic foods to traditional.

In the study published a year later, in 2009 (Popa, Popa, Drăghici and Miteluţ), these issues were further analysed. Thus, more than three quarters of respondents said they were willing to pay more for a green product than for a classic product. Of these, almost a half would be willing to pay up to 10% more, almost a quarter would be willing to pay 10-20% more, and the others in varying proportions, percentages from 20% to over 70%. It should be noted that 2.1% of the respondents would be willing to pay even 50% more.

In the same study the drivers of this behavior are detailed. Thus:

The factors which stimulate such behavior are:

- The ecological products are healthy products (translated by consumers that they do not contain Es, GMOs, fertilizers or pesticides).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- The ecological products are natural products.
- The ecological products are tastier (no artificial taste of supermarket products, but that of the traditional products).
- International certification schemes are reliable.

The factors which prevent such behavior are:

- The ecological products are expensive.
- The ecological products are difficult to differentiate of products from < peasants> uncertified.
- The ecological products have range restricted (especially fruits and vegetables and meat products).
- The ecological products are found only in a few specialized stores and premium retail supermarkets.
- There is no true ecological production (Romanian producers do not comply with the rules of organic production system).

The problem of consumption and purchasing of organic products began to attract increasingly more interest from Romanian researchers, especially in recent years, aiming the knowledge of the main advantages and barriers to buying organic foodstuff. Thus, a key element is represented by the correlation between the consumption of organic food and a better health.

A study conducted by the Institute for Life Quality Research showed that Romanians increasingly require green products and services. In addition to private households, which determines one of the major consumer groups, the army, the authorities, NGOs, institutions are major categories that use natural products. Researchers stress that the change of consumer habits primarily involves a transformation of values and lifestyles.

Another interesting finding of the study was that the above-mentioned hours of environmental education should be introduced in schools to expose the risks but also the benefits of organic life. The excessive industrialization, fleet of private and companies cars, without catalytic filters, very bad infrastructure, excessive use of fertilizers could be some of the main responsible for the pollution in Romania.

Domestic consumption of organic foods was below 0.1% far below the global average of 0.7%, according to a study published in 2008 (Green Thinking, Daedalus Consulting Public Study Prepared for: Green Report). The internal production of organic food was grown mainly (approx. 90%) due to export demand in countries like Germany, Austria or Greece. From the point of view of the Romanian consumer, an organic product meanings a premium price for a product that offers the same perceived benefits as classical product which could be obtained on the market for a price up to 70% below or in the countryside garden of his grandparents.

An analysis whose results were published in 2014 (Dinu, Stoian, Micu, Condei & Niculae), which aimed to study the consumer of organic products in Romania, showed that young people are the main consumers of these products. Regarding gender distribution of consumption, paradoxically, women are exceeded by men. This result is somewhat contradictory to the results of a study conducted between December 2011 and January 2012, which claims that a higher percentage of women consider that the eco-foodstuff are healthier than the classical ones.

The increasing the frequency of organic food consumption may be driven by price and by ensuring that the purchased product is really organic.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

With regards to understanding the decisional process of purchasing the ecological food, it was motivated basically by: consumer safety, the ratio quality-balanced price, high nutritional value, the presence of the mention "100% natural" on the package.

Regarding the purchasing points, ecological products are bought more often from specialized stores, but also from food stores or online stores. (Voinea et. al., 2015, REMBRANDT, 2011-2012)

The criteria that have the greatest influence on consumers in choosing organic processed foods are: the inscription with the logo of "eco" / "bio" / "organic", the list of ingredients on the packaging, the existence of nutrition label (Voinea et. al., 2015).

Regarding the image of organic products among consumers, we can say that it has become increasingly better. This is based, firstly, on the results of certain research which demonstrate that nutrient content of organic products has positive effects on people's health. Another important element is represented by the monitoring and certification, enhancing the consumer confidence.

Organic food is a growing market in Romania, which has growth potential even in crisis conditions. However, in our opinion there are some barriers to its development, which must be minimized by traders through:

- Communication of the differentiating elements which are relevant for consumers for certified organic products against products "from peasants", focusing on the guarantee and the confidence provided by a certification scheme
- Diversification of the market categories of organic products, especially vegetables & fruits and meat products
- Extending the availability of organic products for an easier access to these products.

FUTURE RESEARCH DIRECTIONS

A better clarification and education of the population is required regarding the notions of ecological, bio, organic and natural. Because they are considered healthier for the environment and people than the regular ones, a promotion opportunity is to inform people about the standards they must meet. Given the current trend of environmental protection, to promote and to raise the awareness of these issues could offer a better image and attractiveness for the ecological products.

Considering the above, we believe that a national representative research should be carried out in order to study consumer buying behavior and consumer Romanian green. In this respect, an approach by comparison with the EU consumer behavior should be appropriate.

Given these, we propose some future research directions:

- Identifying and categorizing the ecological products which are traded on the Romanian market, based on market studies;
- Promotion of the green products marketing by:
  - Specialized web sites;
  - The use of modern methods of communication: newsletters, online banners;
  - Awarding of the Top Rated green products;
  - Awarding of the companies which get the best results on the ecological products market;
- Educating and informing consumers about:

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

  - Use of ecological products;
  - Advantages of replacing the non-ecological products with the ecological ones;
  - Financial and environmental benefits of the ecological products production and distribution, in order to provide a motivation for the consumers;
- Introducing at different levels into teaching curricula of the study subjects about ecological products;
- Initiation of informative workshops, in which the major benefits of the ecological products market should be presented and analyzed;
- Training of personnel in the spirit of the green values (values related to organizational culture directed toward environmental protection);
- Awareness and recognition by the consumers of the real benefits of the green products (here models of good practice of promoting the green products are important).

CONCLUSION

In a report released in 2009 (Popa, Popa, Drăghici and Miteluţ) it was stated that Romanian organic market "will reach about two percent in the next five years, Romania recording [...] higher development trends in this sector than other European countries".

Generally, the criteria underlying product purchase decisions are, in order: quality / price ratio, followed by the price itself and only then are taken into account aspects such as environmental impact, packaging, advertising.

In terms of willingness to pay more for a green product, a study conducted in 2008, by order of Green Report (Green Thinking, Daedalus Consulting Public Study Prepared for: Green Report), showed that nearly 59% of Romanians have declared a total agreement to do this. The percentage rose to 65%, according to results published in 2015 (Roman, Bostan, Manolică, & Mitrica, 2015). This shows an improvement of green purchasing behavior, although it is still room for improvement.

Related to the level of knowledge about the environmental impact of products, the results indicate the following: less than 40% of respondents had a high degree of knowledge, but the majority is represented by those having a low level of knowledge. This shows that people are not informed about these issues. One of the causes of this low level of awareness may due to the improper communication performed by the manufacturing companies about the products they sell. Another problem could be represented by the low level of promotion of the environmental issues among the population.

The idea that emerges from this is that the reason that stated intention to behave ecologically not necessarily materialized is that the environmental impact is not considered too much.

From the viewpoint of the manufacturing companies, the ecolabel is a key element in informing potential clients. This is primarily meant to signal an eco-friendly product. From the perspective of the Romanian customers, a high percentage of them, namely 80%, said they had seen / heard of green label, considering that it's most important significance is that it shows a proper product for the environment.

An important result, emanating from many studies, is that, in Romania, we cannot speak about a significant stream of those who buy green products or who have a green behavior, or at least not yet. This conclusion is supported also by the analysis of time period between two successive purchases of ecological products, which, in many cases, exceed six months.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

REFERENCES

Afzaal, A., Athar, A. K., & Israr, A. (2011). Determinants of Pakistani Consumers' Green Purchase Behavior: Some Insights from a Developing Country. *International Journal of Business and Social Science*, *2*(3), 217–226.

Beckford, C. L., Jacobs, C., Williams, N., & Nahdee, R. (2010). *Aboriginal Environmental Wisdom*. Academic Press.

Beckford, C. L., Jacobs, C., Williams, N., & Nahdee, R. (2010, June 23). Stewardship,and Sustainability: Lessons From the Walpole Island First Nations, Ontario,Canada. *The Journal of Environmental Education*, *41*(4), 239–248. doi:10.1080/00958961003676314

Bell, S., McGillivray, D., & Pedersen, O. W. (2013). *Environmental law* (8th ed.). Oxford, UK: Oxford University Press. doi:10.1093/he/9780199583805.001.0001

Boldureanu, G. (2009). Consumer behavior of Romanian Ecological Products. Lucrări Ştiinţifice USAMV Iaşi. *Seria Agronomie*, *52*(2), 199–202.

Carter, N. (2007). *The politics of the environment: Ideas, activism, policy* (2nd ed.). Cambridge, UK: Cambridge University Press. doi:10.1017/CBO9780511819179

Carter, N., & Huby, M. (2005). Ecological citizenship and ethical investment. *Journal of Environmental Politics*, *14*(2), 256–258.

Cătoiu, I., & Teodorescu, N. (2004). *Comportamentul consumatorului* (2nd ed.). Bucharest: Ed. Uranus.

Chan, R. Y. K. (2001). Determinants of Chinese Consumers' Green Purchase Behavior. *Journal of Psychology & Marketing*, *18*(4), 389–413. doi:10.1002/mar.1013

Cornelissen, G., Pandelaere, M., Warlop, L., & Dewitte, S. (2008). Positive cueing: Promoting sustainable consumer behavior by cueing common environmental behaviors as environmental. *International Journal of Research in Marketing*, *25*(1), 46–55. doi:10.1016/j.ijresmar.2007.06.002

D'Souza, C., Taghian, M., & Lamb, P. (2006). An empirical study on the influence of environmental labels on consumers. Corporate Communications. *International Journal (Toronto, Ont.)*, *11*(2), 162–173.

Dinu, T. A., Stoian, E., Micu, M. M., Condei, R., & Niculae, I. (2014). Study regarding consumption of organic products in Romania. Scientific Papers Series Management. *Economic Engineering in Agriculture and Rural Development*, *14*(2), 116–117.

Dinu, V., Schileru, I., & Atanase, A. (2012). Attitude of Romanian Consumers Related to Products' Ecological Labelling. *The Amfiteatru Economic Journal*, *14*(31), 12–13.

Dobson, A. (2007). Environmental citizenship: Towards sustainable development. *Journal of Sustainable Development*, *15*(5), 282–283.

Dobson, A. (2004). *Ecological Citizenship*. Paper presented at the annual meeting of the Western Political Science Association, Portland, OR. Retrieved from http://www.allacademic.com/meta/p87792_index.html

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Fraj, E., & Martinez, E. (2006). Ecological consumer behaviour: An empirical analysis. *International Journal of Consumer Studies*, 26–34.

Frunteş, C. F. (2014). Organic product market development – Favorable conditions and limits in Romania. Annals of the „Constantin Brâncuşi. *University of Târgu Jiu, Economy Series, Is.*, *1*, 144–148.

Haron, S. A., Paim, L., & Yahaya, N. (2005). Towards sustainable consumption: An examination of environmental knowledge among Malaysians. *International Journal of Consumer Studies*, *29*(5), 426–436. doi:10.1111/j.1470-6431.2005.00460.x

Hayward, T. (2006). Ecological Citizenship: Justice, Rights and the Virtue of Resourcefulness. *Journal of Environmental Politics*, *15*(3), 438.

Iyer, E., & Banerjee, B. (1993). Anatomy of green advertising. The Journal of the Association of Consumer Research (JACR). *Advances in Consumer Research. Association for Consumer Research (U. S.)*, *20*(7), 494–501.

Kane, K., Chiru, C., & Ciuchete, S. G. (2012). Exploring the Eco-attitudes and Buying Behaviour of Facebook Users, Amfiteatru. *The Economic Journal*, *14*(31), 157–171.

Kutarenko, N. (2014). Trends in the market of organic products in Ukraine. *Ecoforum*, *2*(5), 29–36.

Mintz, T. M. (2011). *Profiling Green Consumers: A Descriptive Study*. (Master's Thesis). Appalachian State University. Retrieved from http://libres.uncg.edu/ir/asu/f/Mintz,%20Tara_2011_Thesis.pdf

Pál, Z. (2012). *Considerations Regarding the Relation between Final Consumers' Knowledge and Attitudes toward Organic Foods and their buying Behavior*. Ph.D. Thesis.

Pastiu, C. A. (2013). Green Purchase Intentions of Romanian Consumers. *Annales Universitatis Apulensis Series Oeconomica*, *15*(2), 750–754.

Polonsky, M. J. (1994). An Introduction to Green Marketing. *Electronic Green Journal*, *1*(2), 1–10.

Popa, A., Hubbard, C., Gorton, M., & Du, F. (2010). *Consumer perception about ecological products in Romania and China*. Exploratory Workshop: "Food and Health", Bucharest, Romania.

Reitman, V. (1992, May 18). Green Product Sales seem to be wilting. *Wall Street Journal*, p. B1.

Rex, E., & Baumann, H. (2006). Beyond ecolabels: What green marketing can learn from conventional marketing. *Journal of Cleaner Production*, *15*(6), 567–576. doi:10.1016/j.jclepro.2006.05.013

Roman, T., Bostan, I., Manolică, A., & Mitrica, I. (2015). Profile of Green Consumers in Romania in Light of Sustainability Challenges and Opportunities. *Sustainability*, *7*(6), 6394–6311. doi:10.3390u7066394

Schwepker-Jr, C. H., & Cornwell, T. B. (1991). An Examination of Ecologically Concerned Consumers and Their Intention to Purchase Ecologically Packaged Products. *Journal of Public Policy & Marketing*, *10*(2), 77–101.

Seyfang, G. (2006). Ecological citizenship and sustainable consumption: Examining local food networks. *Journal of Rural Studies*, *22*(4), 393–394. doi:10.1016/j.jrurstud.2006.01.003

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Shabani, N., Ashoori, M., Taghinejad, M., & Beyrami, H. (2013). The study of green consumers ' characteristics and available green sectors in the market. *International Research Journal of Applied and Basic Sciences*, *4*(7), 1880–1883.

Sima, V. (2014). Green Behaviour of the Romanian Consumers. *Economic Insights – Trends and Challenges, 3*(3), 77-89.

Sima, V., & Gheorghe, I. G. (2009). The 'Green Dimension' of Customer satisfaction. *The 11th IBIMA Conference, Creating Global Economies through Innovation and Knowledge Management*, (pp. 1638-1641). Academic Press.

Sima, V., & Gheorghe, I. G. (2015). Changing Consumption Patterns in Green Economy. In Agricultural Management Strategies in a Changing Economy. Hershey, PA: IGI Global. doi:10.4018/978-1-4666-7521-6

Simionescu, M. (2013). A Profile of Romanian Highly Educated Eco-Consumers Interested in Product Recycling. A Statistical Approach. *Folia Oeconomica Stetinensia*, *13*(2), 158–170.

Smith, G. (2005). Green Citizenship and the Social Economy. *Journal of Environmental Politics, 14*(2), 273 – 289.

Straughan, R. D., & Roberts, J. A. (1999). Environmental segmentation alternatives: A look at green consumer behavior in the new millennium. *Journal of Consumer Marketing*, *16*(6), 558–575. doi:10.1108/07363769910297506

Tănase, L. D., Roşca, M. I., & Jurcoane, A. (2012). The Perception on Ecological Products - A Research on the Urban Consumer. The Annals of the University of Oradea. *Economic Sciences*, *21*(1), 1217–1218.

Voinea, L., Popescu, D.V., & Negrea, M.T. (2015). Good Practices in Educating and Informing the New Generation of Consumers on Organic Foodstuffs. *Amfiteatru Economic, 17*(38), 492-498.

Yam-Tang, E. P. Y., & Chan, R. Y. K. (1998). Purchasing Behaviours and Perceptions of Environmentally Harmful Products. *Journal of Marketing Practice: Marketing Intelligence & Planning*, *16*(6), 356–362.

ADDITIONAL READING

Ginsberg, J., & Bloom, P. (2004). *Choosing the Right Green Marketing Strategy*. MIT Sloan Management Review.

Molyneaux, M. (2007). *Health and wellness trends and those specific to personal care*. Harleysville, PA: The Natural Marketing Institute.

Natural Marketing Research Institute. (2010). *The mainstreaming of sustainability in the U.S. Corvalis*. OR: The Natural Marketing Institute.

Thinking, G. (2008). Daedalus Consulting Public Study Prepared for: Green Report, from http://www.daedalus.ro/green/green_eng.pdf

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

KEY TERMS AND DEFINITIONS

Eco–Consumer: A person who is aware of environmental issues and obligations, and supports its causes.

Ecological Citizenship: The orientation of the people towards nature.

Ecological Product: It presents the highest ecological / environmental criteria and concerns, according to the EU eco labeling schemes or other similar protective instruments and initiatives It.'s manufacturing process and its use does not generate negative environmental effects.

Ethical Investment: It defines the type of investment that determines implement strategies for social responsibility.

Green Behavior: A pro-environmental behavior, people being good administrator of natural resources.

Green Market: The relationship between eco-supply and eco-demand.

Green Purchasing: A spending and investment process associated with eco-products and eco-behavior.

Social Economy: It gives people opportunities to act on governance models, production and consumption, which directly affects their livelihood at individual and community level.

Sustainable Consumption: A consumption model which seeks to preserve resources for future generations to be able to satisfy their needs.

This research was previously published in Food Science, Production, and Engineering in Contemporary Economies edited by Andrei Jean-Vasile, pages 203-224, copyright year 2016 by Information Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 59
The Impact of Green Attributes From Suppliers on Supply Chain Performance

Jose Roberto Mendoza Fong
Universidad Autónoma de Ciudad Juárez, Mexico

Jorge Luis García-Alcaraz
Universidad Autónoma de Ciudad Juárez, Mexico

Aidé Aracely Maldonado
Universidad Autónoma de Ciudad Juárez, Mexico

Cuauhtémoc Sánchez Ramírez
Instituto Tecnológico de Orizaba, Mexico

Valeria Martínez Loya
Universidad Autónoma de Ciudad Juárez, Mexico

ABSTRACT

Nowadays, green supplier selection (GSS) is one of the most important activities for companies. Therefore, this research aims to demonstrate the relationship that exists between GSS and the marketing benefits of companies. The chapter proposes a structural equation model that integrates three latent variables. The two independent latent variables concern preproduction green attributes and process green attributes, and they are associated with a dependent latent variable: marketing indexes. Thus, three hypotheses are proposed to relate these latent variables. To validate such hypotheses, a survey is administered to 253 middle and senior managers from the manufacturing industry of Ciudad Juárez. Similarly, a descriptive analysis of the sample and the items is carried out. Results show direct and positive effects among the analyzed variables. However, the highest impact is caused by preproduction green attributes over production process green attributes.

DOI: 10.4018/978-1-5225-7915-1.ch059

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

INTRODUCTION

On one hand, the role of suppliers in the performance and competitiveness of supply chains has made their correct selection and maintenance two top priorities for companies. This is why activities associated with supplier selection, development, and management have notably increased in the last few years (Trapp & Sarkis, 2016). On the other hand, sustainability is also playing a key role in the competitiveness of companies, which consequently seek to adopt more green supply chains (Trapp & Sarkis, 2016).

Sustainability is an intergenerational philosophy that cares for the appropriate use of available resources without compromising the needs of future generations. Therefore, when companies make decisions related to their sustainability, they consider not only environmental, but also economic and social factors (Elkington, 1998; Trapp & Sarkis, 2016). Thus, sustainable practices range from actions that respond to regulations imposed by the government – such as the safe handling of hazardous materials – to the development of sustainable plans to gain competitive advantage from green practices (green design, green marketing, repair, recycling, remanufacturing, and reutilization of materials and products), which reduce the negative effects of industrial processes on the environment (Buysse & Verbeke, 2003; T. Wu, Jim Wu, Chen, & Goh, 2014). Therefore, product recovery, waste reduction along the supply chain, and the implementation of green practices have become essential to every company (Mangla, Madaan, & Chan, 2013).

From such a sustainable context, the concept of green supply chain management (GSCM) has emerged and can be defined as the integration of environmental concepts in the supply chain, including product design, material supply, green supplier selection, production processes, final product delivery, and product management after its use (Srivastava, 2007). Integrating these activities improves the environmental performance of the supply chain, enables companies to comply with government regulations, and contributes to a greener corporate image. All these benefits can later translate into greater financial or economic profits (Christensen, 2008). Moreover, rather than being costly practices, sustainable initiatives have proven to be a successful competitive advantage for companies (Hollos, Blome, & Foerstl, 2012), but their success also depends on the suppliers involved in the whole supply chain.

Companies from all industries are thus seeking to incorporate more and more green suppliers in their daily operations and processes (Meehan, 2011), since they help directly and indirectly to improve the environmental performance of companies, which must include specific green criteria in decision-making processes. That is, green supplier selection allows for the incorporation of environmental criteria in the supply chain (Igarashi, de Boer, & Michelsen, 2015).

Green Suppliers

Supplier selection and management can be applied along the whole lifecycle of the product; that is, from materials supply until the end of the product usage. However, since there is a great amount and variety of attributes, the supplier selection process may be complicated. Moreover, companies must take into account different operational, strategic, and economic features, which are intangible (Bai & Sarkis, 2010) and thus difficult to quantify.

Despite its complexity, green supplier selection is viewed as an important element to develop a sustainable system. Therefore, since sustainability is frequently interpreted as an important part in the economic, environmental, and social development of companies, the employment of green suppliers is rapidly increasing. Green suppliers can provide materials of good quality at a reasonable price. Moreover,

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

they help manufacturers to meet the environmental factors in today's manufacturing environment of the GSCM (Kuo & Lin, 2011). Research has demonstrated that suppliers play a strategic role in companies (Jabbour, Frascareli, & Jabbour, 2015), they are vital to the development of a competitive advantage, and their actions positively impact on the performance of companies at all levels. Therefore, green supplier selection, including its evaluation criteria, has been implemented by manufacturers as an opportunity to improve processes and products. Thus, since suppliers are also accountable for raw materials and the final products, they become part of the technological development and environmental commitment of manufacturers (Çifçi & Büyüközkan, 2011).

Methodologies for Green Supplier Selection

The number of methodologies and techniques for supplier selection has significantly increased during the last two decades. An example of these tools are modeling methods, ranging from basic optimization models with traditional business criteria to more integrated techniques, which employ several methods that address a wide range of tangible and intangible criteria (Kasirian & Yusuff, 2013).

The green or intangible attributes that must be integrated in evaluation models include reputation, supply management risk, corporate image, social impact, government regulations, and green policies, among others (Govindan, Rajendran, Sarkis, & Murugesan, 2015). Some of the models traditionally employed in the selection of green suppliers are:

- Linear programming (LP) and nonlinear programming (NLP) (Liu, Ding, & Lall, 2000).
- Hierarchical fuzzy systems (P. Humphreys, McCloskey, McIvor, Maguire, & Glackin, 2006; Shaw, Shankar, Yadav, & Thakur, 2012; D. D. Wu, Zhang, Wu, & Olson, 2010).
- Fuzzy analytic hierarchy process (fuzzy AHP) (Choudhary & Shankar, 2014; Lee, Kang, Hsu, & Hung, 2009).
- Fuzzy extended analytic hierarchy process (FEAHP system) (Grisi, Guerra, & Naviglio, 2010).
- Fuzzy TOPSIS (Awasthi, Chauhan, & Goyal, 2010).
- Fuzzy Set Theory and Grey Relational Analysis (Chen, 2011).
- Data Envelopment Analysis (DEA) and Analytical Network Process (ANP) (Kuo & Lin, 2011).
- Fuzzy AHP – Fuzzy DEA (Kuo & Lin, 2011).

Green Attributes

Companies have always sought to identify the different green attributes along their supply chains (Çifçi & Büyüközkan, 2011; Rao & Holt, 2005). For instance, (Çifçi & Büyüközkan, 2011; Rao & Holt, 2005) highlighted the importance of using more environmentally friendly transport and cleaner production technologies. Similarly, they emphasized on the collection and recycling of packaging and containers, and they praised companies that informed consumers of their environmentally friendly products. Similarly, authors (Noci, 1997; Shaik & Abdul-Kader, 2011) designed a green vendor rating system that assessed the environmental performance of suppliers. The model considered four categories: green competencies, environmental efficiency, supplier green image, and net life cycle cost.

From a similar perspective, (Genovese, Lenny Koh, Bruno, & Esposito, 2013; P. K. Humphreys, Wong, & Chan, 2003) identified the environmental criteria that influenced on the purchasing decisions made by companies. Authors classified these criteria into two groups: quantitative environmental criteria

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

and qualitative environmental criteria. The latter included categories of environmental management, supplier green image, products with high environmental impact, environmental management systems, and environmental competencies. Likewise, (Rao & Holt, 2005; Rostamzadeh, Govindan, Esmaeili, & Sabaghi, 2015) pointed out materials, energy consumption, waste, and green packaging as other environmental criteria.

Nowadays, many different attributes can be considered when evaluating and selecting a green supplier. Some of them include green design, the use of environmentally friendly technologies, green buyers, social responsibility, clean production, and environmental costs. All of them play different roles in each company, depending on the type of green supplier that is sought.

Preproduction Green Attributes

Green attributes must be considered from the moment a product is being designed thus, the environmental factors that are selected based on the manufacturing process are critical. Green attributes can be considered at any stage of the product life cycle, from raw materials extraction to manufacture, including the product usage, reutilization, recycling, and final disposal (Büyüközkan & Çifçi, 2011). However, as regards the product preproduction stage, the green attributes typically judged are green design, green process management, green customer, and green competencies.

Preproduction attributes assess all activities that seek to minimize the environmental impact of products (Govindan, Kannan, & Shankar, 2015). Such attributes integrate all environmental dimensions in the product design process and along the whole supply chain. Similarly, they can be considered from the purchase of raw materials to their management for the product manufacturing (Rostamzadeh et al., 2015). This is important, since most of the industrial practices that harm the environment emerge at the product design stage, and they thus alter the production goal and affect the consumption and elimination of products that are harmful to the environment (Eltayeb, Zailani, & Ramayah, 2011).

Process Green Attributes

Companies must also take into account green attributes for the production process. Green attributes at this stage aim to continuously improve industrial processes in order to minimize their environmental impact (Johansson, 2009). They typically assess energy consumption during the manufacturing process, clean production, the environmental collaboration with customers, the use of environmentally friendly technology, and green product manufacturing. Integrating process green attributes in product manufacturing can help reduce the costs of raw material, increase efficiency of production, and reduce costs of both environmental and occupational safety (Srivastava, 2007).

In conclusion, since damages caused to the environment occur at any stage of the supply chain and the manufacturing process, companies must ensure green initiatives in their systems in order to reduce their environmental impact (Tseng, 2011). However, the question now is: what is the impact caused by the attributes from the preproduction stage on the attributes from the process stage? To answer this question, the following working hypothesis is proposed:

H_1: *Preproduction green attributes* have a direct and positive impact on the *Process green attributes* considered in green supplier selection.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Benefits of Green Attributes

Benefits from green suppliers can be a source of motivation for companies to constantly improve their environmental practices. In addition to being helpful to comply with government regulations, green attributes are an important source of competitive advantage (Villanueva-Ponce et al., 2015). In fact, the lack of green practices or the absence of a suitable green system may be detrimental to companies, since important costs usually derive from the inability to regulate energy consumption, from a poor waste treatment, or because of an excessive waste generation. Finally, another benefit of green attributes from suppliers is that they help improve and legitimize a green corporate image, which is why companies are increasingly focusing on green suppliers (Lee et al., 2009).

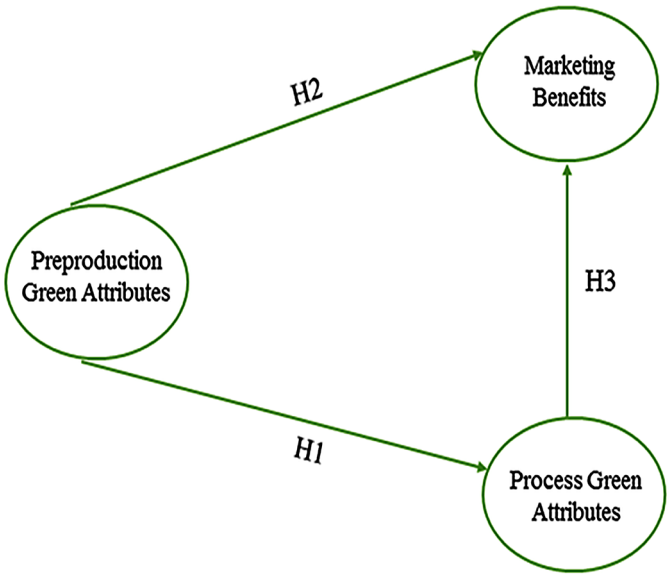
For all these reasons, benefits that companies obtain in their market indexes from their products depend on the attributes that they consider from a supplier. This leads us to propose the following two hypotheses:

H_2: *Preproduction green attributes* have a direct and positive impact on the benefits that manufacturing companies obtain in their marketing indexes.

H_3: *Process green attributes* have a direct and positive impact on the benefits that manufacturing companies obtain in their marketing indexes.

Relationships established with these hypotheses are depicted in Figure 1 as arrows connecting one latent variable to another. As previously mentioned, the objective of this chapter is to demonstrate the importance of green attributes from suppliers (at both the preproduction and the process stages) for the marketing indexes of manufacturing companies.

Figure 1. Proposed hypotheses (Own creation)



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

METHODOLOGY

The methodology followed to prove the hypotheses is divided into eight stages.

Step 1: Literature Review

Literature on green supplier selection (GSS) is reviewed by considering year 1990 as a point of departure. The research focuses on the most used attributes, those recently incorporated, and their classification. Similarly, it is carried out in databases such as Springer, Taylor & Francis, and Sciencedirect, among others. To refine the search, key words are used, including: *supplier selection, attributes used for supplier selection*, and *attributes used in supply chain management*. Then, the multicriteria models found in the literature are analyzed. However, the benefits that some authors mention. This literature review represents the rational validation for the questionnaire that is later designed. This means that research carried out overseas is adapted to the context of the Mexican manufacturing industry.

Step 2: Survey Design

For this research, a survey is designed as data collection instrument in order to determine the magnitude of the industrial phenomenon under study, which is the impact of green attributes from suppliers on the marketing benefits of manufacturers. Therefore, the survey aims to gather the opinion of Mexican middle and senior managers regarding the attributes that should be evaluated in suppliers (Martínez, 2002). The survey designed by (Villanueva Ponce, 2014) is considered as a reference.

The questionnaire is composed of three sections. The first section briefly explains the aim of the research and provides the directions to answer the survey. Demographic information is also demanded at this point, including the gender of participants, seniority, and the size and industrial sector of the company. These questions describe the overall characteristics of the sample, which merely involves middle and senior managers, since they are responsible for supplier selection.

The second section of the questionnaire includes a table listing 39 attributes that can be considered in the supplier selection process. These attributes were previously identified in the literature review. Items in this part of the questionnaire must be answered with a five-point Likert scale, where 1 indicates that an attribute is not important in green supplier selection, and 5 implies that the attribute is very important.

Finally, the third section of the survey also includes a table, but this table lists 12 benefits that can be attributed to the correct green supplier selection. A Likert scale is also used to answer these items.

Step 3: Administration of the Survey

The survey is administered to manufacturing companies in Ciudad Juárez, México, from January 2015 to May 2015. The sample is composed of middle and senior managers from different departments who take part in the supplier selection and evaluation processes. These departments include the engineering department, the purchasing department, the management department, finances, quality control, and warehouses among others.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Step 4: Information Capture

Data obtained from the survey are captured in a database with statistical software SPSS 20. This piece of software is one of the best known statistical programs, considering its ability to work with large databases as well as its simple interface for most analyzes. In the database, each row represents a case or answered survey, while columns stand for the variables analyzed.

Step 5: Data Screening

Data are screened in order to find missing values and outliers. On one hand, missing data can occur for different reasons. Typically, they imply that a respondent was not familiar with the response that he/she accidentally missed a question, or that he/she simply refused to answer it. However, the main issue with missing data is that if a respondent did not answer a lot of questions, other answers may be useless when it comes to testing causal models (Lynch, 2003). Thus, it is generally agreed that if more than 10% of answers in a particular variable are missing, these values can be problematic and the case must be discarded (Joseph F. Hair Jr., 2013). In this research, missing values were replaced by the median value of the variable in question, since a Likert scale was used to answer all the items (Lynch, 2003).

On the other hand, outliers are detected by means of box plots, where they appear at the edges. Then, data are standardized, considering any absolute value higher than 4 as an outlier (Kohler, Müller, & Walk, 2015). Similarly, the standard deviation is estimated in each case or survey, where values close to 0 suggest that a respondent assigned the same value to all questions. Thus, if the value of the standard deviation is lower than 0.500 for a scale of 5 points, the questionnaire is discarded (Leys, Ley, Klein, Bernard, & Licata, 2013).

Step 6: Statistical Validation

Any suitable instrument must comply with two requirements: reliability and validity. They both determine whether an instrument properly measures variables. On one hand, validity refers to the degree to which an instrument really measures the variable that aims to measure (González, 2008). On the other hand, reliability defines the probability of success of a system, which must necessarily depend on the reliability or success of its components (Niebel B. & Freivalds, 2009).

Several indices are used to validate the survey. First, the Cronbach's alpha is estimated. Although it is not accompanied by any P-value to reject the hypothesis of reliability of the scale, the closer its value to 1, the greater the reliability of the scale (George, 2003). Also, the reliability index is used to measure internal validity. Thus, if items are strongly correlated with one another, this means that they measure the same latent variable (the cause). Nevertheless, this does not imply that the latent variable stands for the construct these items intend to measure (validity). Finally, AVE measures convergent validity, while the R-squared, adjusted R-squared, and Q-squared are employed to measure predictive validity (Kock, 2013).

Step 7: Descriptive Analyses

In this research, the descriptive analyses include the description of the sample and the description of items.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Descriptive Analysis of the Sample

Cross tables are used to describe the sample. The table includes information regarding gender, seniority, and the industrial sector of companies. This information helps determine the level of experience of participants and, therefore, the reliability of information gathered.

Descriptive Analysis of Items

A descriptive analysis is carried out for all the items analyzed within the latent variables. The median is used as a measure of central tendency, while the interquartile range (IQR) is used as a measure of dispersion. High values in the median indicate that an item is important to participants in the supplier selection process (Silver, 2007). However, low median values imply that an item is not relevant. Similarly, high IQR values indicate no consensus among respondents regarding the significance of an item, while IQR values imply consensus about its significance (Rossi & Mirtchev, 2016).

Step 8: Structural Equation Model

In order to prove the hypotheses stated in Figure 1, the model is evaluated using the Structural Equation Modelling (SEM) technique. SEM is widely used to validate causal relationships, especially in the supply chain environment. For instance, it has been employed to measure the impact of JIT on supply chain performance (Green Jr, Inman, Birou, & Whitten, 2014), or the effects of flexibility, uncertainty, and firm performance on supply chain (Merschmann & Thonemann, 2011). Likewise, authors (Villanueva-Ponce et al., 2015; Yang, Albert, & Carlo, 2013) proposed a structural equation model to identify the effects of green supply chain management on green performance and firm competitiveness.

In this research, the SEM model is executed in WarpPLS 5.0® software, since its main algorithms are based on Partial Least Squares (PLS), widely recommended for small samples (Kock, 2013). Moreover, a bootstrapping resampling method is used to obtain better coefficients values convergence and diminish the effect of possible outliers. In addition, three model fit indices are analyzed: average path coefficient (APC), average R-squared (ARS), and average variance inflation factor (AVIF). These indices were proposed by (Kock, 2013) and used by (Ketkar & Vaidya, 2012) in the supply chain environment.

The P-values of APC and ARS are estimated by considering 0.05 as the maximum cutoff value. This means that causal inferences show a 95% of confidence level, testing the null hypothesis where APC and ARS are equal to 0, versus the alternative hypothesis, stating that APC and ARS are different from 0. As regards AVIF, values lower than 5 are desirable.

Finally, three different effects are measured in the structural equation model:

1. Direct effects (they appear in Figure 1 as arrows connecting one latent variable to another),
2. Indirect effects (paths with two or more segments from one latent variable to another), and
3. Total effects (the sum of direct and indirect effects).

To determine the significance of these effects, the P values are analyzed, considering the null hypothesis: $\beta_i = 0$, versus the alternative hypothesis: $\beta_i \neq 0$.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

RESULTS

This section is divided into three subsections addressed below:

Descriptive Analysis of the Sample

A total of 270 surveys were collected after five months. However, merely 253 of these questionnaires were used in the analysis, since the others were discarded due to an excessive amount of missing data. Table 1 shows information about the size of the companies as well as the industrial subsectors surveyed. As can be observed, 39.52% of the sample works in the automotive sector. Similarly, 61.65% of participants work in large companies, which have more than 500 workers.

Descriptive Analysis of Items

Table 2 shows the descriptive analysis of the items comprised in each latent variable appearing in Figure 1. As regards preproduction green attributes and process green attributes, all the eight items within these latent variables have a median value higher than 3. This indicates that manufacturing companies in Ciudad Juárez often consider these green attributes when selecting a green supplier.

Additionally, fourth column details the interquartile range, in this case the item with the highest RI corresponds to the item with the highest median, indicating their importance, since it has the least variability in that category.

Latent variable marketing benefits consists of six items, none of which obtains a value exceeding three, indicating that these benefits are rarely obtained. It is also noted that values of RI for items are high, indicating that there is no consensus regarding to the true value that they have.

Structural Equation Modeling

The structural equation model was evaluated according to the methodology described before. Figure 2 shows results obtained, where each of the segments represents the relationship between two latent variables, also are indicated the value of the beta parameter and p-value of statistical significance test. Note

Table 1. Size of companies and industries surveyed

Size of the Company	Industry							Total
	Automotive	Electronics	Electrical	Medical	Plastics	Packaging	Others	
>500	65	15	16	21	9	2	28	156
201-500	27	4	4	3	6	1	11	56
101-200	5	5	0	3	4	2	6	25
51-100	3	1	0	0	1	2	3	10
0-50	0	0	0	0	0	1	5	6
Total	100	25	20	27	20	8	53	253

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 2. Descriptive analysis

Preproduction Green Attributes	Median	Percentiles		Interquartile range (IR)
		25	75	
Green design	3.473	2.521	4.391	1.870
Green buyers	3.449	2.544	4.343	1.799
Green process management	3.613	2.603	4.553	1.950
Green competencies	3.375	2.496	4.245	1.749
Process Green Attributes				
Use of environmentally friendly technology	3.579	2.624	4.500	1.876
Green product manufacturing	3.525	2.601	4.387	1.786
Recycling systems	3.803	2.825	4.655	1.830
Environmental costs	3.796	2.900	4.635	1.735
Marketing Benefits				
How often has the company expanded its market thanks to a good supplier?	2.452	1.656	3.276	1.620
How often has been called "green" to company's image where you work due to its selection processes to choose suppliers?	2.642	1.814	3.612	1.798
How often the company has expanded to domestic market by selecting a good supplier?	2.468	1.615	3.439	1.824
How often the company has increased its economic gains by consider environmental aspects in the supplier selection?	2.727	1.915	3.688	1.772
How often the company has expanded internationally by selecting a green supplier?	2.553	1.665	3.547	1.881
How frequently the company has obtained economic profits due to choosing a green supplier?	2.695	1.821	3.631	1.810
How often has been improved the company prestige by electing green suppliers?	2.695	1.810	3.688	1.878

also that in each of the latent dependent variables, the R2 value is indicated for measuring the variance that is explained by the dependent variables.

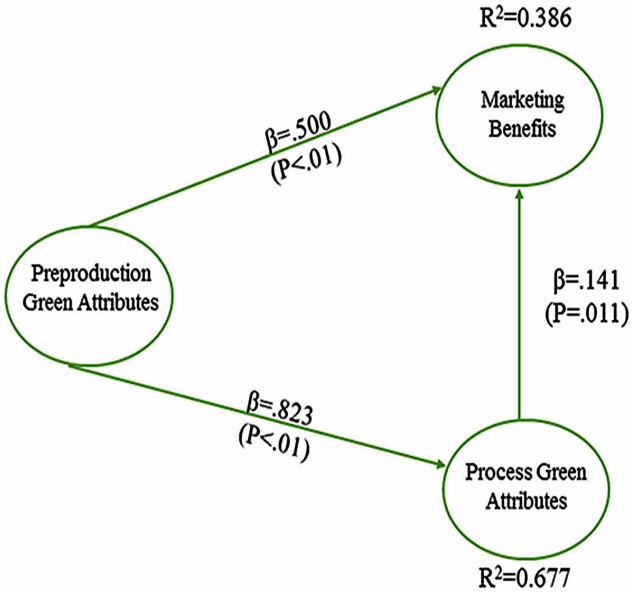
The efficiency indexes of model are indicated following.

- Average path coefficient (APC)=0.488, P<0.001
- Average R-squared (ARS)=0.532, P<0.001
- Average adjusted R-squared (AARS)=0.529, P<0.001
- Average block VIF (AVIF)=3.076, acceptable if <= 5, ideally <= 3.3
- Average full collinearity VIF (AFVIF)=2.699, acceptable if <= 5, ideally <= 3.3
- Tenenhaus GoF (GoF)=0.621, small >= 0.1, medium >= 0.25, large >= 0.36

The APC, ARS and AARS indexes, present a p-value in order to determine statistical significance, it can be stated that the model has sufficient predictive validity and the dependencies between the latent variables analyzed on average is different from zero, because they are statistically significant at a confidence level of 95%.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 2. Evaluated model



According to the collinearity between the latent variables, it is observed that the AVIF and AFVIF indexes are less than 3.3, thus there is no problem of collinearity in the model. Finally, the Tenenhaus index is considered an acceptable value because it is less than 0.36.

Direct Effects

Direct effects are used to test the initially hypotheses in the model in Figure 1 and Figure 2 shows results obtained. Based on them, the following conclusions are presented:

H_1: There is enough statistical evidence to state that Preproduction Green Attributes evaluated in suppliers have a direct and positive impact on Process Green Attributes, since when the first latent variable increases its standard deviation by one unit, the standard deviation of the second latent variable also increases by 0.823 units.

H_2: There is enough statistical evidence to state that Preproduction Green Attributes evaluated in suppliers have a direct and positive impact on the benefits that manufacturing companies obtained in their marketing indexes, since when the first latent variable increases its standard deviation by one unit, the standard deviation of the second latent variable also increases by 0.500 units.

H_3: There is enough statistical evidence to state that Process Green Attributes evaluated in suppliers have a direct and positive impact on the benefits that manufacturing companies obtained in their marketing indexes, since when the first latent variable increases its standard deviation by one unit, the standard deviation of the second latent variable also increases by 0.141 units.

However, it is worthy to mention that 67.7% of the latent variable "Process Green Attributes" is explained by the variable "Preproduction Green Attributes" since the value of R-square is 0.677. Given

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

those values, it is concluded that preproduction green attributes are very important to achieve the green attributes of processes, because they have a character of planning and forethought.

Sum of Indirect Effects

The model in Figure 2 shows that the latent variable called preproduction green attributes has an indirect impact on the latent variable called marketing benefits, which is given through the mediating variable denominated process green attributes it is obtained as a result of the product of effects of two segments. In this case, the indirect effect is 0.116 (P = 0.04), which is statistically significant with a confidence level of 95% and may explain more than 7.2% of its variability, since the size of the effect is 0.072.

Total Effects

The sum of the direct and indirect effects represent the total effects. Table 3 shows a summary of the effects. In this case, there is only an indirect effect. It is worthy to mention that in two of the relationships between variables, the direct effect is equal to the total effect. Only in the relationship between the variables Preproduction Green Attributes and Marketing Benefits, the effect includes both the direct and indirect effects.

CONCLUSION

Based on the results obtained from the model, the following conclusions are presented:

- By segmenting the green attributes in two different latent variables: preproduction and green process, it has been demonstrated that there is a relationship between them thus that these two variables have a positive impact on the benefits that manufacturing companies obtain in their marketing indexes. Therefore, managers and responsible of supplier selection process should focus on these attributes, primarily in preproduction, since it is associated with the planning of the production process of the article, distributing and recycling. Thus, this research is consistent with the results provided by (Gurel, Acar, Onden, & Gumus, 2015) and the techniques indicated by (Igarashi, de Boer, & Fet, 2013), who state that green suppliers be an essential part of the production process of the manufacturer.
- The organizations that evaluate green attributes in their suppliers, obtain benefits associated with their marketing indexes, such benefits may be a better imagen in both senses, organizationally and

Table 3. Total effects

	Preproduction Green Attributes	Process Green Attributes
Process Green Attributes	0.823 (P<0.001) ES = 0.677	
Marketing Benefits	0.616 (P<0.001) ES = 0.380	0.141 (P=0.011) ES = 0.078

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

socially, as it is the continuation of a green supply chain, but also adds value to all supply chain (Gopaldas, 2015; Igarashi et al., 2015).

- All department managers must share financial information associated with the integration of green suppliers as partners in the production process, due to is common that different opinions exist regarding to the benefits that can be obtained and some of them can be incorrect, especially those associated with costs.

REFERENCES

Awasthi, A., Chauhan, S. S., & Goyal, S. K. (2010). A fuzzy multicriteria approach for evaluating environmental performance of suppliers. *International Journal of Production Economics*, *126*(2), 370–378. doi:10.1016/j.ijpe.2010.04.029

Bai, C., & Sarkis, J. (2010). Integrating sustainability into supplier selection with grey system and rough set methodologies. *International Journal of Production Economics*, *124*(1), 252–264. doi:10.1016/j.ijpe.2009.11.023

Buysse, K., & Verbeke, A. (2003). Proactive environmental strategies: A stakeholder management perspective. *Strategic Management Journal*, *24*(5), 453–470. doi:10.1002mj.299

Büyüközkan, G., & Çifçi, G. (2011). A novel fuzzy multi-criteria decision framework for sustainable supplier selection with incomplete information. *Computers in Industry*, *62*(2), 164–174. doi:10.1016/j.compind.2010.10.009

Chen, Y.-J. (2011). Structured methodology for supplier selection and evaluation in a supply chain. *Information Sciences*, *181*(9), 1651–1670. doi:10.1016/j.ins.2010.07.026

Choudhary, D., & Shankar, R. (2014). A goal programming model for joint decision making of inventory lot-size, supplier selection and carrier selection. *Computers & Industrial Engineering*, *71*, 1–9. doi:10.1016/j.cie.2014.02.003

Christensen, J. (2008). A Practical Guide to Green Sourcing. *Supply Chain Management Review, 12*(8).

Çifçi, G., & Büyüközkan, G. (2011). A Fuzzy MCDM Approach to Evaluate Green Suppliers. *International Journal of Computational Intelligence Systems*, *4*(5), 894–909. doi:10.1080/18756891.2011.9727840

Elkington, J. (1998). *Cannibals with forks: The triple bottom line of 21st century business*. Gabriola Island, BC: New Society Publishers.

Eltayeb, T. K., Zailani, S., & Ramayah, T. (2011). Green supply chain initiatives among certified companies in Malaysia and environmental sustainability: Investigating the outcomes. *Resources, Conservation and Recycling*, *55*(5), 495–506. doi:10.1016/j.resconrec.2010.09.003

Genovese, A., Lenny Koh, S. C., Bruno, G., & Esposito, E. (2013). Greener supplier selection: State of the art and some empirical evidence. *International Journal of Production Research*, *51*(10), 2868–2886. doi:10.1080/00207543.2012.748224

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

George, D., & Mallery, P. (2003). *SPSS for Windows step by step: A simple guide and reference. 11.0 update*. Academic Press.

González, Y. (2008). *Instrumento Cuidado de comportamiento profesional: validez y confiabilidad*. Academic Press.

Gopaldas, A. (2015). Creating firm, customer, and societal value: Toward a theory of positive marketing. *Journal of Business Research*, *68*(12), 2446–2451. doi:10.1016/j.jbusres.2015.06.031

Govindan, K., Kannan, D., & Shankar, M. (2015). Evaluation of green manufacturing practices using a hybrid MCDM model combining DANP with PROMETHEE. *International Journal of Production Research*, *53*(21), 6344–6371. doi:10.1080/00207543.2014.898865

Govindan, K., Rajendran, S., Sarkis, J., & Murugesan, P. (2015). Multi criteria decision making approaches for green supplier evaluation and selection: A literature review. *Journal of Cleaner Production*, *98*, 66–83. doi:10.1016/j.jclepro.2013.06.046

Green Jr, K. W., Inman, R. A., Birou, L. M., & Whitten, D. (2014). Total JIT (T-JIT) and its impact on supply chain competency and organizational performance. *International Journal of Production Economics, 147*, 125-135. doi:10.1016/j.ijpe.2013.08.026

Grisi, R. M., Guerra, L., & Naviglio, G. (2010). Supplier Performance Evaluation for Green Supply Chain Management. In P. Taticchi (Ed.), *Business Performance Measurement and Management: New Contexts, Themes and Challenges* (pp. 149–163). Berlin: Springer Berlin Heidelberg. doi:10.1007/978-3-642-04800-5_10

Gurel, O., Acar, A. Z., Onden, I., & Gumus, I. (2015). Determinants of the Green Supplier Selection. *Procedia: Social and Behavioral Sciences*, *181*, 131–139. doi:10.1016/j.sbspro.2015.04.874

Hollos, D., Blome, C., & Foerstl, K. (2012). Does sustainable supplier co-operation affect performance? Examining implications for the triple bottom line. *International Journal of Production Research*, *50*(11), 2968–2986. doi:10.1080/00207543.2011.582184

Humphreys, P., McCloskey, A., McIvor, R., Maguire, L., & Glackin, C. (2006). Employing dynamic fuzzy membership functions to assess environmental performance in the supplier selection process. *International Journal of Production Research*, *44*(12), 2379–2419. doi:10.1080/00207540500357476

Humphreys, P. K., Wong, Y. K., & Chan, F. T. S. (2003). Integrating environmental criteria into the supplier selection process. *Journal of Materials Processing Technology*, *138*(1–3), 349–356. doi:10.1016/S0924-0136(03)00097-9

Igarashi, M., de Boer, L., & Fet, A. M. (2013). What is required for greener supplier selection? A literature review and conceptual model development. *Journal of Purchasing and Supply Management*, *19*(4), 247–263. doi:10.1016/j.pursup.2013.06.001

Igarashi, M., de Boer, L., & Michelsen, O. (2015). Investigating the anatomy of supplier selection in green public procurement. *Journal of Cleaner Production, 108*, 442-450. doi:10.1016/j.jclepro.2015.08.010

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Jabbour, A. B. L. d. S., Frascareli, F. C. d. O., & Jabbour, C. J. C. (2015). Green supply chain management and firms' performance: Understanding potential relationships and the role of green sourcing and some other green practices. *Resources, Conservation and Recycling, 104*, 366-374. doi:10.1016/j.resconrec.2015.07.017

Johansson, G., & Winroth, M. (2009). Lean vs green manufacturing: similarities and differences. *Proceedings of the 16th International Annual EurOMA conference, Implementation Realizing Operations Management Knowledge*, 14-17.

Kasirian, M. N., & Yusuff, R. M. (2013). An integration of a hybrid modified TOPSIS with a PGP model for the supplier selection with interdependent criteria. *International Journal of Production Research*, *51*(4), 1037–1054. doi:10.1080/00207543.2012.663107

Ketkar, M., & Vaidya, O. S. (2012). Study of Emerging Issues in Supply Risk Management in India. *Procedia: Social and Behavioral Sciences*, *37*, 57–66. doi:10.1016/j.sbspro.2012.03.275

Kock, N. (2013). Using WarpPLS in e-collaboration studies: What if I have only one group and one condition. *International Journal of e-Collaboration*, *9*(3), 12. doi:10.4018/jec.2013070101

Kohler, M., Müller, F., & Walk, H. (2015). Estimation of a regression function corresponding to latent variables. *Journal of Statistical Planning and Inference*, *162*, 88–109. doi:10.1016/j.jspi.2014.12.006

Kuo, R. J., & Lin, Y. J. (2011). Supplier selection using analytic network process and data envelopment analysis. *International Journal of Production Research*, *50*(11), 2852–2863. doi:10.1080/00207543.2011.559487

Lee, A. H. I., Kang, H.-Y., Hsu, C.-F., & Hung, H.-C. (2009). A green supplier selection model for high-tech industry. *Expert Systems with Applications*, *36*(4), 7917–7927. doi:10.1016/j.eswa.2008.11.052

Leys, C., Ley, C., Klein, O., Bernard, P., & Licata, L. (2013). Detecting outliers: Do not use standard deviation around the mean, use absolute deviation around the median. *Journal of Experimental Social Psychology*, *49*(4), 764–766. doi:10.1016/j.jesp.2013.03.013

Liu, J., Ding, F. Y., & Lall, V. (2000). Using data envelopment analysis to compare suppliers for supplier selection and performance improvement. *Supply Chain Management: An International Journal*, *5*(3), 143–150. doi:10.1108/13598540010338893

Lynch, S. M. (2003). Missing data.

Mangla, S., Madaan, J., & Chan, F. T. S. (2013). Analysis of flexible decision strategies for sustainability-focused green product recovery system. *International Journal of Production Research*, *51*(11), 3428–3442. doi:10.1080/00207543.2013.774493

Martínez, F. (2002). *El cuestionario. Un instrumento para la investigación en las ciencias sociales*. Barcelona: Laertes Psicopedagogía.

Meehan, J., & Bryde, D. (2011). Sustainable Procurement Practice. *Business Strategy and the Environment*, *20*(2), 94–106. doi:10.1002/bse.678

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Merschmann, U., & Thonemann, U. W. (2011). Supply chain flexibility, uncertainty and firm performance: An empirical analysis of German manufacturing firms. *International Journal of Production Economics*, *130*(1), 43–53. doi:10.1016/j.ijpe.2010.10.013

Niebel, B., & Freivalds, A. (2009). *Ingeniería Industrial métodos, estándares y diseño del trabajo*. Editorial Mc. Graw Hill.

Noci, G. (1997). Designing green vendor rating systems for the assessment of a suppliers environmental performance. *European Journal of Purchasing & Supply Management*, *3*(2), 103–114. doi:10.1016/S0969-7012(96)00021-4

Rao, P., & Holt, D. (2005). Do green supply chains lead to competitiveness and economic performance? *International Journal of Operations & Production Management*, *25*(9), 898–916. doi:10.1108/01443570510613956

Rossi, F., & Mirtchev, V. (2016). *Descriptive Statistics and Graphical Analysis. In Statistics for Food Scientists* (pp. 3–11). San Diego, CA: Academic Press. doi:10.1016/B978-0-12-417179-4.00002-0

Rostamzadeh, R., Govindan, K., Esmaeili, A., & Sabaghi, M. (2015). Application of fuzzy VIKOR for evaluation of green supply chain management practices. *Ecological Indicators*, *49*, 188–203. doi:10.1016/j.ecolind.2014.09.045

Shaik, M., & Abdul-Kader, W. (2011). Green supplier selection generic framework: A multi-attribute utility theory approach. *International Journal of Sustainable Engineering*, *4*(1), 37–56. doi:10.1080/19397038.2010.542836

Shaw, K., Shankar, R., Yadav, S. S., & Thakur, L. S. (2012). Supplier selection using fuzzy AHP and fuzzy multi-objective linear programming for developing low carbon supply chain. *Expert Systems with Applications*, *39*(9), 8182–8192. doi:10.1016/j.eswa.2012.01.149

Silver, G. L. (2007). Operational measures of central tendency. *Applied Mathematics and Computation*, *186*(2), 1379–1384. doi:10.1016/j.amc.2006.07.130

Srivastava, S. K. (2007). Green supply-chain management: A state-of-the-art literature review. *International Journal of Management Reviews*, *9*(1), 53–80. doi:10.1111/j.1468-2370.2007.00202.x

Trapp, A. C., & Sarkis, J. (2016). Identifying Robust portfolios of suppliers: A sustainability selection and development perspective. *Journal of Cleaner Production*, *112*(Part 3), 2088–2100. doi:10.1016/j.jclepro.2014.09.062

Tseng, M.-L. (2011). Green supply chain management with linguistic preferences and incomplete information. *Applied Soft Computing*, *11*(8), 4894–4903. doi:10.1016/j.asoc.2011.06.010

Villanueva-Ponce, R., Garcia-Alcaraz, J., Cortes-Robles, G., Romero-Gonzalez, J., Jiménez-Macías, E., & Blanco-Fernández, J. (2015). Impact of suppliers green attributes in corporate image and financial profit: Case maquiladora industry. *International Journal of Advanced Manufacturing Technology*, *80*(5-8), 1277–1296. doi:10.100700170-015-7082-6

Villanueva Ponce, R. D. (2014). *Encuesta de atributos en la selección de proveedores*. Academic Press.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Wu, D. D., Zhang, Y., Wu, D., & Olson, D. L. (2010). Fuzzy multi-objective programming for supplier selection and risk modeling: A possibility approach. *European Journal of Operational Research*, *200*(3), 774–787. doi:10.1016/j.ejor.2009.01.026

Wu, T., Jim Wu, Y.-C., Chen, Y. J., & Goh, M. (2014). Aligning supply chain strategy with corporate environmental strategy: A contingency approach. *International Journal of Production Economics, 147*, 220-229. doi:10.1016/j.ijpe.2013.02.027

Yang, S., Albert, R., & Carlo, T. A. (2013). Transience and constancy of interactions in a plant-frugivore network. *Ecosphere*, *4*(12), art147. doi:10.1890/ES13-00222.1

KEY TERMS AND DEFINITIONS

Hypothesis: A tentative explanation for an observation, phenomenon, or scientific problem that can be tested by further investigation.

Interquartile Range: The range of values of a frequency distribution between the first and third quartiles.

Marketing: It is the activity, set of institutions, and processes for creating, communicating, delivering, and exchanging offerings that have value for customers, clients, partners, and society at large.

Reliability: Refers to the degree to which an assessment tool produces stable and consistent results.

Structural Equation Modelling: It is a statistical technique for building and testing statistical models, which are often causal models. It is a hybrid technique that encompasses aspects of confirmatory factor analysis, path analysis and regression.

Survey: A gathering information based in questions for obtain a sample of data or opinions of people previously chosen according to the needs of the study.

Sustainability: It is the ability to maintain rates of renewable resource harvest, pollution creation, and non-renewable resource depletion that can be continued indefinitely.

This research was previously published in Green Marketing and Environmental Responsibility in Modern Corporations edited by Thangasamy Esakki, pages 83-103, copyright year 2017 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 60
Evaluating Factors Motivate Users on Green IT Readiness (Part 2)

Yas A. Alsultanny
Arabian Gulf University, Bahrain

Fatma M. Alnassar
Arabian Gulf University, Bahrain

ABSTRACT

Due to the advancement of information and communications technology, most of the businesses and services have transformed into an e-businesses and e-services. The organizations are facing a great deal of pressure from regulators to move toward green IT. The aim of this article is to evaluate the factors affecting on green IT readiness from the perspective of IT users, a questionnaire designed for this purpose. The questionnaire divided into two parts, the first part for demographics information, and the second part contains 34 statements divided into 6 factors. There are 460 respondents to the questionnaire. The results of the data analysis showed that the factors, technology and attitude have an agreed degree of agreement, while the practice, policy, governance, and green IT readiness have a neutral degree of agreement. The governance factor has the highest effect on green IT readiness. The article recommends the ministries of electricity must be increasing the awareness for green IT as part of their awareness for power consumption saving.

1. INTRODUCTION

Reducing carbon dioxide (CO_2) is very critical and important to the protection of human health and the environment. The Environmental Protection Agency (EPA) developed the EPA equation to help in calculating the power consumption and CO_2 emissions. This equation depends on the finding value; to compare with the default values of CO_2 emissions measured in money cost per mega-watts-hours (MWh) of power consumption.

DOI: 10.4018/978-1-5225-7915-1.ch060

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

To minimize or eliminate the environmental impact of IT, that helps in creating a sustainable environment. IT hardware poses environmental problems during its production and its disposal. Each personal computer in use generates about a ton of carbon dioxide every year. Greening IT has the responsibility of creating a more sustaining environment. Green IT benefits the environment by improving energy efficiency, and encouraging reuse and recycling (Murugesan, 2008).

Consumer buying habits have become more driven by ethical concerns for environmentally friendly, products as it was found stakeholders react in a positive way toward greening ICT (Sen, Battacharya, & Korschun, 2006; Whitby, 2007). Moving toward green IT would benefit different stakeholders such as employees, capital market, consumer and the public. One great way to motivate people to go green is to make it easier. Many people find making greener choices is inconvenient to their daily lives, especially in regions that are less environmentally conscious (www.oureverydayearth.com).

The first section of this paper provides an introduction. The second section is for the motivations for this study. The third section is for the literature review. The fourth section is for the study objective. The fifth section is for research methodology. The sixth section describes data analysis. The final section is for the conclusion.

2. MOTIVATIONS FOR THIS STUDY

The association between environmentally friendly attitudes and the green IT movement reported that in order to encourage IT users to act with concern for the environment, emotional factors playing a significant role. Scientists in the field of Information and Communication Technologies have estimates that the ICT is the source of around 2% of global CO_2 emissions (Goasduff & Forsling, 2007). The enlargement in IT emissions are expected to reach 6% at the end of 2020. Green IT will be the main concern in future.

There are three types of motivations to go green. One is environmental risk management to reduce operational and financial concerns such as reducing emission from energy consumption. Upside benefit is one of motivation types to develop renewable energy solutions that are environmentally friendly. The third type of motivation is environmental stewardship, which is doing the right thing to be environmentally responsible (Hart, 1997). Power usage has emissions that influence the environment, which mainly concern human health and improve economics (Jongsaguan & Ghoneim, 2013).

3. LITERATURE REVIEW

Greening IT allows organizations to reduce their carbon footprint, greenhouse gasses and waste by following more environmentally healthy practices such as managing the PC power, server virtualization, recycling, disposal management, and contracting with green suppliers (Graaf, 2008). The Environmental Protection Agency in 2010 updated the output emission rate to $6.89551*10^{-4}$ metric tons CO_2/kWh (www.epa.gov). Jonathan (2014) showed that three states out of 50 USA states are implementing EPA best practices in CO_2 emissions from electric generating units. It creates CO_2 emission rate goals measured in pounds of CO_2 emissions per megawatts-hours (MWh).

For the customer, being green would increase their satisfaction, enhance their loyalty and enhance recruitment. It gives greater trustworthiness, appeals to new consumers and gives higher customer satisfaction. According to the public, it enhances the image, and enhances the implementation of Corporate

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Social Responsibility (CSR) strategy as well as enhancing brand value (Hermann, Von Der Gathen, & Daus, 2010). Organizations, which adopt CSR, are considering sustainability and the mounting demands of greening ICT in order to satisfy diverse environmental groups and regulations. Firms uses sustainability and CSR hence consider greening technologies to show for the commitment that they have to the environment`s CO_2 emissions (Hendry & Vesilind, 2005; McWilliams, Siegel, & Wright, 2006).

Organizations were facing pressures from consumers, suppliers, rivals, regulators, and community groups to implement sustainable business practices. Hence, balancing needed services and IT performance to be environmentally green and competitive became a key issue in the strategic plan and operation (Molla & Cooper, 2009). Molla et al. (2008) developed the green IT readiness model. It consists of five factors. These factors are; attitude, policy, practice, governance, and technology. Attitude means, how business organizations as well as business leaders and personal are considering their effect on the environment, and to what extent their awareness pushes to reducing their negative effects (Molla, Cooper, & Pittayachawan, 2009). Policy, measures the degree that green and sustainability policies in organizations (Molla & Cooper, 2009). Practice, involves ICT infrastructure sourcing, operations, as well as disposal (Cooper & Molla, 2012). Governance, responsible for electricity and it holds accountabilities regarding energy efficiency, and how PC power must be managed (Molla & Cooper, 2009). Technology, organizations has to build a green technological infrastructure, and the organizations have to move toward green power supplies (Brocade, 2007). The results of Alsultanny and Alnassar, (2015) showed that the governance has the highest correlation and influence on green IT readiness from the perspective of IT staff.

The efficiency of cooling and lighting data centers and IT energy consumption are the top issues (Minsani & Imam, 2012). Information system assessment, including costs, benefits, and risks within a company plays a role in creating and raising awareness and incorporating green IT into all components of the business functions (Jongsaguan & Ghoneim 2013).

4. STUDY OBJECTIVE

The main objective of this study is to evaluate the factors affecting green IT readiness from the perspectives of the users, by identifying the factors that affecting green-IT readiness and study the effect of demographic information on the green IT readiness factors.

From the study objective the following questions derived;

1. What are the factors that affect green IT readiness from the perspective of IT users?
2. *Does the demographics information of IT users have statistically significant differences effect on green IT factors and green IT readiness?*

5. RESEARCH METHODOLOGY

This study used descriptive and quantitative methods. A questionnaire designed for evaluating the factors impact on green IT readiness, from the perspectives of IT users. This questionnaire divided into two parts. The first part was for demographic information (gender, age, education, and experience). The second part for green IT factors. These factors adopted from Molla et al. (2009), which had five

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

factors (technology, practice, policy, governance, and attitude). The demographics information (gender, age, education, and experience) were used to test their effect on the five factors and green IT readiness. Figure 1 shows the conceptual model of the study.

The hypotheses of the study are;

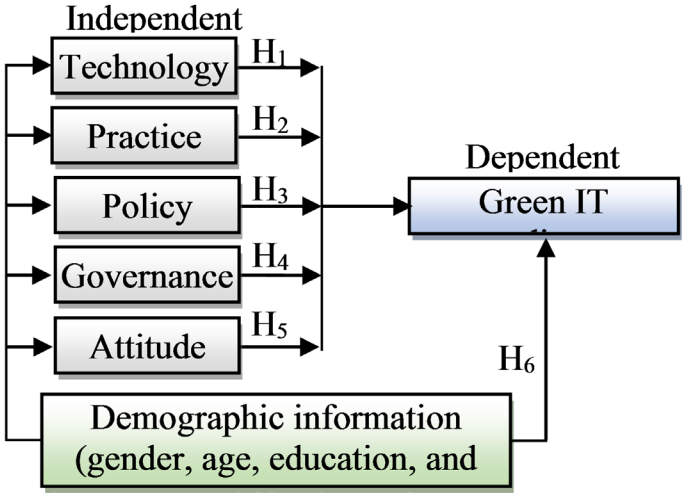
H_1: There is a statistically significant effect of *technology* on *green IT readiness*.
H_2: There is a statistically significant effect of *practice* on *green IT readiness*.
H_3: There is a statistically significant effect of *policy* on *green IT readiness*.
H_4: There is a statistically significant effect of *governance* on *green IT readiness*.
H_5: There is a statistically significant effect of *attitude* on *green IT readiness*.
H_6: The IT users *demographics information* (gender, age, education, and experience) have a statistically significant differences in (*technology, practice, policy, governance, attitude, and green IT readiness)*.

Six experts evaluated the statements for each factor of the questionnaire. The degree of respondents' agreement ranked by the scale: Strongly Disagree (SD)=1 to less than 1.8, Disagree (D)=1.8 to less than 2.6, Neutral (N)=2.6 to less than 3.4, Agree (A)=3.4 to less than 4.2, and Strongly Agree (SA)=4.2 to 5.

The correlation coefficient represented by r in this study. According to Gerstman (2003) coefficient with a value $r \geq \pm 0.7$ indicates a strong association between variables, moderate correlation when the values $\pm 0.7 > r \geq \pm 0.3$, and weak correlation for $r < \pm 0.3$. The population of the study is the IT users, whom are employees working in public and private organizations. The questionnaire distributed online and manually, data of 460 respondents used in the analysis.

The validity checked by Spearman, the results of testing showed the factors of the questionnaire are significant positive correlated with a range from 0.703 to 0.886. Cronbach's alpha used to measure reliability. Yin (2003) determined that the cut-off-point for Cronbach's alpha is 0.7. The results of testing showed the factors of the questionnaire have reliability ranged from 0.720 to 0.886, which indicates the data collected by this questionnaire is reliable for analysis.

Figure 1. The IT users' conceptual model



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

6. DATA ANALYSIS

From the 460 IT users' respondents, there are 259 (54.1%) females and 211 (45.9%) males. Most of the respondent 334 (72.6%) are between 21 to 40 years old. Most of the 281 (61.1%) carrying bachelor degree, and 354 (77.0%) of the respondents have experience between 1 to 16 years for using IT.

The second section of the questionnaire contains 27 statements divided into six factors. For each statement the average, standard deviation (Std), rate, and rank were calculated. The rank is the order of agreement of each statement in the factor. Table 1 shows the descriptive statistics of respondents for the six factors. The average values of the statements of the first statement ranged between 3.39-3.45, while the values of standard deviation ranged between 1.071–1.145. The first rank goes to statement 1, with the highest average 3.45 and standard deviation 1.145, which means the IT users agreed that their organization shut down systems after the end of the official working hours.

The average values of the statements of factor *practice* ranged between 3.30-3.49, while the values of standard deviation ranged between 1.060–1.170. The first rank goes to statement 8, with the highest average 3.49 and standard deviation 1.078, which means the IT users agreed that their organizations may have recycle department for old IT equipment. The IT users have a restriction on the printing limit in their offices, because they are agreeing to the statement 9, which is "Organize print optimization" with average 3.45 that ranked second.

The average values of the statements of factor *policy* ranged between 3.02-3.25, while the values of standard deviation ranged between 1.155–1.247. The first rank goes to statement 14, with the highest average 3.25 and standard deviation 1.199. This indicated that maybe there is no policy set to use IT in efficient way to save energy. The results showed that the IT user's neutral satisfied with all policy factor items like "Disposal of old IT items in an environmentally friendly manner". May be the reason is the organizations not implement the policy of disposal consumable IT components in green environmental ways.

The average values of the statements of factor governance ranged between 3.14-3.26, while the values of standard deviation ranged between 1.163–1.217. The first rank goes to statement 16, with the highest average 3.26 and standard deviation 1.163. The results showed that the IT users were neutral satisfied with the governance factor items, so shifting to green sources of energy for IT components may be not applied in their organization, and neither green IT policy.

The average values of the statements of factor attitude ranged between 3.30-3.60, while the values of standard deviation ranged between 1.098–1.189. The first rank goes to statement 20, with the highest average 3.60 and standard deviation 1.101. The results showed that IT users agreed on IT energy consumption. May be the information technology users feel that climate change is an important issue.

The average values of the statements of factor green IT readiness ranged between 3.20-3.35, while the values of standard deviation ranged between 1.080–1.198. The first rank goes to statement 27, with the highest average 3.35 and standard deviation 1.080. The results showed that the IT users were neutral satisfied of the green IT readiness items. This indicates that the organizations were not taking care in their IT purchasing products the impact on the environment.

The data distribution of the statements tested by Kolmgrov-Simirnov, the results showed that the IT users' responses distribution of the statements is a non-normal distribution; therefore, the Spearman test used for testing the correlation between the factors of this questionnaire. Table 2 shows the matrix of correlations. The results indicated that the strongest positive correlation between green IT readiness and governance with value 0.785. This indicates that the governance is an important factor effect on green

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 1. Descriptive statistics for the questionnaire factors

No	Factor	Statements	Average	Std	Rate	Rank	Factor Average
1.	**Technology**	There is a power shut down system after the end of the official working hours.	3.45	1.145	A	1	**3.416 Agree**
2.		Right sizing IT equipment were used.	3.41	1.092	A	3	
3.		Data was stored by optimal methods.	3.43	1.071	A	2	
4.		The organization removes inefficient energy systems.	3.40	1.120	N	4	
5.		More energy efficient lights were used.	3.39	1.100	N	5	
6.	**Practice**	Prefer IT suppliers that have a green track record	3.35	1.105	N	4	**3.378 Neutral**
7.		Electricity supplied by green energy providers	3.30	1.065	N	6	
8.		There is a system for recycle consumable equipment (e.g. batteries, ink cartridges, and paper).	3.49	1.078	A	1	
9.		The organization organize print optimization.	3.45	1.060	A	2	
10.		To what extent your organization practices double sided documents?	3.37	1.144	N	3	
11.		Switch off unnecessary equipment when not needed.	3.31	1.170	N	5	
12.	**Policy**	Dispose of old IT items in an environmentally friendly manner.	3.19	1.155	N	2	**3.122 Neutral**
13.		The employee has limitations when printing.	3.03	1.247	N	3	
14.		A policy directs staff to use IT in an efficient manner to save energy.	3.25	1.199	N	1	
15.		Green IT sustainability policy were applied.	3.02	1.186	N	4	
16.	**Governance**	The organization considers shifting to green sources of energy for IT equipment.	3.26	1.163	N	1	**3.193 Neutral**
17.		Green IT policy were applied.	3.18	1.194	N	2	
18.		Top management, discuss green IT issues as a priority	3.14	1.217	N	3	
19.	**Attitude**	I am concerned with green IT.	3.59	1.098	A	2	**3.448 Agree**
20.		I am concerned with IT energy consumption.	3.60	1.101	A	1	
21.		Responsibilities on green IT are clearly defined.	3.51	1.129	A	3	
22.		Your organization is concerned with the energy consumption for lighting and cooling IT equipment.	3.31	1.157	N	5	
23.		Your organization is concerned with the efficiency of powering IT system.	3.38	1.170	N	4	
24.		Your organization is concerned with the environmental impact in disposing IT items at the end of its lifecycles.	3.30	1.189	N	6	
25.	**Green IT readiness**	The CEO plays a leading role in green IT initiatives.	3.20	1.198	N	3	**3.276 Neutral**
26.		Set targets for implementing green IT factors.	1.161	N	2	1.161	
27.		Purchase IT components more environmentally friendly.	1.080	N	1	1.080	

Std: Standard deviation

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

IT readiness. The technology factor has the moderate correlation value 0.550 with green IT readiness, which indicates that the technologies used in the organization need to be changed, with technologies have less power consumption.

A linear regression test carried out for testing the hypotheses (H_1 to H_5) as shown in Table 3. For hypothesis H_1 the results show a moderate correlation r = 0.591, with factor of determination r square = 0.349, between technology and green IT readiness, and sig value is 0.000 it indicates there is a statistically significant effect of technology on green IT readiness. Therefore, hypothesis H_1 is accepted. The regression equation is: Green IT readiness = *1.086+0.642* (technology), which shows a linear relationship between the two variables because 36.5% of the IT users still using LCD 17 inch screen types, in their offices, this is corresponds with Molla et al. (2009) finding; which is technological components that follow green IT readiness are saved IT energy consumption.

For hypothesis H_2 the results show a moderate correlation r = 0.653, with factor of determination r square = 0.426, between practice and green IT readiness, which indicates a moderate effect of practice on green IT readiness. The sig value is 0.000 it indicates there is a statistically significant effect of practice on green IT readiness. Therefore, hypothesis H_2 is accepted. The regression equation is: Green IT readiness = 0.773+0.742 (practice), which shows a linear relationship between the two variables because 5.4% of IT users print in their office more than 50 sheets daily, which means they are too far from green IT. In addition, the IT users must recycle consumable equipment as mentioned in Molla et al. (2009) that implementation of practices enhance green IT readiness.

For hypothesis H_3 the results show a strong correlation r = 0.739, with factor of determination r square = 0.546, between policy and green IT readiness, and sig value is 0.000 it indicates there is statistically significant effect of policy on green IT readiness. Therefore, hypothesis H_3 is accepted. The regression equation is: Green IT readiness = 1.171+0.675 (policy), which shows a linear relationship between the two variables, because policy directed the IT users to use IT in an efficient manner to save energy as recommended by Minsani & Imam, (2012) that policy would have a big role in enhancing green IT.

For hypothesis H_4 the results show a strong correlation r = 0.794, with factor of determination r square = 0.631, between governance and green IT readiness, and sig value is 0.000. It indicates there is a statistically significant effect of governance on green IT readiness. Therefore, hypothesis H_4 is accepted. The regression equation is: Green IT readiness = 1.018+0.708 (governance), which shows a linear relationship between the two variables, because governance usually directed employees to follow rules and regulations, which is confirmed with Molla et al. (2009) result, that governance has the highest effect on green IT readiness in the USA.

Table 2. Matrix of correlation

Factor	Technology	Practice	Policy	Governance	Attitude	Green IT readiness
Technology	1					
Practice	0.708**	1				
Policy	0.557**	0.653*	1			
Governance	0.473**	0.582**	0.599**	1		
Attitude	0.413**	0.513**	0.556**	0.582**	1	
Green IT readiness	0.550**	0.638**	0.702**	0.785**	0.571**	1

**Means statically significant at the level of significance ($\alpha = 0.05$)

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

For hypothesis H_5 the results show a moderate correlation r = 0.581, with factor of determination r square = 0.338, between attitude and green IT readiness, and sig value is 0.000 it indicates there is statistically significant effect of attitude on green IT readiness. Therefore, hypothesis H_5 is accepted. The regression equation is: Green IT readiness = 1.203+0.601 (attitude). This shows a linear relationship between the two variables, because most of the IT users concerned about IT energy consumption, and they need more awareness for using IT equipment in the right way. This indicates that they need training courses or workshops to inform them the typical methods of using IT equipment, because 69.6% of the IT users are not attending lectures or workshop in the green IT awareness field.

The hypothesis H_6 related to demographic information of respondents.

Table 4 shows the results of T-test used to investigate the effect of gender on green IT readiness and the five factors. The gender of IT users has no statistically significant differences in their perception regarding green IT readiness and the five factors.

Table 5 shows the results testing the effect of age, education and experience of using IT on green IT readiness and the five factors by using one way ANOVA. The results showed that age has no statistically significant differences on attitude, while the Green IT readiness and the other factors have statistically significant differences according to age.

Table 3. Regression test for the hypotheses H_1 to H_5

Hypothesis	r	r square	F value	Sig.
H_1	0.591	0.349	15.677	0.000
H_2	0.653	0.426	18.432	0.000
H_3	0.739	0.546	23.448	0.000
H_4	0.794	0.631	27.987	0.000
H_5	0.581	0.338	15.282	0.000

Table 4. T-test for the IT users' gender

Factor	Gender	N	Average	Std	T value	f	Sig
Technology	Female	249	3.12	1.098	0.195	458	0.846
	Male	211	3.40	0.841	0.196		
Practice	Female	249	3.33	0.951	-1.175	458	0.240
	Male	211	3.42	0.744	-1.193		
Governance	Female	249	3.20	1.024	-0.133	458	0.599
	Male	211	3.21	1.006	-0.133		
Policy	Female	249	3.16	1.031	0.010	458	0.923
	Male	211	3.16	0.910	0.010		
Attitude	Female	249	3.39	0.871	-1.547	458	0.123
	Male	211	3.52	0.958	-1.535		
Green IT readiness	Female	249	4.13	0.983	-0.617	458	0.502
	Male	211	4.18	0.908	-0.627		

N: number, df: degree of freedom

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 5. One way ANOVA test for the IT users' age, education, and experience

Factor	Age		Education		Experience	
	F value	Sig	F value	Sig	F value	Sig
Technology	5.923	0.000	1.287	0.274	1.847	0.119
Practice	6.714	0.000	2.411	0.048	2.711	0.030
Governance	3.122	0.015	0.724	0.576	2.124	0.077
Policy	7.412	0.000	2.670	0.032	1.492	0.203
Attitude	2.084	0.082	1.387	0.237	5.598	0.000
Green IT readiness	5.752	0.000	1.727	0.143	3.663	0.006

The results indicate that the technology, governance, attitude, and green IT readiness have no statistically significant differences according to the IT users' education, while the practice and policy have statistically significant differences according to education.

The results show that the technology, governance, and policy have no statistically significant differences according to experience, because these three factors do not need experience. These are rules and all employees must follow regulations, while the practice, attitude, and green IT readiness have statistically significant differences according to experience.

7. CONCLUSION

The awareness of green IT and energy saving by using products carrying the *Energy Star* label are very important for individuals and organizations to share, in reducing CO_2 emission, especially the IT users. The perspective of the IT users are employees selected randomly, from different public and private organizations. The factors of this paper identified with the help of previous studies related to green IT readiness and awareness.

For the first question: What are the factors that affect green IT readiness from perspective of IT users? The five factors determined from the related studies are; technology, practice, policy, governance, attitude, and green IT readiness. These factors tested from the IT users' points of view toward green IT readiness. The results showed that the technology and attitude have an agreed degree of agreement; the practice, policy, governance, and green IT readiness have a neutral degree of agreement. The highest correlation coefficient was between governance and green IT readiness. The strongest factor that has a significant effect on green IT readiness was governance, followed by policy.

For the second question: Does the demographics information of IT users have statistically significant differences effect on green IT factors and green IT readiness? The results of the IT users showed that the gender have no statistically significant differences on green IT readiness factors. Age groups have statistically significant differences in green IT readiness except attitude. Educational level has no statistically significant differences in green IT readiness except practice and policy. Years of experience have no statistically significant differences in green IT readiness except practice, attitude, and green IT readiness.

The recommendation of this study is; the governance needs setup strategies for green IT readiness. The user's needs encouragement to apply green IT readiness practices, in addition, enhance IT user's awareness regarding the concept of green IT, by training courses and workshops about green IT.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

REFERENCES

Alsultanny, Y. & Alnassar, F. (2015). Evaluating Factors Affect Green IT Readiness (Part 1). *International Journal of Green Computing*, *6*(2), 30-42.

Brocade. (2007). Storage Area Network Going Green with Brocade. Brocade Communication Systems. Retrieved February 10, 2017, from: www.brocade.com

Cooper, V., & Molla, A. (2012). Developing Green IT Capability: An absorptive Capacity Perspective. In Proceedings of the *Pacific Asia Conference on Information Systems*, Vietnam, July 13-15.

EPA. (n.d.). Retrieved on February 10, 2017 from www.epa.gov

Gerstman, B. (2003). Stat Primer. Retrieved February 10, 2017, from ww.sjsu.edu

Goasduff, L., & Forsling, C. (2007). Gartner Says 50 Percent of Mid and Large Sized Western European IT Organizations Will Develop a Green Strategy by the End of 2008. Gartner.

Graaf, C. (2008). *Search of Green IT Governance*. Greener Computing.

Hart, S. (1997). Beyond Greening Strategies for a Sustainable World. *Harvard Business Review*, *85*(3), 58–68.

Hendry, J., & Vesilind, P. (2005). Ethical Motivations for Green Business and Engineering. *Clean Technologies and Environmental Policy*, *7*(4), 252–258. doi:10.100710098-005-0013-8

Hermann, S., Von Der Gathen, A., & Daus, P. (2010). Retail Pricing Higher Profits through Improved Pricing Processes. In *Retailing in the 21st Century* (pp. 319-336).

Jonathan, R. (2014). State CO_2 Emission Rate Goals in EPA`s Proposed Rule for Wxisiting Power Plants. Congressional research Service. Retrieved on February 11, 2017. From: www.csr.gov

Jongsaguan, S., & Ghoneim, A. (2013). Investing the Factors Affecting Information Systems Evaluation within Sustainable Environments. In *Proceedings of the Mediterranean and Middle Eastern Conference on Information Systems*, Windsor, UK, October 17-18.

McWilliams, A., Siegel, D., & Wright, P. (2006). Corporate Social Responsibility: Strategic Implications. *Journal of Management Studies*, *43*(1). doi:10.1111/j.1467-6486.2006.00580.x

Minsani, M., & Imam, K. (2012). A Preliminary Study of Green IT Readiness in Indonesian Organizations. *Journal of Energy Technologies and Policy.*, *2*(5), 1–9.

Molla, A., & Cooper, V. (2009). Green IT Readiness; a Framework and Preliminary Proof of Concept. *AJIS. Australasian Journal of Information Systems*, *16*(2), 271–385.

Molla, A., Cooper, V., Corbitt, B., Deng, H., Peszynski, K., & Pittayachawan, S. (2008). E-Readiness to G-Readiness: Developing a Green Information Technology Readiness Framework. In *Proceedings of the 19th Australasian Conference on Information Systems*, Christchurch, New Zealand, December 3-5.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Molla, A., Cooper, V., & Pittayachawan, S. (2009). IT and Eco-Sustainability: Developing and Validating a Green IT Readiness Model. In *Proceedings of the 13th International Conference on Information Systems*, Phoenix, Arizona, December 15-18.

Murugesan, S. (2008). *Harnessing Green IT: Principles and Practices*. Published by the IEEE Computer Society.

Oureverydayearth. (n.d.). Retrieved February 10, 2017 from www.oureverydayearth.com

Sen, S., Battacharya, C., & Korschun, D. (2006). The Role of Corporate Social Responsibility in Strengthening Multiple Stakeholder Relationships: A field experiment. *Journal of the Academy of Marketing Science*, *34*(2), 158–166. doi:10.1177/0092070305284978

Whitby, P. (2007). The Benefits of Green IT: The Reasons for Adopting a Greener IT Policy have Become too Good to Ignore. Retrieved February 10, 2017, from: www.computing.co.uk

Yin, R. (2003). *Case Study Research: Design and Methods* (3rd ed.). Thousand Oaks: Sage Publications Inc.

This research was previously published in the International Journal of Green Computing (IJGC), 8(1); edited by Vicente Gonzalez-Prida, pages 23-35, copyright year 2017 by IGI Publishing (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 61
Drivers and Barriers to Green Supply Chain Management Practices:
The Views of Turkish and Egyptian Companies Operating in Egypt

Selin Kucukkancabas Esen
Trakya University, Turkey

Sahar Sobhy El Barky
Arab Academy for Science, Technology, and Maritime Transport, Egypt

ABSTRACT

The main purpose of this chapter is to extend the literature on drivers and barriers to GSCM from a different cultural framework, namely Egypt. The chapter is structured as follows. First, the importance and the components of GSCM are discussed briefly. Next, the benefits of GSCM and the main pressures/drivers that force the business sector to migrate its traditional supply chain activities to be green are highlighted. Next, the key theme of this chapter, the barriers and challenges facing the global business sector for extending green supply chain practices are discussed. Then, the results of multiple interviews that were conducted in multinational Turkish and Egyptian companies operating in Egypt are revealed in order to explore the drivers, benefits and barriers of GSCM and to propose the strategies for overcoming the barriers toward green economy. Finally, the chapter concludes with discussion and recommendations.

INTRODUCTION

'Green' is the new slogan in today's business world. Global warming, increasing quantities of municipal solid waste, scarcity of natural resources, and many other factors impel regulatory and international bodies to take corrective and proactive actions towards the sustainability of the environment. The concept of sustainable development emerged to control these impending environmental, economic, and social crises

DOI: 10.4018/978-1-5225-7915-1.ch061

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

(ElBarky & ElZarka, 2015). Businesses in return found themselves in the spotlight to make fundamental changes in their practices to fit into the 'green' era and achieve sustainable development objectives.

Many strategies, approaches, and standards have been proposed and implemented such as eco-design, green production, green logistics, and reverse logistics. All of these strategies contribute to green supply chain management. Consequently, Green Supply Chain Management (GSCM) emerged as a complement to Supply Chain Management (SCM), since many of its processes have a significant impact on the environment in the form of CO^2 and other toxic emissions, solid waste, and effluent water (Sarkis, 2012). The concept of a 'green supply chain' was first proposed by the Manufacturing Research Consortium of Michigan State University in the U.S. in 1996 for comprehensively considering environmental impacts and resource optimization in manufacturing supply chains. There is no existing standard definition of GSCM. However, for the purposes of this chapter, the concept is defined as "Integrating environmental thinking into supply-chain management, including product design, material sourcing and selection, manufacturing processes, delivery of the final product to the consumers as well as end-of-life management of the product after its useful life" (Srivastava, 2007, p.54).

Under the backdrop of globalization, supply chain involves partners across continents. Globalization of supply chain represents differences in economies, infrastructures, cultures, and politics in the competitive environment (Manuj & Mentzel, 2008). In other words, globalization puts added pressures on techniques and practices of SCM. Besides, international trade drives sustainable supply chains. A sustainable supply chain requires proactive relationship management, including organizational learning, transfer of knowledge and capabilities from the large players in the supply chain, as well as development of an appropriate organizational culture and trust (Ki & Rowlinson, 2011). On the other hand, GSCM helps businesses to reduce operating costs, enhance productivity, enhance business reputation and reduce the risk of being prosecuted for anti-environmental and unethical practices. Considering GSCM's expanded positive long term impacts on organizations, international trade promotes the transnational spread of green supply chains, and it is recognized as an effective mechanism to address environmental issues alongside the global supply chain.

Despite ample evidence of the benefits of GSCM, bigger portions of organizations in different industries are reluctant to adopt GSCM or fail to implement such advanced systems because of internal and external environmental barriers. Considering this, the main aim of this chapter is to explore the primary barriers to implementing GSCM in the international business sector.

Although there exists a well-defined body of evidence on barriers and their consequences on GSCM operations in various countries, research on GSCM in Egypt is rather limited. Therefore, one of the purposes of this study is to extend the literature on drivers and barriers of GSCM from a different cultural framework, namely Egypt. Interviews with companies operating in the same country with different countries of origin (Turkish and Egyptian) were used to arrive at a better understanding of drivers and barriers to implementing GSCM in Egypt.

IMPORTANCE OF GSCM

As stated by Gibson, Mentzer and Cook (2005) SCM is about the planning and management of all operations related with sourcing and procurement, exchange, value creation and fulfillment, and logistics. However due to recent changing environmental policies, companies face increasing pressures from government, customers, shareholders, and suppliers to improve environmental performances of their

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

supply chains. There is evidence in today's literature to suggest that implementation of all supply chain activities creates excessive emission of greenhouse gases, such as methane and carbon dioxide (CO2, Sox, Nox), different types of waste, such as solid and liquid wastes, and high usage of resources (Emmett & Sood, 2011). Companies need to give back more to their community and the environment than they take away (Delmas & Montiel, 2008).

Accordingly, the concept of GSCM has become a very serious and profound area of study in the past decade. Much of the early work in this area focused on the significant impact of GSCM on the well-being of the environment in which corporations operate. Porter and Van der Linde (1995) characterized companies' categorization of green investments as resource saving, waste elimination, and productivity improvement. Emmett and Sood (2011) argued for implementing GSCM to lower emissions of greenhouse gases, to optimize usage of resources, and for huge reductions in different types of wastes. They emphasized the importance of collaboration among all interested parties (supplier, manufacturer, retailer, consumer and logistics providers) in the chain to implement and maintain green management strategy. Likewise, Albino, Dangelico and Pontrandolfo (2012) found that collaborations with all internal and external stakeholders can enhance companies' environmental performances.

There is an abundance of literature exploring whether implementing GSCM leads to enhanced firm performance (Lee, Lee & Pennings, 2001; Sarkis, 2012). Seuring (2004) maintained that implementation of GSCM may result in a win-win situation and provides environmental and economic trade-offs for all supply chain partners. A study of US manufacturing companies carried out by Green, Zelbst and Bhadauria (2012) revealed that the adoption of GSCM practices by companies leads to improved environmental and economic performance, which in turn, positively impact competitiveness. In the literature GSCM practices are often promoted as a basis of sustainable competitive advantage (Barratt & Oke, 2007). Sen (2009) stated that companies can gain competitive advantage by being the first to adopt GSCM practices. Masoumik, Rashid and Olugu (2014) regarded strategic capability as a mediator between GSCM and competitive advantage. Rao and Holt (2005) noted that companies adopting GSCM in Southeast Asia eventually improved competitiveness.

COMPONENTS OF GSCM AND GSC INITIATIVES IN EGYPT

Given typical practices of companies, the main components of GSCM can be broken down as follows:

- Green Outbound Logistics.
- Green Packaging.
- Green Product Design.
- Green Inbound Logistics.
- Green Procurement.
- Green Production.
- Green Reverse Logistics.

Logistics as a part of the supply chain process plans, implements, and controls the efficient flow and storage of products and related information from the point-of-origin to the point-of-consumption in order to meet customers' requirements (Council of Supply Chain Management Professionals, 2016). However, conventional logistics systems do not cover environmental issues adequately. In an environ-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

mentally responsible logistics approach, managers need to expand their visions by adding minimization of total environmental impact to their objectives (Wu & Dunn, 1994). To achieve this objective they must take environmental costs and benefits into consideration from a total system perspective (Copacino & Rosenfield, 1987). The greening of logistics generally depends upon the extent of willingness and the intentions of three main players: government, enterprise, and consumer (Chunguang, Xiaojuan, Kexi, & Pan, 2008). Government should make law and regulations effective, enterprises should put supply chain management into practice, and consumers should promote green consumption.

Green outbound logistics contribute to the success of overall supply chain systems by involving activities such as eco-friendly distribution, packaging, and waste management. These activities can improve a company's overall environmental and economic performance (Rao & Holt, 2005).

Eco-friendly distribution systems enable companies to use traditional fuels more efficiently or to use more eco-friendly fuels, to use eco-friendly vehicle technologies, to minimize toxic emissions, and to adopt eco-friendly infrastructures. These essentials and the dynamics that unite them determine the environmental impact created in the logistics phase of the supply chain (Kam, Christopherson, Smyrnios & Walker, 2003). Establishing their own green outbound systems may well motivate companies to convince their distribution partners to adapt to more environmentally friendly and sustainable transportation systems (Ndubisi & Nair, 2009).

Today, Egypt's emissions represent almost 0.6% of global emissions, of which transportation has the largest share (Ahmed, 2015). It is crucial for Egypt to take concrete steps to reduce emissions arising from transportation. An initiative began in 2004 to develop an integrated plan to realize a long-term sustainable transport sector (Ahmed, 2015). The main objective of this initiative is to minimize the energy consumption and the related greenhouse gas emissions of the transportation. Establishing public-private partnerships is essential to achieve a more energy efficient transportation systems.

Packaging is also a very important component of green outbound systems. In order to address environmental impacts of packaging, many countries now attempt to create environmental programs and put packaging take-back laws into practice to minimize the amount of packaging that enters the waste stream. This legislation causes many companies to rethink the design of their packaging and to manage their delivery and logistics systems accordingly. Labeling is a particularly important aspect of green packaging. It provides customers information to support their recycling behaviors (Peattie & Charter, 2003).

Currently in Egypt, most products in the market come in eco-friendly packaging. However, like other developing countries, many organizations face the problem of the disposal of the waste. Despite government attempts to impose penalties or fines, as well as relying on academic studies and research centers to develop solutions for waste management, municipal solid waste (MSW) in Egypt gets produced at the rate of about 15 million metric tons annually (El-Haggar, 2010). To address the problem of industrial waste management in Egypt, many academics and NGOs try to promote sustainable waste and materials management, where the main focus is the active involvement of industrial waste generators in the reduction of waste volumes at source, supplemented by private sector participation in solid waste management services, particularly collection and recycling (Elfeki & Tkadlec, 2015).

Focusing on outbound shipments alone is not enough to achieve an environmentally responsible supply chain strategy. Logistics activities associated with the receiving, storing, and movement of raw materials, management decisions related to freight consolidation, mode and carrier selection, materials handling, warehousing, and backhaul management are essential parts of GSCM (Wu & Dunn, 1994).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Although implementation is not always easy, the greening of inbound processes can significantly reduce waste and cost and leads to third part involvement, which in turn encourage environmental innovation (Bowen, Cousins, Lamming & Farukt, 2001).

Greater parts of the green inbound system encompass green procurement strategies adopted by companies in response to increasing global concerns. Green procurement tries to reduce the environmental impacts of products and involves decisions regarding retailer choice, material selection, outsourcing, negotiation, delivery planning, and inventory. Accordingly, it addresses issues such as general waste reduction, material substitution, and waste reduction of pollutants. Nikbakhsh (2009) stated that green procurement processes should be the initial step in green supply chain management. During the procurement process, companies have a chance to persuade their suppliers to meet their requirements directly, which consequently may lead to greening the whole supply chain.

To contribute to the creation of a sustainable environment for future generations, some global companies in Egypt incorporate energy conservation in material selection, even in the equipment they use. Depending upon their environmental policy, the procurement department ensures the selection and purchasing of energy efficient electrical equipment, recyclability of packing materials, and remanufacturability of equipment.

The main goal of green production is to minimize environmental impacts of the products by using appropriate substances and technologies (Lund, 1984). Green production compromises largely the activities aiming to reduce energy consumption and waste emission such as clean and lean production, green design, and remanufacturing.

Clean production systems concentrate on the causes of pollution by integrating environment protection systems to companies' products, processes and services. This approach aims to prevent pollution at its very source as opposed to the end of the pipe solution practiced in many places (Rao & Holt, 2005). Lean production focuses on processes but similarly aims to eliminate waste by reducing or minimizing external and internal stakeholder variability (Shah & Ward, 2007, p. 791). Furthermore, green design concentrates on the design issues related to environmental health and safety over the product life cycle during new product design and production process design (Fiksel, 1996). Successful eco-design decisions require intra-organizational and inter-organizational decision support systems (Kumar & Chandrakar, 2012). Remanufacturing which might be considered as part of eco-design decisions, broadly includes collection of used products or materials, evaluation of their forms, and replacement of worn, broken, or obsolete parts with new or refurbished parts. Unlike recycling and re-use, the process of remanufacturing does not degrade the overall value of the substances used (Beamon, 1999).

Under Egyptian environmental law there are articles associated with recycling and remanufacturing, although they are not binding. The Egyptian Environmental Affairs Agency provides no incentives (Elbarkouky & Abdelazeem, 2013). That means a large amount of natural resources are wasted. The challenges cannot be adequately addressed without a green production model that takes into account the social and environmental dimensions in policy-making and decision-making.

On the other hand, there are some initiatives that may lead companies to adopt green production in Egypt. One of those was the establishment of the Egypt National Cleaner Production Center (ENCPC) in 2005 by the Ministry of Industry, Trade and SMEs in cooperation with the United Nations Industrial Development Organization (UNIDO) as a service provider for the Egyptian Industry. The aims of the center are to achieve cleaner production, energy efficiency, renewable energy and waste valorisation,

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

increased environmental awareness, and the development of sustainable production. The center mainly targeted food and chemical industries. The other initiative was the establishment of the Egyptian Green Building Council in 2009. One of the objectives of the council is to provide mechanisms to encourage building investors to amend existing codes to satisfy both energy efficiency and environmental conservation.

Reverse Logistics is the process of planning, implementing, and controlling the efficient, effective inbound flow and storage of secondary goods and related information opposite to the traditional supply chain direction for the purpose of recovering value or proper disposal (Fleishmannn, 2000, p.7). The definition of reverse logistics from an environmental perspective focuses primarily on the source reduction, substitution; reintroduce recyclable or reusable products and materials into the forward supply chain (Wells & Seitz, 2005). The stages of all these processes may differ depending on the industry and product category.

Source reduction refers to conducting similar practices using fewer resources. This process helps companies to reduce total waste in their systems. Substitution means using more eco-friendly materials instead of customary ones that create toxic waste. Reuse employs the same item numerous times in its original form so that little is discarded (Wu & Dunn, 1995). Recycling is at the heart of reverse logistics and involves the chemical and physical processes that give discarded materials a new life (Gencer, 2015). Overall, a company's manufacturing processes, product components, and potential for designing reusable recyclable structures mainly determines its success with reverse logistics (Dowlatshahi, 2000).

Currently in Egypt there are few small-to-medium size companies like Recyclobekia that are responsible for collecting electrical and electronic waste from industry and households. They operate inspection processes to sort e-waste and assign appropriate recovery processes in terms of reuse, recycling, and remanufacturing. Third party logistics companies and dealers export e-waste for recovery processes. Unfortunately e-waste is recovered by original equipment manufacturers, which usually are outside Egypt. Multi-national companies use authorized dealer sites as collection centers for their used products. There are a large number of companies that recycle their packing and plastics waste for themselves and others.

Improving reverse logistics functions can help companies to increase their revenues across total sales, but if ignored, these vital tasks can cost companies millions in lost profits due to broken customer supplier relationships that could have massive impact on their business (Gencer & Akkucuk, 2015).

BENEFITS OF ADOPTING GSCM

Many companies recently started to consider greening the supply chain not as an unnecessary burden on companies, but instead as an elementary mechanism for innovation, uncovering new market opportunities, and wealth creation. The benefits of greening the supply chain are not limited to reduced usage and pollution. For instance, in a green world managers might redesign a product so that it uses fewer eco-friendly or resource-depleting raw materials—an effort that if successful could result in cuts in direct manufacturing costs and inventory savings (Clarke, 1999).

The literature reveals that companies do get involved with GSCM either because they can profit from it, because they have to, and/or because they feel socially and environmentally motivated to do it (Bowen et al., 2001; Holt, 1998; Rao, 2002). Accordingly, the benefits of GSCM are categorized under four main headings:

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- Financial benefits.
- Compliance with laws and regulations.
- Good reputation.
- Minimizing waste and energy use.

Despite ample evidence to the contrary, there persists a myth that greening the system costs additional expense. There are several factors that lead to the persistence of this myth, such as lack of a systematic approach and an unwillingness to engage in sustained and green thinking. Empirical evidence suggests that the most fundamental benefit of GSCM is a positive long term net influence on the financial performance of the company. Implementation of GSCM may provide new opportunities for competition, cost savings, operational efficiency, and innovation, which in turn impact profitability (Dodgson, 2000; Hansmann & Kroger, 2001). For instance in 2014, Cisco planted 3 solar photovoltaic (PV) systems at business facilities in Texas and Bangalore, India that produced savings of over $380,000 annually as well as 2 million kilowatt hours of electricity and prevented 1150 metric tonnes of carbon emission.

Several laws and regulations passed in the last 10 years highlight the significance of the environment, which in turn raises the need for environmental protection. Companies need to adopt green practices to comply with the laws and regulations. GSCM initiatives can help companies create policies that may take them beyond compliance with regulations and help them to gain advantage over competitors and to increase profitability in the long run. For example, Volvo set up refining operations for salvaging and dismantling vehicles to comply with Swedish laws that made automakers responsible for disposal of used vehicles, and eventually generated a significant return (Bose & Pal, 2012).

Environmental approaches can help companies to enhance their corporate reputations and improve market image. For example, Ford Motor Co. developed an environmental management system compliance with ISO 14001 standard as part of the organization's strategy to implement its environmental policy. In 2014, Ford ranked first on Interbrand's list of Best Global Green Brands, and in 2015 it was recognized by the Ethisphere Institute, for the sixth year in a row, as one of the World's Most Ethical Companies (Sustainability Report Summary 2014/15, 2015). All these awards and recognition extend its brand recognition to new audiences, contribute significantly to positive corporate image, and consecutively provide a competitive advantage.

Whether driven by cost savings, a principled strategy, or compliance with regulations, companies started to recognize the environment and implement many environmental and social initiatives voluntarily. Most of the companies are aware of the need to protect their community's goodwill and environment as a valuable resource, because long-term business sustainability depends on this. Minimizing waste and energy use is typically the most argued benefit of GSCM in literature. Several studies suggests that GSCM initiatives encourage companies to protect the environment by using alternative energy sources, keeping away the burning of fossil fuels, recycling, and reducing waste (e.g. Geffen & Rothenberg, 2000; Klassen & Vachon, 2003; Simpson & Samson, 2008). For instance, Starbucks has an environmentally friendly business plan that focus on environmental sustainability and GSCM practices. Through initiatives such as creating "green" stores by adjusting the temperature in its stores from the standard 72°F to 75°F, purchasing cabinetry made with 90% post-industrial material, incorporating low-flow water valves, and achieving EED® certification for all new company-owned outlets, Starbucks has taken positive steps toward environmental protection and established an environmentally friendly corporate culture (Lamm & Dimas,2016).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

DRIVING FORCES BEHIND GSCM

Existing literature focuses extensively on different stakeholder pressures as the key drivers of GSCM initiatives. From a developing country perspective, the motives for adopting GSCM are grouped into six categories:

- Regulatory Stakeholders.
- External Stakeholders:
  - Competitors,
  - Consumers, and
  - NGOs.
- Internal Stakeholders.

Regulatory stakeholders include governments and trade associations that are able to force companies to adopt environmental practices or technologies (Henriques & Sadorsky, 1999). Several government agencies control environmental regulations and laws (e.g. the Egyptian Environmental Affairs Agency in Egypt and the Environmental Protection Agency in the USA). The Egyptian Environmental Affairs Agency formulates environmental policies, prepares necessary plans for environmental protections, and grants environmental relations between Egypt and national and international associates. Furthermore, there are a number of environmental regulations (e.g. in Europe, ELV 2000, RoHS 2003, EUP 2005, REACH 2007) and ISO certifications (9001, 14001) that force companies to reduce their use of natural resources, to reduce the amount of waste they create, and to transport their products for recycling (Baines, Brown, Benedettini & Ball, 2012). ISO 14001:2004 specifies requirements for an environmental management system to enable an organization to develop and implement a policy and objectives that take into account legal and other requirements to which the organization subscribes, providing information about significant environmental aspects. This certificate does not necessarily state environmental performance criteria. It is considered an initial management system for green supply chain implementation (ISO, 2015).

Some countries establish different environmental requirements for different industries and products. Japan, the Netherlands, Norway, the United States, Sweden and France have strict regulations and requirements in terms of fabrics and dyes of clothes imported from China (Zhu, Sarkis & Geng, 2005). Likewise, The Restriction of Hazardous Substances directive (RoHS) confines the quantity of lead and five other materials found in products sold to Europe after July 1, 2006 (RoHS Guide, 2005). All these regulations and agencies have a vast impact on a company's decision to adopt GSCM and assist companies to run GSCM operations more efficiently.

Today the business environment has become more competitive than ever before. This highly competitive global business environment encourages companies to compete through their supply chains. In the literature it has been argued that GSCM not only lowers the ecological impacts of business and but also can create a sustainable supply chain and higher profits (Martusa, 2013; Simpson & Samson, 2008). Consequently, companies place greater emphasis on their environmental practices and upgrade their supply chain management to a more strategic level to comply with environmental regulations and maintain a long-term competitive advantage (Shang & Marlow, 2005). Thus, competitors can be identified as a driver for GSCM as they are able to influence their industry's dynamics, innovation, performance and competitive advantage (Van Hoek, 1999).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

In many cases consumers express emotional resonance, which reinforces cost and convenience factors and demands special products and treatment. Customers are one of the main driving forces for companies to engage in GSCM. However, despite ample evidence from studies regarding pressure to adopt GSCM, research shows consumer's pressure on GSCM adaptation is sometimes inadequate. One study showed that green practices in supply chain does matter to consumers when making decisions on intention to buy the product as well as their willingness to pay for that product (Schniederjans & Starkey, 2014). Similarly, Simpson, Power, and Samson (2007) found a relationship between supply chain sustainability and customers' environmental performance requirements. Accordingly, companies need to manage supply chains more effectively and work on greening their supply chains to meet their customer's expectations and to satisfy them.

Additionally, national and international environmental NGOs which are rapidly growing all over the world have a significant influence on companies' motivation to fulfill the environmental regulations and to adopt GSCM. Regarding the environmental practices of a company, NGOs may influence consumers, companies, and governments' attitudes and behaviors in many different ways. They may provide both negative information to critique companies' insufficiently green processes or unlawful operations and positive information to develop positive attitudes toward companies' products and services. In some cases without NGOs, substantial change is not likely to occur. For example, a report presented by a group of Chinese NGOs describing pollution created by Apple's China-based suppliers' illegal operations raised national and global awareness and thus damaged companies and their customer's reputations and caused economic loss (CCICED Annual General Meeting, 2011). NGOs act for the benefit of companies and contribute to the well being of society at large. Companies need to find ways to collaborate with NGOs in order to find more green solutions to ensure a positive corporate image (Vanpoucke, 2014).

In addition to external stakeholders, internal stakeholders such as top management, employees and shareholders significantly influence successfully implementation of GSCM initiatives by companies (Sarkis, 2012). Top management's control over management system enables companies to provide appropriate technologies and resources, motivate employees, and guide shareholders to implement GSCM activities towards environmental excellence. Highly qualified and talented professional employees are able help to adopt new technologies easily and successfully (Lin & Ho, 2008). Moreover, if a company addresses environmental risk in its supply chain, shareholders might buy more shares seeking a higher return (Henriques & Sadorsky, 1999). Hence, the impact of internal stakeholders to adopt GSCM should not be undervalued.

BARRIERS IN IMPLEMENTING GSCM

It is clear that there are many benefits to implementing GSCM, but many companies are still not adopting and implementing green practices. Consistent with the literature, the barriers of GSCM adoption and implementation broadly divided into two categories:

- Internal barriers, and
- External barriers.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Internal barriers mostly link to financial, human resources, internal stakeholder commitment, awareness, technical, and managerial constraints. With respect to external barriers, GSCM initiatives can be influenced by three constraints: legislation, external stakeholders, and resources.

Financial Constraints

Financial constraints are generally considered the most important barrier to green initiatives (Ravi & Shankar, 2005). Some argue that the level of financial investment required for GSCM may be beyond the reach of small and medium-size enterprises (Min & Galle, 2001). This is partly due to lack of bank loans to encourage green processes. Hazardous waste management regulations of collection, transport, treatment, and disposal of wastes greatly increase the cost of GSCM. Companies are reluctant to invest in GSCM because they feel that investments will generate a lower or slower return. These constraints create major hurdles against the adoption and achievement of GSCM.

Human Resource Barriers

As mentioned previously in this chapter, trained and highly educated personnel are one of the essential components to carry out GSCM requirements. Finding trained personnel is a major obstacle in developing countries. Budgetary restrictions and the cost of hiring qualified personnel are the biggest GSCM challenges in terms of human resources. Employee resistance to change is another issue facing companies in the adoption and the implementation of GSCM. One of the most common reasons for resistance is fear of failure (Jayant & Azhar, 2014). Large scale changes in the system can cause employees to doubt their capability, and they may resist changes without considering their potential benefits. Management needs to diagnose the sources of distress in order to minimize resistance. Offering incentives to employees may help managers to struggle with resistance before, during and after GSCM implementation.

Poor Internal Stakeholder Commitment

Inadequate internal stakeholder commitment may delay or prevent companies from becoming more environmental friendly. One of the primary reasons for this lack of commitment within the organization is poor top management involvement. Perception within an organization that taking steps toward environmental good-will is not their responsibility makes GSCM implementation unfeasible (Hillary, 2000; Shen & Tam, 2002). Previous research has underlined the role of top management as one of the most important elements of GSCM implementation and success (Sarkis, 2012). More involved, efficient and optimistic leadership can defeat the employees' and shareholders' views of green practices as not only political or moral responsibilities and develop good business sense to integrate green thinking into corporate decision making (Baines et al., 2012).

Poor Awareness

One of the initial steps in launching and implementing GSCM is to develop environmental vision and awareness about the benefits of GSCM within the company. Holland and Gibbon (1997) stated that there is a substantial gap between the environmental awareness of SMEs and the business benefits they can gain. Similarly, a number of studies maintained that lack of awareness of environmental issues and

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

strategies, along with a perceived lack of information and support, has been a major barrier to GSCM implementation (Merrit, 1998; Tilley, 1999). Previous research has outlined important linkages between education/training and green awareness (Madsen & Ulhui, 2001; Perron, 2005). The particular qualifications and knowledge obtained by environmental education would help in changing attitudes towards environment and clarifying the goals and benefits of GSCM initiatives. Internal stakeholders with environmental knowledge and GSCM skills would create new ideas for environmental problems of companies and would be more motivated to take part in GSCM implementation.

Technical Constraints

From an operations perspective, GSCM initiatives must deal with the latest reconfigurable, recyclable, and cleaner technologies in order to create minimal environmental damage and maintain cost effectiveness (Koren, Heisel Jovane, Moriwaki, Pritschow, Ulsoy & Van Brussel, 1999). Many companies in developing countries still rely on conventional technology and lack access to green materials and processes (Perron, 2005). In an eco-transportation system, inadequate supply chain infrastructure can be a huge burden. Inadequate infrastructure is mainly related to budgetary constraints of the company. Lack of governmental research funds and inadequate R&D efforts by the company also contribute to this gap. Therefore, companies need to improve their R&D and technical capabilities to resolve these infrastructure problems and to find new and innovative ways for implementing GSCM (Ghazilla, Sakundarini, Rashid, Ayub, Olugu & Musa, 2015; Zhu & Geng, 2013).

Managerial Constraints

Managerial barriers as a result of poor institutional experience to manage all the mechanisms of GSCM have restrained green development in many companies. Poor inter-departmental cooperation and communication due to restrictions in information flow across organization hierarchy prevents companies from adopting green practices (Ravi & Shankar, 2005). Poor monitoring and evaluation of environmental practices of suppliers inhibit companies to control supplier's deviations from environmental standards. Hence, companies need to develop new auditing standards in order to establish a dynamic GSCM process, with an objective of increasing managerial effectiveness. As stated earlier in this chapter ISO 14001 is recognized as an important indicator of environmental intention of a company. Thus, lack of information on environmental standards such as ISO 14001 is one of the most common barriers to GSCM in developing countries (Mathiyazhagana, Govindan, NoorulHaq & Geng, 2013). Some companies who were already aware of environmental standards state that they are not certified because of the high costs. However, environmental decisions made without considering their impact on operations are generally more costly than having an ISO 14001 certification (Gavronski, Ferrer & Paiva, 2008).

Regulatory Constraints

Various environmental regulations and governmental control on the one hand would drive GSCM practices which were explained in detail previously. On the other hand they can act as a barrier to the process. This primarily depends on how a company manages regulatory trade-offs (Mollenkopf, Stolze, Tate & Ueltschy, 2010). Although regulations related with GSCM implementation may impose high environmental standards, companies need to seek integration of environmental policies and regulations

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

on a global scale in order to be a part of the competition and to gain more customer attention. Industrial differences in environmental regulations can impede GSCM efforts (Muduli, Govindan,, Barve & Geng, 2013). Governments and other regulatory institutions should harmonize environmental regulations and standards in order to establish a successful and feasible environmental management system (Luthra, Kumar, Kumar & Haleem, 2011).

External Stakeholder Constraints

Successful GSCM efforts call for active involvement and commitment of external stakeholders. Without governmental support to adopt environmentally friendly policies (e.g. incentives, low interest loans) companies cannot easily overcome the financial barriers and survive in a highly competitive marketplace (Dam & Petkova, 2014). Supplier relationships in GSCM are essential for the adoption and diffusion of green processes. In order to develop a green supply chain, companies need to select appropriate and committed suppliers based on the expected outcomes of the relationship (Hutchins & Sutherland, 2008). Companies establish high commitment and trust relationships with suppliers through open and transparent communication. The success of green efforts depends considerably on potential interests, motives and priorities of customers and NGOs as well (Stead & Stead, 2000). Companies seek ways to publicize their green activities to overcome customers' lack of faith in green claims (Reinhardt, 1999) and encourage NGOs to raise green awareness. As companies' operations are relocated around the world, key supply chain players and non-national employees face cultural challenges related to language and belief systems in each region creating misunderstandings, monetary loss (Hudson, 2005), information distortion (Setthasakko, 2009), and inability to participate and share experiences in the workplace. Cultural diversities tend to act as a barrier to the spread of green awareness in companies (Harris & Crane, 2002).

Resource Constraints

GSCM systems require a large number of resources due to the changes required in company structure, planning, practices, and processes in developing and implementing green practices. Hence, the resistance by companies to undertake GSCM is partly related to inadequate external resources such as clean fuel and recyclable materials markets, leading to additional barriers to implementation. In order to take effective steps towards saving fuel, finding critical environmental resources, and reducing the climate change impact of their businesses and supply chain activities, companies should maintain collaborative relationships with their suppliers and retailers. Lack of training courses, institutions to give training, and monitoring and mentoring services specific to each industry are major constraints, particularly in small and medium companies and companies operating in developing countries that do not hold the required expertise and knowledge to implement environmental systems (Govindan, Khodaverdi & Jafarian, 2013). Limited regulatory instruments and incentives have been identified as a barrier to GSCM (Chan & Yung, 2002). This has further been confirmed through research carried out by Massoud, Fayad, Kamleh and El-Fadel (2010) who found that "lack of government support and incentive is a significant barrier to acquiring an environmental certificate." Ninlawan, Seksan, Tossapol and Pilada (2010) also made the point that inadequate incentives to separate recycled or hazardous materials, ineffective law enforcement, and technology limitation at the community level are obstacles for green management.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

QUALITITATIVE STUDY

In this study a range of interviews were conducted with the managers of multinational Turkish and Egyptian companies operating in Egypt in order to provide greater depth and insight into drivers, benefits, and barriers of GSCM. Interviews carefully targeted companies in which green supply management was successfully implemented with positive outcomes. A structured interview method was used where all interviewees were presented the same questions and asked to choose answers from among the same set of alternatives but in a conversational/informal manner rather than a question-and-answer style. Interviews were conducted within a span of two months. In order to identify the relevant companies to be interviewed, lists provided by the office of the Turkish Commercial Counselor in Cairo and the Ministry of Industry and Trade were used. Purposive sampling was carried out to identify the common barriers of Egyptian and Turkish companies adopting GSCM in Egypt. The companies in the sample were chosen because they were:

- Experienced in adoption of GSC practices.
- Involved in environmental projects.
- Provided direct comparison between Turkish and Egyptian companies.
- Located in Egypt.

At the end of the sampling process, 18 Turkish and 9 Egyptian companies were chosen for the study. A total of 19 companies (12 Turkish and 7 Egyptian) agreed to take part in the study giving a response rate 70.3%. The companies were located in the geographical areas of Cairo and Alexandria. Of the 19 interviews, 14 were with the chief executive officer of the firm. The remaining five interviews were conducted with the procurement officer of the firm. These officers were considered the most knowledgeable firm-internal interviewees on the subject matter of GSCM.

Before conducting interviews, the questions were translated to Turkish and Arabic through the use of a back translation process. First the items were translated into Turkish and Arabic by researchers. They were then back-translated into English by a native speaker. Differences between them were then analyzed and some necessary modifications were made to improve the overall clarity of the items. Prior to conducting the full interviews, a pilot interview was conducted with a procurement officer.

Two university academicians and one practitioner were specifically asked to check for content validity of the interview protocol. Adjustments were made accordingly before final execution. The data from the pilot study were not included in the final analysis. The aim of the study and the domain of the constructs were specified to respondents at the start of the interviews, as recommended by Churchill (1979) and the respondents were offered full anonymity. Each interviews lasted 30-45 minutes.

The questionnaire of the interviews was divided into three parts. The first part of the questionnaire dealt with the demographic profile of the company, including industry category and employee size. In the second part of the questionnaire, respondents were asked about their GSCM practices and their views about the benefits and drivers of GSCM practices. In the final part of the questionnaire, respondents were asked to indicate essential internal and external barriers to implementing GSCM in their companies.

Interview instruments were designed using multiple items from previous studies, covering GSCM implementations and internal and external barriers of GSCM. Financial barriers of GSCM were measured by asking questions used in the studies of Mathiyazhagana et al. (2013), Govindan et al. (2013), Simpson, Taylor and Barker (2004), Zhu et al. (2005). Items in the studies of Mathiyazhagana et al.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

(2013), Luthra et al. (2011) were used to examine barriers related to human resources. Barriers related to commitment of internal stakeholders were measured by questions adapted from studies of Mathiyazhagana et al. (2013), Luthra et al. (2011), and Tilley (1999). Items in the studies of Mathiyazhagana et al. (2013) and Shen and Tam (2002) were used to examine barriers related with awareness. Barriers related with technical capabilities were measured by items adapted from studies of Mathiyazhagana et al. (2013) and Perron (2005). Final internal barriers related with managerial systems were assessed by items adapted from Mathiyazhagana et al. (2013), Luthra et al. (2011), Govindan et al. (2013). Items used in the studies of Mathiyazhagana et al. (2013) and Tilley (1999) were used to constitute barriers related to legislation. Barriers related to commitment of external stakeholders were measured by asking the questions used in the studies of Mathiyazhagana et al. (2013), Luthra et al. (2011), Setthasakko (2009), and Orsato (2006). Finally, barriers related to environmental resources was measured by items adapted from the studies of Mathiyazhagana et al. (2013), Luthra et al. (2011), and Muduli et al. (2013).

Demographic Profile of Companies

Table 1 presents the demographic profile of companies. Among 19 companies, there are 12 Turkish companies and 7 Egyptian companies. Of the 12 Turkish companies, 50% of the companies were in textiles, 25% of them were in chemicals, 8% of them were in retail, 8% of them were in Food, and 8% of them were in household appliances/white goods industries. A profile of Egyptian companies shows a reasonable spread across the industries: automotive (14%), chemical (14%), food (14%), household appliances/electronics (14%), steel (14%), shipping (14%) and glass (14%). 41% of Turkish firms had less

Table 1. Demographic profile of the companies

	Value	Turkish Companies (n=12) %	Egyptian Companies (n=7) %
Industry	Textile	50,0	-
	Chemicals	25,0	14,3
	Retailer	8,3	-
	Food	8,3	14,3
	Household Appliances	8,3	14,3
	Automotive	-	14,3
	Steel	-	14,3
	Shipping	-	14,3
	Glass	-	14,3
Size	less than 250	41,7	-
	250-500	8,3	14,3
	501-1000	16,7	-
	1001-1500	16,7	-
	1501-2000	8,3	57,1
	more than 2000	8,3	28,6
ISO 14001 certificate	Yes	16,7	100,0
	No	83,3	-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

than 250 employees, 25% had between 250-1000 employees, 25% had between 1001-2000 employees and only 8.3% had more than 2000 employees. Of all the 7 Egyptian firms, 57% had between 1501-2000 employees, 29% had more than 2000 employees and 14% had between 250-500 employees.

In the interviews, information about IS0 14001 series certification was also elicited. Out of 12 Turkish firms 83% stated that they were not certified. The most frequently stated reason for not having ISO 14001 certification was the firms' weak internal capabilities that restrain them to have the basic competencies to implement ISO 14001 organization-wide. In contrast 100% of Egyptian firms had ISO 14001 certification.

Results

Statistical calculations mainly based on the frequencies of collective judgments of all the participating companies were conducted to summarize the categorical data obtained from structured interviews. In the first part, firms' current GSCM practices, drivers/pressures behind GSCM practices, and benefits expected to be gained by practicing GSCM were computed for both Turkish and Egyptian companies. The results are presented in Table 2.

The data revealed that 75% of the Turkish companies and 100% of Egyptian companies had practiced several GSCM activities between 1-5 years. Currently 42% of the Turkish companies practice outbound logistics, and this was followed by inbound logistics (33%), "green procurement" (33%), "green production" (33%), "green packaging" (33%) and "product recovery strategy" (33%). Among Egyptian companies, green production (100%) was the most practiced green activity. Comparatively, 1 Turkish and 2 Egyptian companies out of 19 were the only ones that apply the full spectrum of green activities. Moreover, 42% of the Turkish companies stated outbound logistics as their first GSCM practice and that followed by inbound logistics (17%). All of the Egyptian companies' first GSCM activity was green production.

The majority of Turkish companies (75%) and all Egyptian companies (100%) identified ''regulatory stakeholders'' as the main driving force behind GSCM practices. This was followed by ''NGOs '' for Turkish companies (42%) and ''internal stakeholders'' for Egyptian companies (43%). One of the Turkish chief executives identified corporate global environment policy as one of the pressures for GSCM initiatives. These results indicate that the companies implement GSC mainly to comply with the laws and regulation to avoid any penalties and drawbacks from regulatory bodies such as the Ministry of Environmental Affairs that conduct regular audits on industrial companies to check their environmental performance.

As can be seen in Table 2, ''good reputation'' was the main expected benefit for both Turkish (67%) and Egyptian (100%) companies. This was followed by ''complying with legislation and regulations'' for Turkish companies (58%) and ''minimizing waste and energy use'' (58%) for Turkish companies and similarly "minimizing waste and energy use'' (86%) for Egyptian companies. One Turkish procurement officer indicated that enhanced employees' health was the main expected benefit of their GSCM initiatives.

In the second part of the calculations, essential barriers that companies faced during the implementation of GSCM were identified. Based on the judgments of all the participating companies, "total responses in each barrier category" and "average response per company" were computed. Then, by dividing "average response per company" to "total questions in each barrier category", "average response per company" was presented as percentage of "total questions in each barrier category" for assessing the significance of each barrier category. As shown in Table 3 awareness (36%) was the most important internal barrier category among Turkish companies. Legislation (50%) was the most important external barrier category

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 2. Drivers and benefits of GSCM

	Turkish Companies (n=12) %	Egyptian Companies (n=7) %
Current Practices Related to GSCM		
Inbound logistics	33,3	28,6
Outbound logistics	41,7	28,6
Green procurement	33,3	28,6
Green product design	25,0	28,6
Green production	33,3	100,0
Green packaging	33,3	28,6
Reverse logistics	16,7	28,6
Product recovery strategy	33,3	28,6
The First GSCM Practice		
Inbound logistics	16,7	0,0
Outbound logistics	41,7	0,0
Green procurement	8,3	0,0
Green product design	8,3	0,0
Green production	8,3	100,0
Green packaging	8,3	0,0
Reverse logistics	0,0	0,0
Product recovery strategy	8,3	0,0
GSCM Practice Time		
1-5 years	75,0	100,0
6-11 years	16,7	0,0
more than 11 years	8,3	0,0
Main Drivers of GSCM		
Regulatory Stakeholders	75,0	100,0
Competitors	25,0	0,0
Consumers	33,3	0,0
NGOs	41,7	0,0
Internal Stakeholders	25,0	42,9
Other	8,3	0,0
Main Benefits of GSCM		
Financial benefits	25,0	0,0
Complying with legislations and regulations	58,3	0,0
Minimizing waste and energy use	58,3	85,7
Good reputation	66,6	100,0
Other	8,3	0,0

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 3. Main internal and external barriers of GSCM

Barriers		Number of Questions	Turkish Companies (n=12)			Egyptian Companies (n=7)		
			Total Responses	Average Response per Company	Average Response per Company as % of Total Specific Barrier	Total Responses	Average Response per company	Average Response per Company as % of Total Specific Barrier
INTERNAL BARRIERS	Financial Constraints	7	18	1,50	21,4	8	1,14	16,3
	Human Resource	6	21	1,75	29,2	21	3,00	50,0
	Commitment of Internal Stakeholders	4	7	0,58	29,2	0	0,00	0,0
	Awareness	2	11	0,92	45,8	7	1,00	50,0
	Technical Capabilities	4	14	1,17	29,2	2	0,29	7,1
	Management System	5	11	0,92	18,3	18	2,57	51,4
EXTERNAL BARRIERS	Legislation	4	24	2,00	50,0	0	0,00	0,0
	Commitment of External Stakeholders	5	27	2,25	45,0	7	1,00	20,0
	Resources	4	19	1,58	39,6	13	1,86	46,4
Total of Internal Barrier Items		28	82	6,83	24,4	56	8,00	28,6
Total of External Barrier Items		12	66	5,50	45,8	20	2,86	23,8

that Turkish companies encountered during the implementation of GSCM. Among Egyptian companies human resource (50%) was the most stated internal barrier which was closely followed by awareness (48%) whereas lack of resources (46%) was the most important external barrier.

In the final part, relative importance of specific barriers under each category was computed. In the financial constraints category "high capital investment" was the most important barrier for both Turkish (42%) and Egyptian companies (100%). In the human resources category "lack of trained personnel" was the most stated barrier by Turkish (83%). Similarly among Egyptian companies "lack of trained personnel" (100%) along with "resistance to change" (100%) was the most important barrier in terms of human resources. In the commitment of internal stakeholders category "perception of out of responsibility zone" was the most stated barrier by Turkish companies (33%). However during the interviews none of the Egyptian companies indicated any concern about commitments of internal stakeholders. In the awareness category "lack of awareness of potential advantages of GSCM" was the most stated barrier among both Turkish (58%) and Egyptian (100%) companies. In terms of technical constraints "lack of new technology, materials and processes" was the most stated barrier among both Turkish (58%) and Egyptian companies (29%). In general terms, interviewees complained about lack of consulting firms that could provide specialized advice about GSCM practices, processes and implementation. In the

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

management system category "lack of adequate information about implementation" was the most stated barrier among both Turkish (42%). "Lack of inter-departments cooperation in communication" was the most stated managerial barrier among Egyptian companies (100%).

With respect to legislation category which was also found as the most important external barrier for Turkish companies, "environmental legislations & regulations" (58%), "industry specific legislations" (58%), "ineffective legal sanctions" (50%) were the most stated ones. In contrast interviewees from Egyptian companies did not put emphasis on barriers related to legislation. In terms of commitment of external stakeholders, "lack of customer awareness about GSCM" (58%) and "lack of governmental support to adopt environmental friendly policies" (50%) were the most stated barriers by Turkish companies. As for the Egyptian companies "cultural diversity" (100%) was the most and the only indicated one. Finally in the resources category "lack of direct incentives" was the most stated barrier by Turkish companies (50%). "Lack of clean fuel" (100%) was the most important resource related barrier among Egyptian companies which was closely followed by "lack of direct incentives" (86%). These results are presented in Table 4.

SOLUTIONS AND RECOMMENDATIONS

In recent years the green movement has reached out a broader base. Companies now realize that implementing green practices not only improves the environment but also can provide significant financial, environmental and social benefits by reducing waste, regulatory costs, and potential long-term liabilities. The results of this study revealed that for Turkish companies complying with legislation was the main motivation and expected benefit for taking up GSCM. Similarly, Egyptian managers' stated that they were expecting to enhance company reputation by complying with the environmental laws and regulations.

Greening supply chains is important for Egypt's green transformation but is not an easy task for companies operating in an environment lacking government incentives, industrial guidance, trained personnel, and a mature market of green consumption. Analyzing the main barriers of GSCM in order to address environmental problems of the companies operating in Egypt was the main objective of the empirical part of this chapter. In the exploratory study, 9 barriers that include 40 different constraints under 2 main categories were examined based on the findings of numerous studies.

A majority of the managers of Turkish and Egyptian companies stated that human resources and awareness are the main internal barriers for GSCM. Most of the interviewees openly mentioned that they are not aware of ISO 14001 certification. This finding is in line with earlier research indicating that environmental strategy requires trained, qualified and environmentally motivated and aware personnel in the first place (Jayant & Azhar, 2014; Merritt, 1998; Tilley, 1999). A number of managers believe that there is resistance by managers, employees and shareholders to undertake environmental management programs mainly due to fear of failure or the perception that such undertakings are outside of their responsibility zones. During the interviews solutions were discussed with the interviewees, who they stated that environmental information databases and training classes for internal stakeholders would help to raise awareness about the environment and GSCM practices. These initiatives would consequently support the companies in reducing the resistance to change which was indicated by interviewees as one of the most challenging barriers.

Regarding external barriers, Turkish managers indicated environmental legislation and regulations as the key factor for non-implementation of GSCM. This finding is also in line with studies in which

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 4. Barriers of GSCM within each category

	Barriers		Turkish Companies (n=12) %	Egyptian Companies (n=7) %
INTERNAL	**Cost / Financial**	High capital investment	25,0	100,0
		Implementation costs	41,7	0,0
		Financial constraints	25,0	0,0
		Less return-on-investments	16,7	0,0
		Lack of financial resources	8,3	0,0
		Non-availability of bank loans to encourage green products/ processes	8,3	0,0
		High cost for disposing hazardous wastes	25,0	14,3
	Human Resource	Lack of access to technical expertise	33,3	0,0
		Lack of trained personnel	83,3	100,0
		Fear of failure	0,0	0,0
		Resistance to change and adoption	16,7	100,0
		Lack of direct incentives	8,3	42,9
		Difficulty in setting the mindset and behavioral change	33,3	57,1
	Commitment of Internal Stakeholders	Poor shareholder commitment	0,0	0,0
		Poor management involvement	8,3	0,0
		Poor employee commitment	16,7	0,0
		Perception of "out-of-responsibility" zone	33,3	0,0
	Awareness	Poor environmental awareness	33,3	0,0
		Lack of awareness of potential advantages of GSCM	58,3	100,0
	Technical Capabilities	R&D inadequacies	25,0	0,0
		Complexities in design to reuse or recycle the product	25,0	0,0
		Lack of new technology, materials and processes	58,3	28,6
		Infrastructure inadequacies	8,3	0,0
	Management System	Lack of adequate information about implementation	41,7	42,9
		Lack of knowledge of environmental management standards such as ISO 14001	33,3	0,0
		Complexities to measure and monitor the environmental practice of suppliers	8,3	57,1
		Lack of management skills and environmental knowledge	8,3	57,1
		Lack of inter-departments co-operation in communication	0,0	100,0

continued on following page

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 4. Continued

	Barriers		Turkish Companies (n=12) %	Egyptian Companies (n=7) %
EXTERNAL	**Legislation**	Environmental legislations & regulations	58,3	0,0
		Ineffective legal sanctions	50,0	0,0
		Industry specific legislations	58,3	0,0
	Commitment of External Stakeholders	Poor supplier commitment	33,3	0,0
		Lack of customer awareness and pressure about GSCM	58,3	0,0
		Lack of government support to adopt environmental friendly policies	50,0	0,0
		Inadequate pressure from NGOs	41,7	0,0
		Cultural differences	41,7	100,0
	Resources	Lack of consultancy institutions to train, monitor the progress specific to each industry	41,7	0,0
		Lack of critical environmental resources.	41,7	0,0
		Lack of clean fuel	25,0	100,0
		Lack of direct incentives	50,0	85,7

it was found that governments and other regulatory institutions can discourage the adoption of GSCM by setting time consuming, costly and industry-specific environmental regulations (Mathayazhagan et al., 2013; Zhu et al., 2006). Egyptian companies did not identify regulations as a barrier to green activities; instead they described their companies' green regulations as more uptight than those required by Egyptian environmental law. Differences in perception of legal pressures might be due to distinctive regulations faced by public regulators in terms of country of origins or industries, which should be explored in more depth.

Egyptian companies' major external barriers to GSCM implementation was related to inadequate environmental resources. During the interviews, managers mainly emphasize the importance of clean fuel and direct incentives in green practices. Most of the interviewees noted that lack of direct investment is the main obstacle for them in implementing GSCM. They feel that government financial support or increases in some incentives would be helpful in practicing green. The importance of collaborative relationships with their suppliers and retailers was also discussed in order to take effective steps towards saving fuel and finding critical environmental resources that companies should maintain. They felt that the Egyptian government should provide clean or less polluting fuels such as organic fuel and natural gas to help companies to comply with green principles in their decision making processes.

Solutions to overcome all these barriers were discussed with the interviewees, and interviewers proposed a model that delivers an enhanced probability of success in the implementation of GSCM. In the literature there a numerous models (Akkucuk, 2016; Lin & Ho, 2008; Rao & Holt, 2005; Sarkis, 2012; Wu & Dunn, 1995,) which seek to help companies to manage their supply chain's environmental impacts, resulting in more efficient operations. The authors proposed GSC migration model developed

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

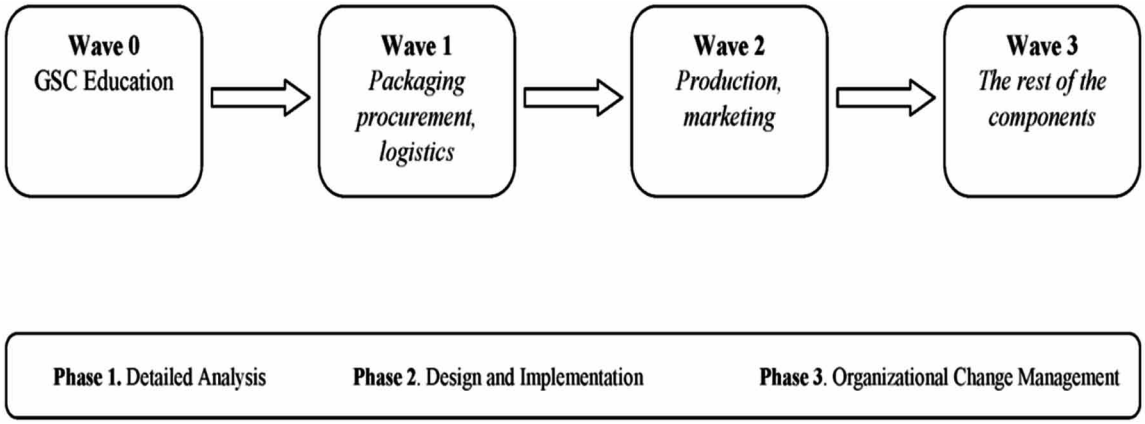
by Elbarky and Elzarka (2015) as a point of reference due to its suitability for the identified barriers during the interviews. This model divides GSCM practices into seven key processes: green planning, green procurement, green execution, carbon management, migration strategy/approach, performance evaluation and continual improvement.

The migration strategy is one of the significant elements of the model and provides a practical road map to guide companies towards GSCM and overcome the stated barriers. The migration strategy includes four waves that last less than eighteen months, as shown in Figure 1. Each wave includes three phases of no less than 6 months. Waves help companies to implement green supply chain practices in a more controlled approach. In Wave 0, which was added to the original model as a foundation, companies should conduct a detailed analysis on the educational needs of their employees, stakeholders, customers, and other interested parties to determine the areas of development within the scope of sustainability and green supply chain management. Consequently, a detailed training plan should be designed to deliver the required knowledge for a period of no less than 12 months. Wave 1 should be started with greening packaging, procurement, and logistics. It is worth noting that it is not recommended to start the greening process with production, which involves high capital investment and very sophisticated processes that might discourage companies from executing their green initiatives. In Wave 2 companies should focus on production and marketing, and in the final wave the rest of the components should be well covered. Each wave should start with phase 1, which makes an initial assessment and a gap analysis for the current situation of the company regarding green practices. In phase 2, the companies should design their environmental programs to mitigate their environmental impacts and finally measure their environmental performances and progresses in terms of previous steps.

CONCLUSION

This chapter outlined the drivers, benefits that encourage, and barriers that prevent companies from implementing environmental practices within their organizations. It is clear from the literature and the results of the interviews that there are many motivators, but resistance by internal and external stakeholders to GSCM practices is undoubtedly a problem. Qualitative study of this chapter has thrown light

Figure 1. Green supply chain migration model



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

on some of the critical barriers that companies operating in Egypt face in implementing GSCM. Accordingly, the authors suggested a model to overcome these limiting conditions. Although the proposed model may help companies practicing GSCM in Egypt to cope with these constraints, it suffers from the flaw that it is based upon the authors' opinions which may lead to bias. Thus it is advised to be tested in a realistic scenario in the future.

REFERENCES

Ahmed Essam, H. M. (2015). *Multi-year Expert Meeting on Transport, Trade Logistics and Trade Facilitation Sustainable Freight Transport Systems: Opportunities for Developing Countries*. Retrieved July 18, 2016 from http://unctad.org/meetings/en/ Contribution/Essam%20H.M.%20AHMED.pdf

Akkucuk, U. (2016). SCOR Model and the Green Supply Chain. In U. Akkucuk (Ed.), Handbook of Research on Waste Management Techniques for Sustainability (pp. 108-124). Hershey, PA: Information Science Reference. doi:10.4018/978-1-4666-9723-2.ch006

Albino, V., Dangelico, R. M., & Pontrandolfo, P. (2012). Do inter-organizational collaborations enhance a firms environmental performance? A study of the largest US companies. *Journal of Cleaner Production*, *37*, 304–315. doi:10.1016/j.jclepro.2012.07.033

Baines, T., Brown, S., Benedettini, O., & Ball, P. (2012). Examining green production and its role within the competitive strategy of manufacturers. *Journal of Industrial Engineering and Management*, *5*(1), 53. doi:10.3926/jiem.405

Barratt, M., & Oke, A. (2007). Antecedents of supply chain visibility in retail supply chains: A resource-based theory perspective. *Journal of Operations Management*, *25*(6), 1217–1233. doi:10.1016/j.jom.2007.01.003

Beamon, B. M. (1999). Designing the green supply chain. *Logistics Information Management*, *12*(4), 332–342. doi:10.1108/09576059910284159

Bose, I., & Pal, R. (2012). Do green supply chain management initiatives impact stock prices of firms? *Decision Support Systems*, *52*(3), 624–634. doi:10.1016/j.dss.2011.10.020

Bowen, F. E., Cousins, P. D., Lamming, R. C., & Farukt, A. C. (2001). The role of supply management capabilities in green supply. *Production and Operations Management*, *10*(2), 174–189. doi:10.1111/j.1937-5956.2001.tb00077.x

CCICED Annual General Meeting. (2011). *Practices and Innovation of Green Supply Chain, Chapter 6.* Retrieved June 26, 2016 from http://www.cciced.net/encciced/ policyresearch/policyreoport/201206/P020120612560389713362.pdf

Chan, E. H. W., & Yung, E. H. K. (2002). *Evaluating environmental management policies: an international trend, development of construction management and real estate*. Yinchuan.

Chunguang, Q., Xiaojuan, C., Kexi, W., & Pan, P. (2008). Research on green logistics and sustainable development. In *Proceedings of International Conference on Information Management, Innovation Management and Industrial Engineering* (vol. 3, pp. 162-165). IEEE. 10.1109/ICIII.2008.114

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Churchill, G. A. Jr. (1979). A paradigm for developing better measures of marketing constructs. *JMR, Journal of Marketing Research*, *16*(1), 64–73. doi:10.2307/3150876

Clarke, R. A. (1999). *The Challenge of Going Green*. Retrieved June 28, 2016 from https://hbr.org/1994/07/the-challenge-of-going-green

Copacino, W. C., & Rosenfield, D. B. (1987). Methods of logistics systems analysis. *International Journal of Physical Distribution & Materials Management*, *17*(6), 38–59. doi:10.1108/eb014666

Council of Supply Chain Management Professionals. (2016). Retrieved August 1, 2016 from https://cscmp.org/supply-chain-management-definitions

Dam, L., & Petkova, B. N. (2014). The impact of environmental supply chain sustainability programs on shareholder wealth. *International Journal of Operations & Production Management*, *34*(5), 586–609. doi:10.1108/IJOPM-10-2012-0482

Delmas, M., & Montiel, I. (2008). The diffusion of voluntary international management standards: Responsible care, ISO 9000, and ISO 14001 in the chemical industry. *Policy Studies Journal: the Journal of the Policy Studies Organization*, *36*(1), 65–93. doi:10.1111/j.1541-0072.2007.00254.x

Dodgson, M. (1994). Technological collaboration and innovation. The Handbook of Industrial Innovation, 285-292.

Dowlatshahi, S. (2000). Developing a theory of reverse logistics. *Interfaces*, *30*(3), 143–155. doi:10.1287/inte.30.3.143.11670

Elbarkouky, M. M. G., & Abdelazeem, G. (2013). A green supply chain assessment for construction projects in developing countries. *WIT Transactions on Ecology and the Environment, 179*.

Elbarky, S., & Elzarka, S. (2015). A green supply chain management migration model based on challenges faced in Egypt. In *Proceedings of Industrial Engineering and Operations Management (IEOM) International Conference* (pp. 1-8). IEEE. 10.1109/IEOM.2015.7228093

Elfeki, M., & Tkadlec, E. (2015). Treatment of municipal organic solid waste in Egypt. *Journal of Materials and Environmental Science*, *6*(3), 756–764.

ElHaggar, S. (2010). *Sustainable Industrial Design And Waste Management: Cradle-To-Cradle for Sustainable Development*. Academic Press.

Emmett, S., & Sood, V. (2010). *Green supply chain*. John Wiley & Sons.

Fiksel, J. (1996). Achieving eco-efficiency through design for environment. *Environmental Quality Management*, *5*(4), 47–54. doi:10.1002/tqem.3310050407

Fleishmann, M. (2000). *Quantitative Models for Reverse Logistics*. Academic Press.

Gavronski, I., Ferrer, G., & Paiva, E. L. (2008). ISO 14001 certification in Brazil: Motivations and benefits. *Journal of Cleaner Production*, *16*(1), 87–94. doi:10.1016/j.jclepro.2006.11.002

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Geffen, C. A., & Rothenberg, S. (2000). Suppliers and environmental innovation: The automotive paint process. *International Journal of Operations & Production Management*, *20*(2), 166–186. doi:10.1108/01443570010304242

Gencer, Y. G. (2015). Mystery of Recycling: Glass and Aluminum Examples. In U. Akkucuk (Ed.), Handbook of Research on Waste Management Techniques for Sustainability (pp. 172–191). Academic Press.

Gencer, Y. G., & Akkucuk, U. (2015). Reverse Logistics: Automobile Recalls and Other Conditions. In U. Akkucuk (Ed.), Handbook of Research on Waste Management Techniques for Sustainability (pp. 125–153). Academic Press.

Ghazilla, R. A. R., Sakundarini, N., Abdul-Rashid, S. H., Ayub, N. S., Olugu, E. U., & Musa, S. N. (2015). Drivers and Barriers Analysis for Green Manufacturing Practices in Malaysian SMEs: A Preliminary Findings. *Procedia CIRP*, *26*, 658–663. doi:10.1016/j.procir.2015.02.085

Gibson, B. J., Mentzer, J. T., & Cook, R. L. (2005). Supply chain management: The pursuit of a consensus definition. *Journal of Business Logistics*, *26*(2), 17–25. doi:10.1002/j.2158-1592.2005.tb00203.x

Govindan, K., Khodaverdi, R., & Jafarian, A. (2013). A fuzzy multi criteria approach for measuring sustainability performance of a supplier based on triple bottom line approach. *Journal of Cleaner Production*, *47*, 345–354. doi:10.1016/j.jclepro.2012.04.014

Green, K. W. Jr, Zelbst, P. J., Meacham, J., & Bhadauria, V. S. (2012). Green supply chain management practices: Impact on performance. *Supply Chain Management: An International Journal*, *17*(3), 290–305. doi:10.1108/13598541211227126

Hansmann, K. W., & Kroger, C. (2001). Environmental management policies. In *Green Manufacturing and Operations: From Design to Delivery and Back* (pp. 192–204). Sheffield, UK: Greenleaf Publishing. doi:10.9774/GLEAF.978-1-909493-22-3_15

Harris, L. C., & Crane, A. (2002). The greening of organizational culture: Management views on the depth, degree and diffusion of change. *Journal of Organizational Change Management*, *15*(3), 214–234. doi:10.1108/09534810210429273

Henriques, I., & Sadorsky, P. (1999). The relationship between environmental commitment and managerial perceptions of stakeholder importance. *Academy of Management Journal*, *42*(1), 87–99. doi:10.2307/256876

Hillary, R. (Ed.). (2000). *Small and Medium-Sized Enterprises and the Environment: Business Imperatives*. Greenleaf Publishing.

Holland, L., & Gibbon, J. (1997). SMEs in the metal manufacturing, construction and contracting service sectors: Environmental awareness and actions. *Eco-Management and Auditing*, *4*(1), 7–14. doi:10.1002/(SICI)1099-0925(199703)4:1<7::AID-EMA58>3.0.CO;2-9

Holt, D. (1998). The perceived benefits of an environmental management standard. *Business Process Management Journal*, *4*(3), 204–213. doi:10.1108/14637159810224313

Hudson, S. (2005). *Cultural affects on the global supply chain*. The SCRC Articles Library.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Hutchins, M. J., & Sutherland, J. W. (2008). An exploration of measures of social sustainability and their application to supply chain decisions. *Journal of Cleaner Production*, *16*(15), 1688–1698. doi:10.1016/j.jclepro.2008.06.001

Jayant, A., & Azhar, M. (2014). Analysis of the barriers for implementing green supply chain management (GSCM) practices: an interpretive structural modeling (ISM) Approach. *Procedia Engineering, 97*, 2157-2166.

Kam, B. H., Christopherson, G., Smyrnios, K. X., & Walker, R. H. (2006). Strategic Business Operations, Freight Transport and Eco-Efficiency: A Conceptual Model. In I. J. Sarkis (Ed.), *Greening the Supply Chain* (pp. 103–115). Springer London. doi:10.1007/1-84628-299-3_6

Ki Fiona Cheung, Y., & Rowlinson, S. (2011). Supply chain sustainability: A relationship management approach. *International Journal of Managing Projects In Business*, *4*(3), 480–497. doi:10.1108/17538371111144184

Klassen, R. D., & Vachon, S. (2003). Collaboration and evaluation in the supply chain: The impact on plant-level environmental investment. *Production and Operations Management*, *12*(3), 336–352. doi:10.1111/j.1937-5956.2003.tb00207.x

Koren, Y., Heisel, U., Jovane, F., Moriwaki, T., Pritschow, G., Ulsoy, G., & Van Brussel, H. (1999). Reconfigurable manufacturing systems. *CIRP Annals-Manufacturing Technology*, *48*(2), 527–540. doi:10.1016/S0007-8506(07)63232-6

Kumar, R., & Chandrakar, R. (2012). Overview of green supply chain management: Operation and environmental impact at different stages of the supply chain. *International Journal of Engineering and Advanced Technology*, *1*(3), 1–6.

Lee, C., Lee, K., & Pennings, J. M. (2001). Internal capabilities, external networks, and performance: a study on technology-based ventures. *Strategic Management Journal, 22*(6-7), 615-640.

Lin, C. Y., & Ho, Y. H. (2008). An empirical study on logistics service providers' intention to adopt green innovations. *Journal of Technology Management & Innovation*, *3*(1), 17–26.

Lund, R. T. (1984). Remanufacturing. *Technology Review*, *87*(2), 18.

Luthra, S., Kumar, V., Kumar, S., & Haleem, A. (2011). Barriers to implement green supply chain management in automobile industry using interpretive structural modeling technique: An Indian perspective. *Journal of Industrial Engineering and Management*, *4*(2), 231–257. doi:10.3926/jiem.2011.v4n2.p231-257

Madsen, H., & Ulhøi, J. P. (2001). Greening of human resources: Environmental awareness and training interests within the workforce. *Industrial Management & Data Systems*, *101*(2), 57–65. doi:10.1108/02635570110384320

Manuj, I., & Mentzer, J. T. (2008). Global supply chain risk management. *Journal of Business Logistics*, *29*(1), 133–155. doi:10.1002/j.2158-1592.2008.tb00072.x

Martusa, R. (2013). Green supply chain management: Strategy to gain competitive advantage. *Journal of Energy Technologies and Policy*, *3*(11), 334–341.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Masoumik, S. M., Abdul-Rashid, S. H., & Udoncy Olugu, E. (2014). Gaining Competitive Advantage through Strategic Green Supply Chain Management: From a Literature Review towards a Conceptual Model. *International Journal of Supply Chain Management*, *3*(3), 49–58.

Massoud, M. A., Fayad, R., Kamleh, R., & El-Fadel, M. (2010). Environmental management system (ISO 14001) certification in developing countries: Challenges and implementation strategies. *Environmental Science & Technology*, *44*(6), 1884–1887. doi:10.1021/es902714u PMID:20151632

Mathiyazhagan, K., Govindan, K., NoorulHaq, A., & Geng, Y. (2013). An ISM approach for the barrier analysis in implementing green supply chain management. *Journal of Cleaner Production*, *47*, 283–297. doi:10.1016/j.jclepro.2012.10.042

Merritt, J. Q. (1998). EM into SME wont go? Attitudes, awareness and practices in the London Borough of Croydon. *Business Strategy and the Environment*, *7*(2), 90–100. doi:10.1002/(SICI)1099-0836(199805)7:2<90::AID-BSE141>3.0.CO;2-F

Min, H., & Galle, W. P. (2001). Green purchasing practices of US firms. *International Journal of Operations & Production Management*, *21*(9), 1222–1238. doi:10.1108/EUM0000000005923

Mollenkopf, D., Stolze, H., Tate, W. L., & Ueltschy, M. (2010). Green, lean, and global supply chains. *International Journal of Physical Distribution & Logistics Management*, *40*(1/2), 14–41. doi:10.1108/09600031011018028

Muduli, K., Govindan, K., Barve, A., & Geng, Y. (2013). Barriers to green supply chain management in Indian mining industries: A graph theoretic approach. *Journal of Cleaner Production*, *47*, 335–344. doi:10.1016/j.jclepro.2012.10.030

Ndubisi, N. O., & Nair, S. R. (2009). Green entrepreneurship (GE) and green value added (GVA): A conceptual framework. *International Journal of Entrepreneurship*, *13*, 21–34.

Nikbakhsh, E. (2009). Green supply chain management. In Proceedings of Supply Chain and Logistics in National, International and Governmental Environment (pp. 195-220). Physica-Verlag HD. doi:10.1007/978-3-7908-2156-7_9

Ninlawan, C., Seksan, P., Tossapol, K., & Pilada, W. (2010). The implementation of green supply chain management practices in electronics industry. In *Proceedings of the international multiconference of engineers and computer scientists* (*vol. 3*, pp. 17-19). Academic Press.

Orsato, R. J. (2006). Competitive environmental strategies: When does it pay to be green? *California Management Review*, *48*(2), 127–143. doi:10.2307/41166341

Peattie, K., & Charter, M. (2003). Green marketing. *The Marketing Book*, *5*, 726–755.

Perron, G. M. (2005). *Barriers to Environmental Performance Improvements in Canadian SMEs*. Dalhousie University.

Porter, M. E., & Van der Linde, C. (1995). Toward a new conception of the environment-competitiveness relationship. *The Journal of Economic Perspectives*, *9*(4), 97–118. doi:10.1257/jep.9.4.97

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Rao, P. (2002). Greening the supply chain: A new initiative in South East Asia. *International Journal of Operations & Production Management*, *22*(6), 632–655. doi:10.1108/01443570210427668

Rao, P., & Holt, D. (2005). Do green supply chains lead to competitiveness and economic performance? *International Journal of Operations & Production Management*, *25*(9), 898–916. doi:10.1108/01443570510613956

Ravi, V., & Shankar, R. (2005). Analysis of interactions among the barriers of reverse logistics. *Technological Forecasting and Social Change*, *72*(8), 1011–1029. doi:10.1016/j.techfore.2004.07.002

Reinhardt, F. (1999). Market failure and the environmental policies of firms: Economic rationales for beyond compliance behavior. *Journal of Industrial Ecology*, *3*(1), 9–21. doi:10.1162/108819899569368

RoHS Guide. (2005). Retrieved June 25, 2016 from http://www.rohsguide.com/rohs-faq. htm

Sarkis, J. (2012). A boundaries and flows perspective of green supply chain management. *Supply Chain Management: An International Journal*, *17*(2), 202–216. doi:10.1108/13598541211212924

Schniederjans, D. G., & Starkey, C. M. (2014). Intention and willingness to pay for green freight transportation: An empirical examination. *Transportation Research Part D, Transport and Environment*, *31*, 116–125. doi:10.1016/j.trd.2014.05.024

Sen, S. (2009). Linking Green Supply Chain Management and Shareholder Value Creation. *IUP Journal of Supply Chain Management*, *7*(3-4), 95–109.

Setthasakko, W. (2009). Barriers to implementing corporate environmental responsibility in Thailand: A qualitative approach. *The International Journal of Organizational Analysis*, *17*(3), 169–183. doi:10.1108/19348830910974905

Seuring, S. (2004). Industrial ecology, life cycles, supply chains: Differences and interrelations. *Business Strategy and the Environment*, *13*(5), 306–319. doi:10.1002/bse.418

Shah, R., & Ward, P. T. (2007). Defining and developing measures of lean production. *Journal of Operations Management*, *25*(4), 785–805. doi:10.1016/j.jom.2007.01.019

Shang, K. C., & Marlow, P. B. (2005). Logistics capability and performance in Taiwans major manufacturing firms. *Transportation Research Part E, Logistics and Transportation Review*, *41*(3), 217–234. doi:10.1016/j.tre.2004.03.002

Shen, L. Y., & Tam, V. W. (2002). Implementation of environmental management in the Hong Kong construction industry. *International Journal of Project Management*, *20*(7), 535–543. doi:10.1016/S0263-7863(01)00054-0

Simpson, D., Power, D., & Samson, D. (2007). Greening the automotive supply chain: A relationship perspective. *International Journal of Operations & Production Management*, *27*(1), 28–48. doi:10.1108/01443570710714529

Simpson, D., & Samson, D. (2008). Developing strategies for green supply chain management. *Decision Line*, *39*(4), 12–15.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Simpson, M., Taylor, N., & Barker, K. (2004). Environmental responsibility in SMEs: Does it deliver competitive advantage? *Business Strategy and the Environment*, *13*(3), 156–171. doi:10.1002/bse.398

Srivastava, S. K. (2007). Green supply-chain management: A state-of-the-art literature review. *International Journal of Management Reviews*, *9*(1), 53–80. doi:10.1111/j.1468-2370.2007.00202.x

Stead, J. G., & Stead, E. (2000). Eco-enterprise strategy: Standing for sustainability. *Journal of Business Ethics*, *24*(4), 313–329. doi:10.1023/A:1006188725928

Tilley, F. (1999). The gap between the environmental attitudes and the environmental behavior of small firms. *Business Strategy and the Environment*, *8*(4), 238–248. doi:10.1002/(SICI)1099-0836(199907/08)8:4<238::AID-BSE197>3.0.CO;2-M

Van Hoek, R. I. (1999). From reversed logistics to green supply chains. *Supply Chain Management: An International Journal*, *4*(3), 129–135. doi:10.1108/13598549910279576

Vanpoucke, E. (2014, January). Motivation to pursue green supply chain management. In *Proceedings of the 2014 International Conference on Industrial Engineering and Operations Management Bali* (pp.7-9).

Wells, P., & Seitz, M. (2005). Business models and closed-loop supply chains: A typology. *Supply Chain Management: An International Journal*, *10*(4), 249–251. doi:10.1108/13598540510612712

Wu, H. J., & Dunn, S. C. (1995). Environmentally responsible logistics systems. *International Journal of Physical Distribution & Logistics Management*, *25*(2), 20–38. doi:10.1108/09600039510083925

Zhu, Q., & Geng, Y. (2013). Drivers and barriers of extended supply chain practices for energy saving and emission reduction among Chinese manufacturers. *Journal of Cleaner Production*, *40*, 6–12. doi:10.1016/j.jclepro.2010.09.017

Zhu, Q., Sarkis, J., & Geng, Y. (2005). Green supply chain management in China: Pressures, practices and performance. *International Journal of Operations & Production Management*, *25*(5), 449–468. doi:10.1108/01443570510593148

This research was previously published in Ethics and Sustainability in Global Supply Chain Management edited by Ulas Akkucuk, pages 232-260, copyright year 2017 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 62
Effects of Corporate Social Responsibility and Creating Shared Value on Sustainability

Janthorn Sinthupundaja
Japan Advanced Institute of Science and Technology, Japan

Youji Kohda
Japan Advanced Institute of Science and Technology, Japan

ABSTRACT

This article describes how recently, there has been a shift in corporate social responsibility (CSR) to creating shared value (CSV), filling the gap between the strategies underlying competitive advantage and sustainability. Although the principles of CSR and CSV have been broadly studied and investigated, there is still little academic research focusing on the transitions regarding on economic, social, and environmental sustainability. In this article, literature and a case study were reviewed and analyzed to identify differences and contributing factors towards sustainability, based on value co-creation and collaboration approaches. The authors' findings present that the CSV emphasizing on co-created value with the cross-sector collaboration leads to the sustainability. Working together with local people or social organizations enables deep understanding of local context and understand the real social and environmental issues. The study contributes to sustainability and business literature by investigating insights into the sustainability of CSR and CSV, and strengthening the importance of social involvement.

INTRODUCTION

In the old days, firms' only responsibility was to maximize their owners' interests and profit, rather than concerning about social and environmental effects. However, nowadays serious climate changes, environmental disasters, and malnutrition around the world have been emphasizing the criticism toward capitalism and business management (Abdelkafi & Täuscher, 2016). Debates about the firm's responsibility for its economic, social and environmental impacts have also been raising (Motilewa et al., 2016). As a consequence, firms are requested to contribute to the achievement of holistic sustainable development,

DOI: 10.4018/978-1-5225-7915-1.ch062

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

which not only refers to economic sustainability for firms, but also ecological and social sustainability. Business management should think and support the innovative solutions that deal with environmental and social challenges, while creating economic simultaneously (Abdelkafi & Täuscher, 2016). Sheth et al. (2011) suggest that the performance of business does not only depend on economic performance but also environmental and social performance. Therefore, managing the relationship between business and society has become one of the important topics of academic research, business and sustainability management (Wilson & Post, 2013). In addition, there have been studies arguing that the growth of businesses encourages the growth of economic, as businesses have become a major driver of society in terms of, for example, creating employment, providing transportation and health care systems (Motilewaet al., 2016). On the other hand, society also plays an influential role in achieving a firm's economic performance i.e., making a profit (Lawrence & Weber, 2013; Motilewa et al., 2016).

Corporate Social Responsibility (CSR) refers to business management and operations that aim to enhance societal well-being (Jackson & Apostolakou, 2010). Traditional CSR has been associated with corporate philanthropy and could have used up the firm' slack resources such as working hours of employees and financial capital (Wójcik, 2015). Its practice is mostly about sacrificing profits for the social interests. Therefore, the creating shared value (CSV) concept was introduced to address this issue by re-conceptualizing the role of business in the society and offering a theoretical solution through the prism of value. It can be considered as a corporate framework to guide the thinking about the relationship between a firm and society (Porter and Kramer, 2011). Social activities are linked to a firm's goals, meaning that social and environmental responsibility is considered an internal function rather than external obligations. Nevertheless, it is difficult for businesses and academia to demonstrate how corporate responsibility could lead to improvements for the firms, society, and the environment (Camilleri, 2017). Many scholars have called for greater emphasis on value creation within the context of business responsibility (Wójcik, 2015). Socially responsible practices create value for the firm, it stakeholders including society and the environment (Camilleri 2017). Thus, firms should allocate and distribute corporate valuable resources and business capability that concern about social and environmental impacts (Camilleri, 2017; Porter and Kramer 2011). Competitive advantage and legitimacy related to social responsibility are important for firm's survival and growth, which hinges on value co-creation process for sustainable development that meet pressures and expectations from the society (Ahen & Zettinig, 2015).

Although the principles of CSR and CSV have been broadly studied and investigated, there is still little academic research focusing on the transitions regarding on economic, social, and environmental sustainability. Furthermore, academic research that links corporate responsibility with firm, social, and environmental sustainability is still limited. Therefore, this study aims at filling this gap by exploring the conceptual framework of the holistic sustainability and corporate responsibility and investigating the transitional CSR and CSV. This paper identifies, organizes, and analyses existing empirical research to highlight the economic, social, and environmental value creation and sustainability as well as exploring a case study implementing CSV. The main objective of this study is to address the research questions: how do CSR and CSV influence on economic, social, and environmental sustainability? The authors further aim at understanding the differences, and the drivers of these transitions from value-based and sustainability-oriented frameworks. The study contributes to both theoretical and managerial implications. The findings contribute to CSR and sustainability literature by improving the general understanding of the corporate responsibility and sustainability and provides the theoretical framework. The study thereby

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

contributes to the potential managerial implications for firms applying CSR and CSV based on value co-creation and sustainability and demonstrating on how firms may better implement corporate responsible practices in shared value creation for themselves and other stakeholders to attain the sustainability.

Next sections present our theoretical background and literature review exploring key themes of CSR, CSV, and their transitions and followed by the methodology section. The discussion section then explores our theoretical framework and offer insights into the links between CSR, CSV, value creation, and sustainability. After that, a case study is provided to better demonstrate our framework. Finally, the authors discuss and explain the implications, limitations, and directions for future research.

CORPORATE SOCIAL RESPONSIBILITY (CSR)

The concept of CSR was initially introduced in about 1920s when firms attempted to respond to shareholder and social pressures. The purpose was to increase their trust (Frederick, 1994). CSR was more often referred to as social responsibility in the early 1950s and later this idea was broader to business people in which responsibility should also be served to society and goes beyond their financial obligations (Bowen, 1953). The development of CSR has changed dramatically since Levitt in 1958 and Friedman in 1962 started to concern about a firm' responsibility and impacts on society and the environment because there were public pressures that called for social and environmental responsibility beyond their maximizing profit goals and legal requirements (Davis, 1973). In the 1960s and 1970s, firms began to consider about societal and environmental impacts (Camilleri, 2017). Initially, firms focused mainly on philanthropy and charity purposes (Camilleri, 2017). Later, in the 1980s and mid-1990s the concept of CSR was developed into different dimensions based on various academic theories, models, management, and purposes such as corporate social responsiveness, corporate social performance, business ethics, stakeholder theory and management (Carroll, 1999). There is still no universally accepted definition of CSR (McWilliams & Siegel, 2001). CSR has a wide range of definitions from very conceptual and normative to very practical definitions. However, CSR can be broadly defined as a commitment to improving societal well-being through business practices and contributions of corporate resources (Jackson & Apostolakou, 2010), which refers to firms' practices for economic, legal, moral, social and environmental responsibility (Barnard, 1938). It is primarily concerned with a firm's ethical and social behavior to its stakeholders (Motilewa at al., 2016), in which the practices CSR embraces responsibility for its actions and, through its activities, positively affects the environment, society, consumers, employees, communities, and other stakeholders.

CREATING SHARED VALUE (CSV)

CSV was first introduced by Porter and Kramer (2011), seeking to reconnect business with society by suggesting that firm strategies that respond to societal and environmental challenges can enhance the corporate competitive advantage from creating shared value with society. They argue that the more closely firms tied to a social issue, the greater the opportunity to make use of the firm's resources and capabilities to provide benefits for society. The CSV can be considered as a corporate framework to guide

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

the thinking about the relationship between business and society, and firm' engagement in corporate responsibility (Høvring, 2017). Engagement in CSV is seen as a way to signal to stakeholders that the firm is cognizant of its implications on society. Social concern may become a source of shared value creation only when the criterion of the greatest possible benefits relative to costs is met (Voltan et al., 2017). The more social issue relates to the core business strategies, the greater the possibility to leverage the firm's resources and capabilities with mutual benefit (Høvring, 2017; Porter & Kramer, 2006).

CSV is a more action-oriented concept that attempts to translate traditional CSR postulates and practices into business practice (Wójcik, 2015). It is a proactive action and driven internally to pursue social and environmental responsibility (Wójcik, 2015). This means that the CSV strategy links social activities to the firm's goals, and that social responsibility is considered an internal function rather than an external obligation to society, emphasizing its functionalist roots (Høvring, 2017). The core idea suggests that the narrow and short-term economical perspective focusing only on corporate value needs to be replaced by a broader societal perspective focusing on shared value for both society and the firms. According to Porter and Kramer (2011), CSV is defined as the policies and operating practices that enhance the competitiveness of a firm while simultaneously advancing the economic and social conditions in the communities in which it operates. It has been shown as a way forward to regain legitimacy and advance the role of business in society (Voltan at al., 2017). Furthermore, the CSV concept includes both interacting with the internal stakeholders such as employees, technology and work environment and external stakeholders such as society, local communities, and the environment that has an impact on the environment, economic benefits, and social benefits (Lapina et al., 2012). This shared value creation is acted as a compensating point between social and environmental value, and corporate value (Høvring, 2017). CSV is also referred to a measure for alleviating poverty and enhancing social welfare (Porter & Kramer, 2011). Moreover, Chatterjee (2016) includes CSV in a collection of concepts that were initiated to confront the downsides of globalization such as the unequal sharing of benefits (Voltan et al., 2017).

TRANSITION OF CSR TO CSV

Challenges of CSR

In the past, traditional thinking about CSR has been mostly associated with corporate philanthropy, making donations, volunteering activities for society and environmental improvement, (Camilleri, 2017). CSR is traditionally defined and understood as generating social benefits without referring to costs of effort, i.e., the phenomenon is focused on sharing the value created by business and transferring it to the society (Voltan et al., 2017). Consequently, a recently shaped view is that CSR is mostly sacrificing profits in the social interest (Reinhardt et al., 2008) and the only concern is to what extent the private sector shares its profits to alleviate poverty (Clyde & Karnani, 2015; Wójcik, 2015). Certain discretionary expenses in corporate philanthropy could have usurped the businesses' slack resources, for example, financial assets, labour and time, without adding much value in terms of corporate reputation and customer value to the businesses. The corporate philanthropy should be deeply rooted in the firm's competences and linked to its business environment (Porter & Kramer, 2002). Visser (2010) claims that CSR logic cannot serve anymore as an analytical framework, nor as an approach that could conceptually reconcile a firm's goal and social goals.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Shifting to CSV

The CSV concept addresses the issue of scarifying firms' resources for society and the environment by re-conceptualizing the role of business in the society and offering a theoretical solution through the prism of value, i.e., a notion that can be more effectively analyzed than through the CSR concept. Traditional thinking of CSR should be extended and replaced by the CSV concept, which emphasizes into a firm's strategy. This leads to the creation of value for both business and society (Burke & Logsdon, 1996; Lantos, 2001; Porter & Kramer, 2011) and increase the financial performance of businesses in which it minimizes their costs through better operational efficiencies, boosts the employee morale, creates job satisfaction and reduces the staff turnover, along with other benefits (Abdelkafi & Täuscher, 2016; Camilleri, 2017). In response to the perceived conflict between business and social goals, the European Commission put forward a new understanding and defined business responsibility as the responsibility of enterprises for their impacts on society (European Commission, 2011), which means integrating social concerns into companies' business operations and core strategy with the aim of maximizing the creation of shared value. This definition underlined explicitly the balance between firm goals and social goals. The new European Union's CSR strategy, therefore, noted the importance of the problem of the difficulty of reconciling business and social goals and refers indirectly to the CSV concept (Wójcik, 2015). CSV also help to create new opportunities for creating new value. Instead of being forced by external factors, a company is motivated internally to pursue shared value creation (Voltan et al., 2017). CSV implies that the shared value involves corporate activities in at least one of the three areas including reconceiving products and markets, redefining productivity in the value chain, and enabling local cluster development that includes institutions such as universities, social organizations and other associations and that a mutually beneficial relationship exists between society and the firms (Porter & Kramer, 2011). CSV provides the theoretical possibility of a CSR-entrepreneurship synergy such as social entrepreneurship (Raimi et al., 2015).

Differences Between CSR and CSV

The concept of CSV originates from the corporate responsibility debate, it is often confused with traditional CSR (Wójcik, 2015). While business ethics scholars are skeptical about the novelty of the CSV concept, arguing that its core premises overlap with existing concepts within CSR, stakeholder management and social (Crane et al., 2014), management scholars celebrate the CSV concept as a powerful and valuable concept (Bosch-Badia et al., 2013; Høvring, 2017; Moon et al., 2011). The most significant differences between CSR and CSV notions may be distinguished when their conceptualizations are analyzed as summarized in Table 1.

METHODOLOGY

The paper is a theoretical interdisciplinary study, which combines insights from the framework of value co-creation within the application domain of CSR and CSV and looks into the impacts of economic, social, and environmental sustainability. This study is conceptual in character. To answer our research question, a review of relevant literature was first conducted. The paper has built on the previous theoretical underpinnings of the corporate responsibility for economic, social, and environmental dimensions

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 1. Differences between CSR and CSV

CSR	CSV
• Fundamentally about scarifying firms' slack resources for in being a good corporate citizen • Philanthropy, and moral, ethical and legal practices • Engaging employees in community works • Separating from the business strategies • Generating social benefits without referring to costs of effort • Represent unsustainable value with little or no business benefits and some social gains.	• Changing firm's strategies and how it operates • Creating economic, social, and environmental value returns. • Integrating social and environmental impact into the business • Internal motivation • Creating new opportunities for new value creation • Reflect a sustainable value with significant business and social benefits

from a collaboration approach, cross-sector collaboration, value co-creation and holistic sustainability. To better understand our theoretical model, a case study of Socialgiver which implementing CSV strategies into its business model is provided. The case-based approach has been used for understanding emergent phenomena (Miles & Huberman, 1994; Yin, 2009). The data in this study were analysed from the ground up, which rooted in the grounded theory approach. It is an exploratory approach where data are systematically gathered and analysed (Yin, 2009). This method is suitable when no explicit testable hypotheses yet exist and there is little research, as presented in business model innovation for sustainability (Rosca et al., 2016; Sousa-Zomer & Cauchick-Miguel, 2017).

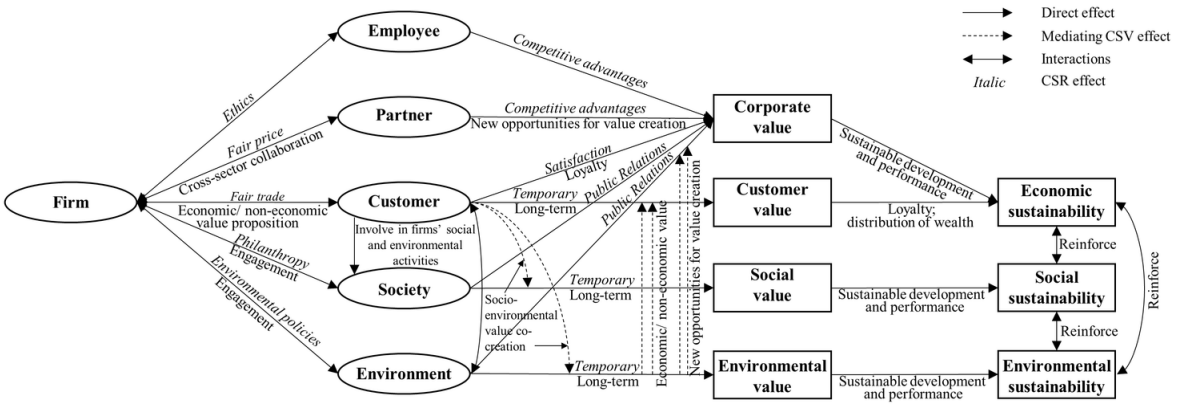
TOWARDS SUSTAINABILITY: VALUE CO-CREATION PERSPECTIVES

The concept of value creation is central to all socio-economic analysis (Ahen & Zettinig, 2015). Value is seen as perceived service and satisfaction for the consumer and other stakeholders such as partners, society and the environment, which then creates value in return for firms such as in forms of reputation, customer perception, revenue and legitimacy. Therefore, the value is not referred to only economic or financial dimensions, which agency theory holds to be the only responsibility of agents (Ahen & Zettinig, 2015; Jensen & Meckling, 1976), but also non-economic/financial dimensions of value. Along with the transition to service-based societies and economies which emphasizes the value and understands exchange in terms of value rather than products or services (Vargo & Lusch, 2004). The service-dominant logic deploys a shift from the firm-centric view on the resource-based view (Barney, 1991), which sees the firm as a center for mostly producing and making exchanges, toward a relationship-based marketing for value co-creation (Ahen & Zettinig, 2015). Vargo and Lusch (2004) suggested that value is always co-created in all kinds of exchange. In addition, Mupepi, 2017 suggests the framework of value creation in socio-technical systems that consider both ethical and technical systems to prevent knowledge leakage during the process.

Figure 1 presents our theoretical model illustrating effects of both a traditional perspective of CSR and CSV strategies that interact with main stakeholders based on a value co-creation approach and a sustainability point of view. These practices may result in economic, social, and environmental sustainability for a firm, society, and the environment. Words or phrases of words in italic are referred to the traditional CSR practices only, which do not cover the CSV strategies. In the traditional idea of CSR, firms mainly focus on external-oriented practices. Their CSR strategies rely on the external environ-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 1. Effects of CSR and CSV on sustainability



ment and do not involve into core strategic management. They tend to focus more on economic, legal and ethical responsibilities, rather than real social and environmental issues. Thus, firms concern about ethical and legalized practices and have overlooked opportunities to co-create and enhance value with other stakeholders in society (Porter & Kramer, 2011). For examples, when firms treat ethically with their employees, trade fairly with partners or suppliers, set a fair selling price, donating money to society, or settling environmental policies according to law and regulations. These practices aim mainly for corporate value in return. Consequently, the value is created temporary, which restricts to achieve the long-term value creation for the sustainability. Therefore, CSR initiatives represent unsustainable value with little or no firms' benefits and some social gains (Wójcik, 2015).

On the other hand, firms that implement CSV strategies involves social and environmental issues into core business model and strategies, and enable the society, such as local people or social organizations, to be their partners for cross-sector collaboration. Cross-sector collaborations form in order to address social or environmental issues (Alvord, Brown, & Letts, 2004; Murphy & Bendell, 1999). Co-created value includes a wide range of benefits for all stakeholders such as access to new knowledge, increase financial or natural resources, improve legitimacy, reputation, and customer perceptions which lead to competitive advantages of firms; preserve the environment, support and develop local people, and relieve social and environmental issues. Corporate, social, and environmental value is co-created in a sustainable way. Furthermore, customers are also involved in this social and environmental activities. CSV strategies enable the firm to reinforce the mutual interdependencies between the value co-created for its customers, society and the environment as well as the value captured for itself. Ideally, the more value the firm can create for its customers, society, and the environment, the higher the value it captures for itself (Abdelkafi & Täuscher, 2016). Consequently, socio-environmental value, which is the mediating effect, is co-created and enhance the normal social and environmental value. Simultaneously, customers are offered co-produced value propositions of economic and non-economic value propositions. Economic value propositions refer to purchased products or services. Non-economic value propositions refer to self-fulfillment and pride for making social contributions. These value propositions amplify customer value. The practice also provides new opportunities for value creation to increase corporate value. The amplified and long-term value co-creation of every stakeholder facilitates the sustainable development,

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

performance, and loyalty which eventually lead to economic, social, and environmental sustainability. Overall, this value-based model distinguishes a transitional view of CSR and CSV strategies using value co-creation and collaboration approaches for the economic, social, and environmental sustainability for the firm, society, and the environment. The active engagement with society will ultimately create synergistic value for all and gain the sustainability.

A CASE STUDY

Introduction to Socialgiver

www.socialgiver.com is an online deal website based in Thailand that virtually connects profit organizations such as restaurants and hotels, non-profit organizations (NPOs) that support social and environmental issues, and customers in ways that have significant and sustainable economic, social, and the environmental impact. Socialgiver is both a shopping website and charity website that simultaneously aims to promote a comfortable lifestyle and social consciousness. The purposes of Socialgiver include (1) to convert spare service capacity from the service sector into social progress, thereby making the entire sector more sustainable, (2) to provide funding for social and environmental projects through sales of services pledged by its partner businesses and to connect those projects with donors, and (3) to improve the sustainability of its partners and social projects. Socialgiver acts as an intermediary connecting business partner, social projects, and customers. It is responsible for deciding and managing value propositions, determining the discount rate, and setting an appropriate price for services. It also validates its partners and social projects in order to protect customers' rights and privacy. The information displayed on its web page is to assure customers and eliminate bias against services providers and social organizations.

Implementing CSV Strategies

Socialgiver implements the CSV strategies that aimed to create shared value together with its partners, society, and customers. Socialgiver aims to change the surplus service capacities of for profit-organizations that currently do not generate any benefits such as unfilled rooms in a hotel and unsold tickets into funding for social and environmental projects of NPOs by engaging customers. First, Socialgiver connects and persuades business partners to donate their surplus products or service capacities of businesses for charity purposes, which later turn into their CSR activities. Seventy percent of every purchase go to NPOs, while the rest is for covering the operating costs of Socialgiver.

Socialgiver allows customers to explicitly see and involve in firms' social and environmental activities by letting customers select projects from NPOs for their donation. From this interaction, customers help to co-create social and environmental value for society and the environment. At the same time, these value also positively influences customer and corporate value. It encourages customers to re-use the services from Socialgiver, leading to the economic sustainability. Long-term social and environmental value co-creation leads to social and environmental sustainability. Sustainability can be achieved in CSV but not in traditional CSR since sustainability refers to sustainable value co-creation from the strategic alliances among the firm, consumers, business and non-business players such as society and the environment in ethically, responsibly and innovatively creating socio-economic and environmental gains. Cross-sector

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

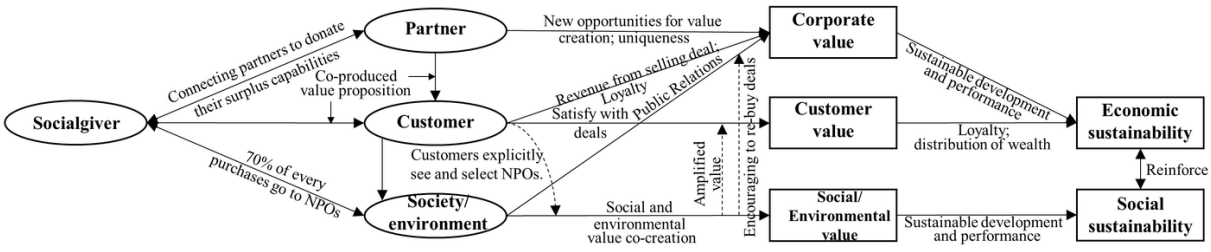
alliances between firms and NPOs are explicitly formed to address social and environmental issues, which appear in the business model of Socialgiver. CSV strategy of Socialgiver is illustrated in Figure 2.

DISCUSSION

The traditional perspective of CSR was associated with corporate philanthropy and legitimacy practices, which usurped firms' resources. Therefore, this concept is not a suitable approach that contributes corporate, social, and environmental sustainability. CSR has been for defined in terms of creating solely social benefits and not explicitly exposing the economic aspect of business engagement in social and environmental issues which aims to gain the legal benefits (Wójcik, 2015). Therefore, the concept of CSV was introduced to address this issue by re-conceptualizing the roles of business in the society and offering a solution focusing on value co-creation and sustainability. CSV guides the thinking about the relationship between business, society, and the environment and aimed at changing how the core business operates, business model, and strategies. It aims to create new opportunities for new value creation instead of being forced by external factors such as legitimacy and stakeholder pressure, a firm is motivated internally to pursue shared value creation to achieve sustainability.

The CSV strategies emphasize co-created value and cross-sector collaboration as the hidden keys for sustainability since working together with local people or social organizations enable deep understanding of local context, constraints and barriers (London, 2007), and enhance corporate value. Simultaneously, sustainable social and environmental value is co-created. Understanding and integrating with the local communities enables the creation of what the literature calls social embeddedness or native capability which in turn leads to a sustainable competitive advantage for the firm and thus the creation of economic, social and ecological value (London, 2007; Rosca et al., 2016). According to Porter and Kramer (2011), a collaboration between for-profit and non-profit organizations is one of the strong signs that creating shared value is possible. For a firm, the starting point for creating this kind of shared value is to identify all the societal needs, benefits, and harms that are or could be embodied in the firm's products or services. An ongoing exploration of societal needs will lead companies to discover new opportunities for differentiation and repositioning in traditional markets, and to recognize the potential of new markets they previously overlooked (Porter & Kramer, 2011). From the sustainability-oriented perspective, integrating economic, environmental, and social value is important for a holistic view of sustainability (Joyce & Paquin, 2016). Moreover, consumer participation and engagement also play a major role in trust and legitimacy that could impact for sustainability.

Figure 2. CSV strategy of Socialgiver



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Sustainability can be achieved in CSV but not in traditional CSR since sustainability refers to sustainable value co-creation from the strategic alliances among the firm, consumers, business and non-business players such as society and the environment in ethically, responsibly and innovatively creating socio-economic and environmental gains.

IMPLICATIONS, LIMITATIONS, AND FUTURE STUDIES

This study contributes to sustainability and business literature by investigating insights into the differences between CSR and CSV from the sustainability-oriented viewpoint and strengthening the importance of social involvement that undertaken in practice. The findings present the movement from abstract to concrete concept into a theoretical model. The CSV concept is still in its nascent stage and its relationship with the CSR umbrella term has not been consistently explained. They are overlapped. This study contributes to theory development and supported by a case study and seeks to delineate a borderline between the notions of CSR and CSV from value and sustainability points of view. Findings would also allow managers to better understand the opportunities for creating sustainability from CSR and CSV practices as well as the characteristics of the implementation based on the value co-creation and cross-sector collaboration approaches.

This research is not without limitations. Our results need to be viewed in the light of limitations, which can provide potential directions for future research. First, this conceptual paper could not have featured all the contributions that are related to CSR's value-driven notions. Second, the analysis of CSV in this study was focused mainly on external stakeholders, which CSV covers both internal and external stakeholders. A holistic view would provide more insights and complete views which would help to distinguish from tradition CSR and provide a better understanding on how it facilitates the economic, social, and environmental sustainability.

REFERENCES

Abdelkafi, N., & Täuscher, K. (2016). Business models for sustainability from a system dynamics perspective. *Organization & Environment*, *29*(1), 74–96. doi:10.1177/1086026615592930

Ahen, F., & Zettinig, P. (2015). Critical perspectives on strategic CSR: What is sustainable value co-creation orientation? *Critical Perspectives on International Business*, *11*(1), 92–109. doi:10.1108/cpoib-03-2012-0022

Alvord, S. H., Brown, L. D., & Letts, C. W. (2004). Social entrepreneurship and societal transformation: An exploratory study. *The Journal of Applied Behavioral Science*, *40*(3), 260–282. doi:10.1177/0021886304266847

Barnard, C. (1938). *The functions of the executive*. Cambridge, MA: Harvard University Press.

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, *17*(1), 99–120. doi:10.1177/014920639101700108

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Bosch-Badia, M. T., Montllor-Serrats, J., & Tarrazon, M. A. (2013). Corporate social responsibility from Friedman to Porter and Kramer. *Theoretical Economics Letters*, *3*(3A), 11–15. doi:10.4236/tel.2013.33A003

Bowen, H. R. (1953). *Social Responsibilities of the Businessman*. New York: Harper.

Burke, L., & Logsdon, J. M. (1996). How corporate social responsibility pays off. *Long Range Planning*, *29*(4), 495–502. doi:10.1016/0024-6301(96)00041-6

Camilleri, M. A. (2017). Corporate sustainability and responsibility: Creating value for business, society and the environment. *Asian Journal of Sustainability and Social Responsibility*, *2*(1), 59–74. doi:10.118641180-017-0016-5

Carroll, A. B. (1999). Corporate social responsibility: Evolution of a definitional. *Business & Society*, *38*(3), 268–295. doi:10.1177/000765039903800303

Chatterjee, S. (2016). Articulating globalization: Exploring the bottom of the pyramid (BOP) terrain. *Organization Studies*, *37*(5), 635–653. doi:10.1177/0170840615604505

Clyde, P., & Karnani, A. (2015). Improving Private Sector Impact on Poverty Alleviation. *California Management Review*, *57*(2), 20–35. doi:10.1525/cmr.2015.57.2.20

Crane, A., Palazzo, G., Spence, L. J., & Matten, D. (2014). Contesting the value of creating shared value. *California Management Review*, *56*(2), 130–153. doi:10.1525/cmr.2014.56.2.130

Davis, K. (1973). The case for and against business assumptions of social responsibilities. *Academy of Management Journal*, *16*(2), 312–322. doi:10.2307/255331

European Commission. (2003). Responsible entrepreneurship: a collection of good practice cases among small and medium sized enterprises across Europe. Belgium: Bruxelles.

Frederick, W. C. (1994). From CSR1 to CSR2. *Business & Society*, *33*(2), 150–166. doi:10.1177/000765039403300202

Høvring, C. M. (2017). Corporate social responsibility as shared value creation: Toward a communicative approach. *Corporate Communications*, *22*(2), 239–256. doi:10.1108/CCIJ-11-2016-0078

Jackson, G., & Apostolakou, A. (2010). Corporate Social Responsibility in Western Europe: An Institutional Mirror or Substitute? *Journal of Business Ethics*, *94*(3), 371–394. doi:10.100710551-009-0269-8

Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, *3*(4), 305–360. doi:10.1016/0304-405X(76)90026-X

Joyce, A., & Paquin, R. L. (2016). The triple layered business model canvas: A tool to design more sustainable business models. *Journal of Cleaner Production*, *135*, 1474–1486. doi:10.1016/j.jclepro.2016.06.067

Lantos, G. P. (2001). The boundaries of strategic corporate social responsibility. *Journal of Consumer Marketing*, *18*(7), 595–632. doi:10.1108/07363760110410281

Lapina, I., Borkus, I., & Starineca, O. (2012). Corporate social responsibility and creating shared value: Case of Latvia. *International Journal of Social, Behavioral, Educational. Business and Industrial Engineering*, *6*(8), 2228–2233.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Lawrence, A., & Weber, J. (2013). *Business and Society: Stakeholders, Ethics, Public Policy* (14th ed.). India: McGraw Hill Education.

London, T. (2007). *A Base-Of-The-Pyramid Perspective on Poverty Alleviation* (Working Paper). William Davidson Institute at the University of Michigan and the United Nations Development Programme (UNDP).

McWilliams, A., & Siegel, D. (2001). Corporate social responsibility: A theory of the firm perspective. *Academy of Management Review*, *26*(1), 117–127.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: an expanded sourcebook*. USA: SAGE.

Moon, H. C., Pare, J., Yim, S. H., & Park, N. (2011). An extension of Porter and Kramer's creating shared value (CSV): Reorienting strategies and seeking international cooperation. *Journal of International and Area Studies*, *18*(2), 49–64.

Motilewa, B. D., Worlu, E. R., Agboola, G. M., & Gberevbie, M. (2016). Creating shared value: A paradigm shift from corporate social responsibility to creating shared value. *International Journal of Social, Behavioral, Educational, Economic*. *Business and Industrial Engineering*, *10*(8), 2443–2448.

Mupepi, M. (2017). *Effective Talent Management Strategies for Organizational Success*. IGI Global. doi:10.4018/978-1-5225-1961-4

Murphy, D. F., & Bendell, J. (1999). Partners in time? Business, NGOs and sustainable development. Geneva, Switzerland: United Nations Research Institute for Social Development (UNRISD).

Porter, M., & Kramer, M. (2006). Strategy and society: The link between competitive advantage and corporate social responsibility. *Harvard Business Review*, *84*(12), 78–92. PMID:17183795

Porter, M. E., & Kramer, M. R. (2002). The competitive advantage of corporate philanthropy. *Harvard Business Review*, *80*(12), 56–68. PMID:12510538

Porter, M. E., & Kramer, M. R. (2011, January-February). The Big Idea: Creating shared value. *Harvard Business Review*.

Raimi, L., Akhuemonkhan, I., & Ogunjirin, O. D. (2015). Corporate Social Responsibility and Entrepreneurship (CSRE): Antidotes to poverty, insecurity and underdevelopment in Nigeria. *Social Responsibility Journal*, *11*(1), 56–81. doi:10.1108/SRJ-11-2012-0138

Reinhardt, F., Stavins, R., & Vietor, R. (2008). Corporate social responsibility through an economic lens. *Review of Environmental Economics and Policy*, *2*(2), 219–239. doi:10.1093/reep/ren008

Rosca, E., Bendul, J., Möllering, G., & Arnold, M. (3-6 July 2016). Sustainable business models for the base of the pyramid: How does co-creation impact the sustainability of business models? In *R&D Management Conference 2016 "From Science to Society: Innovation and Value Creation"*. Cambridge: UK.

Sheth, J. N., Sethia, N. K., & Srinivas, S. (2011). Mindful consumption: A customer-centric approach to sustainability. *Journal of the Academy of Marketing Science*, *39*(1), 21–39. doi:10.100711747-010-0216-3

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Sousa-Zomer, T. T., & Cauchick-Miguel, P. A. (2017). Exploring business model innovation for sustainability: An investigation of two product-service systems. *Total Quality Management & Business Excellence*. doi:10.1080/14783363.2017.1317588

Vargo, S. L., & Lusch, R. F. (2004). Evolving to a new dominant logic for marketing. *Journal of Marketing*, *68*(1). doi:10.1509/jmkg.68.1.1.24036

Visser, W. (2010). The Age of Responsibility: CSR 2.0 and the new DNA of business. *Journal of Business Systems*. *Governance and Ethics*, *5*(3), 7–22.

Voltan, A., Hervieux, C., & Mills, A. (2017). Examining the win-win proposition of shared value across contexts: Implications for future application. *Business Ethics (Oxford, England)*, *26*(4), 347–368. doi:10.1111/beer.12159

Wilson, F., & Post, J. E. (2013). Business models for people, planet (& profits): Exploring the phenomena of social business, a market-based approach to social value creation. *Small Business Economics*, *40*(3), 715–737. doi:10.100711187-011-9401-0

Wójcik, P. (2015). How creating shared value differs from corporate social responsibility. *Journal of Management and Business Administration Central Europe*, *24*(2), 32–55.

Yin, R. K. (2009). *Case study research: Design and Methods*. Thousand Oaks: SAGE.

This research was previously published in the International Journal of Sustainable Entrepreneurship and Corporate Social Responsibility (IJSECSR), 2(1); edited by Amulya Gurtu, pages 27-38, copyright year 2017 by IGI Publishing (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 63
Assessing the Maturity of Green IT Adoption Within the Philippine Manufacturing Industry

Alexander A. Hernandez
Technological Institute of the Philippines Manila, Philippines

ABSTRACT

Green IT is the sustainable use of computing resources in organizations with minimal or no impact on the environment. The role of Green IT is recognized to achieve sustainability in organizations. This study presents the extent of Green IT adoption in a developing country. This study used GIT maturity model to assess the overall level of Green IT maturity among manufacturing organizations. The results suggest that participants recognized Green IT, however, a low level of maturity is found within the manufacturing organizations. To further Green IT adoption in organizations, practical and research implications are presented.

INTRODUCTION

Green IT (GIT) is a resource-efficient consumption strategy through the utilization and operation of IT infrastructures and implementation of associated policies aiming to enhance business and environment sustainability. GIT is recognized for its potential in driving organizations towards reducing business footprint while achieving performance with a lesser impact on the environment (Loeser et al., 2017). Hence, GIT is for greener business activities, efficiency, and conservation of resources. Previous studies have recognized the benefits of GIT to sustain firms' competitiveness. First, cost reduction is one of the emphasis of GIT adoption benefits in organizations to remain sustainable with regard to business operations. GIT lowers business costs for complying with environmental regulations compared with

DOI: 10.4018/978-1-5225-7915-1.ch063

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

competitors who still do traditional way of business which only focus on economic benefits (Ramaya et al., 2013; Gholami et al., 2017a), requires relatively less material and resources during the product design and manufacturing stages (Savita et al., 2016), and lower operational costs (Chugh et al., 2016). Second, the adoption of GIT enhances corporate reputation within the business community and to its stakeholders. GIT improves corporate image of firms as compared with their competitors (Hba et al., 2016), perceived by customers as environmentally responsible (Chuang & Huang, 2016), and favored by shareholders due to their good GIT reputation (Ainin et al., 2016). Third, green innovation as a benefit of GIT aims to make the firms more capable of spurring environmental research and development (Gholami et al., 2016b), enhances environmental management systems (Hoang et al., 2016), and green innovation as compared with major competitors (Hanelt et al., 2016). Hence, GIT can drive green innovation, foster environmental stewardship to improve corporate image and reputation, and cost reduction within business operations.

Despite, the growing benefits of GIT in organizations, there is little work that investigates Green IT adoption in developing countries, such as the Philippines. First, most of these studies have been conducted in developed countries in which Green IT has been progressing enormously using various frameworks, and strategies and research on GIT in the social enterprise are relatively scarce (Coffey et al., 2013). Thongmak (2013) analyzed GIT frameworks in the literature, however, most of these were implemented in developed countries; thus, a proposed sustainable ICT framework for developing countries is discussed. Similarly, Bokolo (2016) found that GIT is more proliferated in IT organizations in developed countries. Thus, this study offers new insights on GIT in a developing country perspective. Second, developed countries are proactively underway of assessing their current level of Green IT maturity and readiness for a more effective propagation of improvement efforts aiming to achieve resource-efficient and low carbon economy guided by a comprehensive GIT strategy. Therefore, a handful of work has been done to initially understand the level of maturity of GIT in organizations in developing economies, such as the Philippines. Seuring and Gold (2013) and de Sousa Jabbour (2014) notes that there are few studies on developing countries exploring the maturity of GIT adoption in the manufacturing industry. Similarly, Ateetanan and Usanavasin (2015) investigated the level of GIT adoption in the government agencies in a developing country using Green IT Maturity Model and found a lower level of adoption. Hence, there is a need to explore GIT maturity in a developing country perspective further. Third, most studies in GIT adoption explored on the factors, antecedents, and drivers to adoption of GIT using well-known Information Systems (IS) theories (Deng & Ji, 2015; Dezdar, 2017), however, few studies attempt to investigate on the level maturity of GIT in manufacturing sector, which greatly contributes to global carbon footprint and degradation of environment (Giret et al., 2015). Thus, this gap in the literature with regards to GIT use in the manufacturing industry is addressed and extends prior empirical findings on GIT adoption maturity in organizations.

Therefore, a study that explores the level of GIT in maturity in developing countries could further insights on its current status, experience, issues, and challenges. To this end, this research aims to assess the level of Green IT maturity within the Philippines manufacturing industry. Hence, this research not only assists policy makers and implementers to further the uptake of GIT within organizations, however, consider GIT as a strategic approach to green growth especially for developing countries and global firms aiming to harness the potential of GIT for economic and environmental sustainability.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

LITERATURE REVIEW

Green IT Benefits

Previous studies suggest some benefits of GIT adoption covering reduction of carbon footprint, optimized business processes, and resource-efficient consumption, and greener end of life management.

First, in the area of reducing carbon footprint, Gholami et al. (2013) found in the study of senior IT managers in the manufacturing and service sector that GIT adoption resulted in a reduction of carbon footprint. Similarly, managers of small and medium enterprises (SME) have agreed that GIT achieved reduction of emissions (Dick et al., 2011; Ramaya et al., 2013). For example, a study on using energy-efficient data center solutions resulted in a major decrease in carbon emissions through real-time monitoring systems (Lee & Zomaya, 2012; Beloglazov et al., 2012). Likewise, intelligent lighting systems helped organizations to reduce their carbon emissions by thirty-five percent (Wang et al., 2012; Nguyen & Aiello, 2013). Hence, GIT adoption through a variety of energy-efficient solutions further reduces carbon emissions of organizations.

Second, business process optimization is also a major concern of organizations to eliminate or minimize duplication information in work processes, making procedures more simplified and systemized (Nowak et al., 2010). For instance, fully integrated business systems could result in better data tracking, expansion of utilization, and enhanced data integration among major work procedures of the organizations (Houy et al., 2010). Business workflows systems used by organizations integrated to a private sector, and agencies reduce inefficiencies and redundancies, likewise, allows better (Vom Brocke, & Seidel, 2012).

Third, efficient resource consumption remains a major priority for organizations slowly adopting to GIT. Beloglazov and Buyya (2010) found that virtualization technologies assist in reducing the number of IT infrastructures deployed by organizations, covering data centers, servers, and other associated equipment. For instance, desktop virtualization has been used and expanded in organizations with automated power management solutions (Younge & Von Laszewski, 2010; Papagianni et al., 2013). Resource efficiency is also translated through many office automation tools such as print management solutions to control printing of unnecessary files and documents, which could be transmitted in digital form (Park et al., 2012; Ateetanan & Usanavasin, 2015). Thus, increasing the resource consumption management on various business activities. Banister et al. (2007) suggest that telecommuting work practice offers new mechanisms to prevent additional travel costs, and footprint while enhancing productivity and efficiency of employees. For instance, some studies presented the benefits of adopting to communication systems allowing multinational companies to promote better collaboration (Ruth, 2011) while reducing the need for travelling of employees from overseas locations and offices, therefore, reducing gas, oil, and other associated natural resources consumption (Schwartz et al., 2010; Hernandez et al., 2016).

Fourth, organizations also strive to enhance end of life management in variety of strategies such as waste reduction schemes (Winkler, 2011; Choudhary & Seth, 2011), 3R (reduce, reuse, recycle) activities (Eltayeb et al., 2011) and improving product designs and throughput for a longer product life span (Dangelico, & Pujari, 2010), and better material recovery, and disposal strategies promoting take-back programs (Sarkis et al., 2010) for employees to increase participation, awareness, and education on the impacts of electronic wastes to the environment (Molla et al., 2014). Park et al. (2012) found that 3R program was an effective approach to encourage organizations to monitor IT asset gradually, replacement of inefficient equipment, convert reused and recycled equipment to monetary benefits. Similarly, Diabat et al. (2013) suggest that capacitating organizations on reusing and recovering schemes for IT equipment

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

offer monetary benefits through material recovery and take-back programs. Dwivedy and Mittal (2013) found that take-back schemes remain relevant approach in enhancing recycling performance and reduction of waste. Thus, it also assists organizations in improving environmental compliance certifications (Arimura et al., 2011).

Generally, GIT benefits were translated in measurable actions by organizations through resource-efficient consumption and preservation.

Green IT Adoption Strategies

The previous section presents the benefits of GIT adoption. More importantly, the literature suggests some strategies to assist organizations in achieving the GIT adoption benefits. Bokolo and Noraini (2015) suggest the strategic approach to GIT through the incorporation of "green" indicators on design, manufacturing, usage, and disposal activities. These variations can result in the resource-efficient design of computing solutions and equipment (Naumann et al., 2011), advanced data center management systems (Molla & Cooper, 2014), and environment-friendly end of life management practices (Ninlawan et al., 2010). Moreover, this domain is appropriate in choosing ecologically compliant and proactive measures to sustainable reproduction and pollution prevention benefits (Dao et al., 2011).

Previous studies suggest GIT metrics by starting from a setting of GIT agenda, conceptualization of operational goals, and development of assessment, and evaluations tools for an efficient GIT adoption (Molla et al., 2011;). Murusegan and Gangadharan (2012) similarly proposes enterprise GIT strategies through a multi-level approach covering strategic, deep green, and incremental tactical solutions. Also, the literature describes eco-efficiency, eco-effectiveness, and eco-collaboration as realization of GIT as strategy (Loeser et al., 2017) provided that energy-efficiency, cost reduction, savings, preservation of natural resource, disposal activities, and stakeholders collaboration serves as eco-goals to further the benefits of GIT adoption within organizations (Zhang & Liang, 2012; Cai et al., 2013).

Green IT Maturity Model

Initially, GIT benefits were achieved through some of the strategies discussed in the previous section. Also, it is significant to explore on the maturity level to understand the extent of GIT adoption in organizations.

A number of GIT maturity models were developed. However, there were varying conditions to which these models were used and adopted by prior studies. First, Accenture developed a green maturity model for assessing the GIT maturity of organizations and proposes a strategy to enhance green performance. The model has five major areas of evaluation with 300 indicators comprising of work practice, office environment, data center, procurement and corporate citizenship (Hersch & Bonecutter, 2008). Second, the British government co-developed with Gartner a GIT scorecard aiming to assess the level of GIT maturity of various government offices. The GIT scorecard was developed assist decision-makers in reducing the impact of ICT on the environment. Also, it was developed and utilized complementing the Sustainable Operations targets, piloted with eight government agencies and the local government of Scotland (Cabinet of the UK, 2008). Third, Korea's National Information Agency (NIA) developed the GIT Maturity Model Integration (GMMI) to assess the state of and support GIT to design a GIT roadmap and action plan. The GMMI consists of 5 areas involving data center, work practice, office environment, corporate citizenship, and procurement with stages of maturity model consisting six stages

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

(0 to 5) for each indicator. An indicator-specific weight is applied to calculate the overall score (Park et al., 2012). Fourthly, Royal Melbourne Institute of Technology with Australia Connection Research developed the GIT readiness index to measure the GIT maturity level among Australian firms. The study was participated by 200 Australian firms, and measured by using 36 indicators in 5 areas such as end user, enterprise, enablement, life cycle, and metrics. Fifthly, Infosys proposed a GIT maturity model to assess the adoption of GIT services, and ranked firms' green maturity and evaluate efforts towards greener future. The major constructs include data center and facilities, end user computing, asset life-cycle, IT service management, and people practices (Desai & Bhatia, 2011). Sixthly, APECTEL through the NSTDA Academy, National Science and Technology Development Agency, Thailand, developed a GIT maturity model assessing the areas of (1) knowledge and awareness, (2) policy and strategy, (3), management techniques, and (4) implementation and development (NSTDA, 2011).

Previous studies suggest that among these models, the Korea's National Information Agency GIT maturity model was the most comprehensive as it highlights both management and technical aspects with a strong emphasis on five areas of GIT. The model was used in some of the assessment studies available in the literature (Park et al., 2012, Ateetanan and Usanavasin; 2015).

Overview of the Philippines Manufacturing Industry

As of 2012, the total manufacturing companies in the Philippines was at an average of 25,064 with different business activities supporting local and international customers (Aldaba, 2014). Moreover, the manufacturing sector continued to grow due to the increased production demands and growing economies. From 2011 to 2015, the manufacturing sector posted PHP 738 Billion in gross valued reaching its 2.7 trillion Gross Value Added (GVA) and growing at an average of 7.3% annually (Batungbacal, 2016). More importantly, the manufacturing sector labor market and productivity increased by 4.9% (Official Gazette, 2015). The steady increase in the manufacturing sector is attributed to the foreign direct investments, and the numerous expansions and projects in the past six years (Philippine Statistics Authority, 2016). To date, the manufacturing sector encourages partnership with government agencies and academe to harness research and development (Department of Trade and Industry, 2016), co-develop industry champions and participate in environmental programs. More recently, the manufacturing sector embarked to greener business activities such as GIT as one of the focus areas for rapid growth and sustainability (Gutterer, 2015). More specifically, the professional association and organization on manufacturing sector developed GIT roadmap and strategy together with the design of guidelines on its implementation (Steigerwald, 2015). Overall, through GIT, the manufacturing sector contributes to achieving a more sustainable business and environment.

METHODOLOGY

Participants

This research covered five manufacturing and eight service locations in Region 4 and National Capital Region, as these sites were considered economic zone centers in the Philippines. This study was participated by senior IT Managers and Heads with existent background and implementation of Green IT

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

adoption practices within their organizations. Table 1 presents the profile of survey respondents. Respondents came from the manufacturing sector. Majority of the respondents held senior management positions, and connected with these positions for more than one year.

Instrument

This study used the survey instrument from Park et al. (2012) Green IT Maturity Model (GMMI) with validated measurements by experts, available in Green IT adoption studies and literature. The survey instrument includes five major constructs in assessing the maturity of Green IT adoption: (a) data centers, (b) office environment, (c) work practice, (d) procurement, and (e) corporate citizenship, a total of 54 survey items were measured and operationalized. The data center constructs consisted 15 items, office environment has 15 items, work practice covered 16 items, procurement consisted nine items, and corporate citizenship with nine items. Table 2 presents the summary of survey constructs and items.

Park et al. (2012) and National Information Agency of Korea (NIA) proposed a level of Green IT maturity with six stages of maturity for each indicator as presented in Table 3.

Data Collection

An email was initially sent to the companies asking their participation in the study. Consequently, another email containing the survey link was provided to companies who confirmed their participation in the survey. There were some companies who did not participate in this study. However, a total of 387 companies answered and completed the questionnaire. The survey was distributed from November 2016 to February 2017. After a couple of months of data gathering, all responses were considered for analysis.

Table 1. Profile of respondents

	Frequency	Percentage
Position		
President / CEO	57	14.73
General Manager / CIO	125	32.29
MIS Director / Manager	115	29.72
IT Head	90	23.26
Time in the Position		
5 years or less	183	47.29
6-10 years	128	33.07
10 years or more	76	19.64
Size		
Small and medium	267	69
Large	120	31

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 2. Constructs and measures

Area	Item	Assessment Indicators
Data Center Shared computing capacity including servers, storage and networks	**Server Assets**	When developing information systems and introducing new servers in your operating environment, does your company consider server virtualization as a basic implementation method?
		To proactively manage the floor space occupied by idle servers, does your company use orchestration tools in all environments?
		Does your company collect data on the use of server instances across all your assets, manage related indicators and conduct optimization activities based on this information?
		Do you company practice intelligent refreshing in servers in all environments to improve their operation efficiency?
		Are all servers in your company optimized based on their performance efficiency and highly efficient in terms of power supply?
	Support Infrastructure	Have your network storages in data centers been integrated to create a single-storage network?
		Does your company collect data on the use of storage equipment on all your assets and develop and manage related indicators?
		Have your networks been converged (voice/data, fixed/wireless) to reduce the number of switches needed in your data centers?
		Is your intelligent power allocation equipment installed in the LAC within the data centers and is linked with monitoring systems?
		Are backup software programs within your organization integrated into a single platform so that they may be used for company-wide backup and restoration?
	Physical Equipment	Is power usage monitored in real time in your company, and is monitored by each section or unit?
		Is the lighting system in your data centers designed with energy efficiency in mind?
		Was energy efficiency considered in the design of your data centers?
		Is the control of temperature and moisture in your data centers automated, and is the control system effective?
		Is your company conducting a data center rationalization program to minimize the number of data centers?
Office Environment Computing resources within an office environment, including desktop and laptop computers, printers and mobile devices	**PC**	Have screensavers been disabled in all display devices so that they go into power saving mode?
		Are all IT equipment in your office controlled by a central power management system?
		Have desktops been replaced by lower-power laptop computers in your company where possible?
		Have your company's desktop units been replaced by thin client solutions where possible?
		Are there rules in your company, requiring employees to shut off power to all unused PCs and IT devices, and a management system to monitor compliance?
	Printers	Are multifunction devices functioning at the same time as a printer, fax machine, scanner and a photocopier used in your company, instead of separate devices?
		Is there support for a virtual fax service for all users in your company, and is its use widespread?
		Are all printers in your company installed with a toner saving solution?
		Are all printers in your company configured so that power is automatically shut off during night hours and weekends?
		Do you have an integrated print management service in your organization to reduce unnecessary printed materials?
	Office Equipment	Do you have wireless network access in your organization to reduce the use of fixed-line networks?
		Is there an intelligent lighting system in all offices of your organization?
		Is the lighting system in your organization energy-efficient?
		Is temperature in your offices controlled by a building control system, and is your company continuously improving the energy efficiency of the heating system?
		Is the power supply to printers in your organization shut off during weekends and night hours?

continued on following page

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 2. Continued

Area	Item	Assessment Indicators
Work Practice The way an IT organization and its members work, including the organizational structure and processes	**Applications**	Can all employees in your company conduct their basic tasks through an electronic approval system or a web interface?
		Are emails or electronic signatures accepted in your company as a valid method for approving or authorizing processes?
		Does your company have and use an electronic payment/settlement system to settle transactions with customers or vendors?
		Does you company have an internet-based sales channel?
		Does your company use an e-billing system to issue paperless customer invoices (or payment receipts)?
		Is your company conducting an application rationalization program to reduce the size of the application portfolio and achieve a company-wide standardized architecture?
		Are organizational processes in your company being thoroughly reviewed and continuously improved in order to reduce the number of tasks performed?
		Does your organization have a single, consolidated tool for communicating internal messages? (email, MSN, Skype, voicemail, fax)
	Operation	Is a video conference system in place and in use, in your company, to minimize travel needs?
		Is your IT unit capable of supporting teleworkforce and mobile workforces through remote support services? (ex. IT support via remote control)
		Does your company provide support tools and office space for telecommuting, and encourage telecommuting by employees?
	Management	Is green IT education provided to employees in your company, on a regular basis?
		Does your company conduct analysis on the environmental impact of its activities, concerning all business cases?
		Does a charge-back mechanism for services provided by the IT unit exist in your company, and if so, is it appropriately managed?
		Does a model for charging back carbon costs to units and projects exist and are improvement activities carried out based on the charge-back model, in your company?
		Does your organization have a green leadership program in place, along with well-defined rules and a management system? Also, is your organization carrying out a green agenda?
Procurement The process through which companies procure and purchase equipment and services	**Asset Management**	Is the lifecycle of IT assets efficiency managed under your company's asset management policy?
		Are all asset purchase activities and power consumption tracked by a centrally-managed configuration management database (CMDB) and included in the audit process?
		Is your company's configuration management database (CMDB) linked to its service catalog?
	Captical Costs	When selecting standard hardware solutions, is the energy efficiency of IT assets, including energy star certification, a key consideration?
		When selecting an asset, does your company consider carbon emissions at the vendor's side, resulting from manufacturing, transportation and disposal processes, and has there been improvement in this area?
		Does your company have rules requiring compliance with environmental regulations, including the EU Restriction of Hazardous Substance (RoHS) Directive and the Waste Electrical and Electronic Equipment (WEEE) Directive, and are the rules enforced?
	Operating Costs	Does your company use a smart logistics system for product delivery? (ex. single packages, single pickup, etc.)
		Does your company have a utility management process in place to minimize the use of consumables?
		Does your company have rules requiring the purchase of office supplies made with recycled/environment-friendly materials, and is encouraging compliance with these rules?

continued on following page

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 2. Continued

Area	Item	Assessment Indicators
Corporate Citizenship The method of interaction between an IT organization and the local or global community	**Waste Disposal**	Does your company conduct analysis on items that are sold or discarded, for instance, to define and classify hazardous substances?
		Does your company have incentive and information programs for reducing IT-related waste production, and are these programs conducted effectively?
		Are all items audited before they are discarded, and has continuous improvement been made in terms of reduction of the environmental impact of your company's activities?
		Are wastewater and waste heat produced from offices and IT resources re-used in your company?
	Recycling/ Re-use	Does your company have rules and processes in place for reusing computers and other internal assets by donating them or changing their intended use, and are these rules and processes effectively implemented?
		Are consumables like batteries and printer cartridges recycled or re-used in your company?
	Waste Reduction	Does your company have set practices for its employees to participate in environmental movements, and has there been a continuous participation in environmental movements?
		Does your company use smart redundancy techniques to reduce the number of physical apparatuses?
		Does your company encourage electronic distribution of product or company brochures to customers and vendors?

Table 3. Levels of maturity

Level	Description
0: Incomplete	Although a process is in place, it is not used, and efforts to draw actual benefits from it are insufficient.
1: Initial	The process is not at all or poorly documented, and tends to be modified depending on the user or event.
2: Repeatable	Although the process manual or instructions are far from clear or complete, they, nevertheless, are helpful in maintaining existing practices.
3: Defined	A clearly-established process exists, and the process has improved over time.
4: Managed	The process is carried out using statistical, Quantitative techniques, and it is possible to predict quantitative values.
5: Optimized	There is a quantitative process improvement goal, and the process has been continuously improved to reflect the business goals.

ANALYSIS OF RESULTS

This section presents the results of the study in Tables 4-8. The following parts discuss the major constructs and their corresponding results based on analyzed survey results.

For data center, organizations considered introducing energy-efficiency in the design of data centers (AVE = 2.9) and made backup software available for organization-wide backup and restoration activity (AVE = 3.1). On the other hand, organizations have lower consideration in managing orchestration tools to enhance the use of floor space for idle servers (AVE = 1.5), and limited practice has been devoted in adopting intelligent refreshing in servers to enhance operational efficiency (AVE = 2.1).

In terms of the office environment, the organizations had utilized multi-function equipment with features to print, scan, fax and photocopy documents within the organizations (AVE = 3.7). Also, the organizations considered using toner saving solutions to reduce costs (AVE = 3.3). However, there were limited guidelines requiring employees to shut down unused computers and other devices, and management

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 4. Data center

Area	Item	Assessment Indicators	Average
Data Center Shared computing capacity including servers, storage and networks	**Server Assets**	When developing information systems and introducing new servers in your operating environment, does your company consider server virtualization as a basic implementation method?	2.8
		To proactively manage the floor space occupied by idle servers, does your company use orchestration tools in all environments?	1.5
		Does your company collect data on the use of server instances across all your assets, manage related indicators and conduct optimization activities based on this information?	2.7
		Do you company practice intelligent refreshing in servers in all environments to improve their operation efficiency?	2.1
		Are all servers in your company optimized based on their performance efficiency and highly efficient in terms of power supply?	
	Support Infrastructure	Have your network storages in data centers been integrated to create a single-storage network?	2.8
		Does your company collect data on the use of storage equipment on all your assets and develop and manage related indicators?	2.5
		Have your networks been converged (voice/data, fixed/wireless) to reduce the number of switches needed in your data centers?	2.7
		Is your intelligent power allocation equipment installed in the LAC within the data centers and is linked with monitoring systems?	2.6
		Are backup software programs within your organization integrated into a single platform so that they may be used for company-wide backup and restoration?	3.1
	Physical Equipment	Is power usage monitored in real time in your company, and is monitored by each section or unit?	2.6
		Is the lighting system in your data centers designed with energy efficiency in mind?	2.7
		Was energy efficiency considered in the design of your data centers?	2.9
		Is the control of temperature and moisture in your data centers automated, and is the control system effective?	2.5
		Is your company conducting a data center rationalization program to minimize the number of data centers?	2.6

systems to ensure the compliance (AVE = 1.3). Moreover, there was limited implementation of intelligent lighting systems within the organizations, as an approach to reducing power and energy consumption.

For work practice, the respondents elicited that electronic approval systems and applications were made available to allow employing to perform their basic functions (AVE = 4.1) and related tasks. Moreover, the respondents agreed that paperless invoicing systems were utilized (AVE = 3.9) to reduce associated costs. However, the respondents pointed that there was limited green leadership program available, with policies and guidelines, management strategy, and green programme encouraging participation of all employees with the organizations (AVE = 1.0) as well as limited Green IT education (AVE = 1.2) was provided to recognize its benefits, outcomes, and implications towards individual and corporate-wide culture.

In terms of procurement, the respondents agreed that their organizations continue to make IT asset management efficient (AVE = 3.5) by ensuring that a management policy is in place, to further its

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 5. Office environment

Area	Item	Assessment Indicators	Average
Office Environment Computing resources within an office environment, including desktop and laptop computers, printers and mobile devices	**PC**	Have screensavers been disabled in all display devices so that they go into power saving mode?	2.5
		Are all IT equipment in your office controlled by a central power management system?	2.3
		Have desktops been replaced by lower-power laptop computers in your company where possible?	1.8
		Have your company's desktop units been replaced by thin client solutions where possible?	2.1
		Are there rules in your company, requiring employees to shut off power to all unused PCs and IT devices, and a management system to monitor compliance?	1.3
	Printers	Are multifunction devices functioning at the same time as a printer, fax machine, scanner and a photocopier used in your company, instead of separate devices?	3.7
		Is there support for a virtual fax service for all users in your company, and is its use widespread?	2.1
		Are all printers in your company installed with a toner saving solution?	3.3
		Are all printers in your company configured so that power is automatically shut off during night hours and weekends?	2.3
		Do you have an integrated print management service in your organization to reduce unnecessary printed materials?	2.5
	Office Equipment	Do you have wireless network access in your organization to reduce the use of fixed-line networks?	2.7
		Is there an intelligent lighting system in all offices of your organization?	1.5
		Is the lighting system in your organization energy-efficient?	2.0
		Is temperature in your offices controlled by a building control system, and is your company continuously improving the energy efficiency of the heating system?	2.8
		Is the power supply to printers in your organization shut off during weekends and night hours?	3.0

implementation, monitoring, and improvement activities. Also, smart logistics systems are recognized as a critical approach to reducing the carbon footprint of transport when deliveries of products to their customers (AVE = 3.1). However, most of the respondents agreed that their little consideration on looking at the carbon emissions by vendors during the product design, development, transport, and end of life management (AVE = 1.0). Also, limited policies are in place requiring the organizations to comply with environmental regulations, lacks monitoring, and continuous enhancement by considering international standards (AVE = 1.4).

For corporate citizenship, the organizations have established environmental programs and practices to enhance participation of employees (AVE = 3.5). Also, the respondents agreed that electronic brochures were distributed to customers to become familiar with the organizations' products and services (AVE = 3.1). However, the respondents agreed that reusing wastewater and waste heat from offices and IT resources were not widely implemented (AVE = 1.1) as well as reusing or recycling consumables to reduce waste disposal (AVE = 1.7).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 6. Work practice

Area	Item	Assessment Indicators	Average
Work Practice The way an IT organization and its members work, including the organizational structure and processes	**Applications**	Can all employees in your company conduct their basic tasks through an electronic approval system or a web interface?	4.1
		Are emails or electronic signatures accepted in your company as a valid method for approving or authorizing processes?	3.8
		Does your company have and use an electronic payment/settlement system to settle transactions with customers or vendors?	3.7
		Does your company have an internet-based sales channel?	3.1
		Does your company use an e-billing system to issue paperless customer invoices (or payment receipts)?	3.9
		Is your company conducting an application rationalization program to reduce the size of the application portfolio and achieve a company-wide standardized architecture?	2.5
		Are organizational processes in your company being thoroughly reviewed and continuously improved in order to reduce the number of tasks performed?	2.1
		Does your organization have a single, consolidated tool for communicating internal messages? (email, MSN, Skype, voicemail, fax)	3.8
	Operation	Is a video conference system in place and in use, in your company, to minimize travel needs?	3.1
		Is your IT unit capable of supporting teleworkforce and mobile workforces through remote support services? (ex. IT support via remote control)	3.5
		Does your company provide support tools and office space for telecommuting, and encourage telecommuting by employees?	2.1
	Management	Is green IT education provided to employees in your company, on a regular basis?	1.2
		Does your company conduct analysis on the environmental impact of its activities, concerning all business cases?	1.5
		Does a charge-back mechanism for services provided by the IT unit exist in your company, and if so, is it appropriately managed?	1.8
		Does a model for charging back carbon costs to units and projects exist and are improvement activities carried out based on the charge-back model, in your company?	1.3
		Does your organization have a green leadership program in place, along with well-defined rules and a management system? Also, is your organization carrying out a green agenda?	1.0

DISCUSSION

The results of the survey revealed that organizations within the manufacturing industry had initiated Green IT practices (see Table 9). However, further recognition, research, and implementations should be taken into consideration to harness the benefits of Green IT and reduce business processes impacts to the environment. For data center, newly developed and advanced energy-efficient solutions should be in place to reduce energy consumption and operational costs of data center and related equipment. With regard to enhancing the office environment, although improvements are being made to enhance efficiency

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 7. Procurement

Area	Item	Assessment Indicators	Average
Procurement The process through which companies procure and purchase equipment and services	**Asset Management**	Is the lifecycle of IT assets efficiency managed under your company's asset management policy?	3.5
		Are all asset purchase activities and power consumption tracked by a centrally-managed configuration management database (CMDB) and included in the audit process?	2.1
		Is your company's configuration management database (CMDB) linked to its service catalog?	1.5
	Captical Costs	When selecting standard hardware solutions, is the energy efficiency of IT assets, including energy star certification, a key consideration?	2.1
		When selecting an asset, does your company consider carbon emissions at the vendor's side, resulting from manufacturing, transportation and disposal processes, and has there been improvement in this area?	1.0
		Does your company have rules requiring compliance with environmental regulations, including the EU Restriction of Hazardous Substance (RoHS) Directive and the Waste Electrical and Electronic Equipment (WEEE) Directive, and are the rules enforced?	1.4
	Operating Costs	Does your company use a smart logistics system for product delivery? (ex. single packages, single pickup, etc.)	3.1
		Does your company have a utility management process in place to minimize the use of consumables?	1.8
		Does your company have rules requiring the purchase of office supplies made with recycled/environment-friendly materials, and is encouraging compliance with these rules?	1.7

Table 8. Corporate citizenship

Area	Item	Assessment Indicators	Average
Corporate Citizenship The method of interaction between an IT organization and the local or global community	**Waste Disposal**	Does your company conduct analysis on items that are sold or discarded, for instance, to define and classify hazardous substances?	2.8
		Does your company have incentive and information programs for reducing IT-related waste production, and are these programs conducted effectively?	1.8
		Are all items audited before they are discarded, and has continuous improvement been made in terms of reduction of the environmental impact of your company's activities?	2.1
		Are wastewater and waste heat produced from offices and IT resources re-used in your company?	1.1
	Recycling/ Re-use	Does your company have rules and processes in place for reusing computers and other internal assets by donating them or changing their intended use, and are these rules and processes effectively implemented?	2.5
		Are consumables like batteries and printer cartridges recycled or re-used in your company?	1.7
	Waste Reduction	Does your company have set practices for its employees to participate in environmental movements, and has there been a continuous participation in environmental movements?	3.5
		Does your company use smart redundancy techniques to reduce the number of physical apparatuses?	2.5
		Does your company encourage electronic distribution of product or company brochures to customers and vendors?	3.1

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 9. Summary of Green IT areas

Area	Average
Data Center	2.57
Office Environment	2.41
Work Practice	2.65
Procurement	2.02
Corporate Citizenship	2.34
Overall Average	2.39

and energy consumption, IT equipment is not sufficiently used to enhance the working environment of organizations. In the area of work practice, the organizations had higher scores among all other Green IT areas in terms of the efficient utilization of software applications and mobile work practices. However, concerns were pointed on the limited Green IT education, leadership and programs, and placing practices on carbon charge-back systems. The organizations also received had lower results regarding procurement, and requires enhancement in procurement activities covering purchasing, recycling, reuse, and disposal processes. Also, the results revealed the organizations had established corporate citizenship programs, effective processes are in place for waste disposal, recycling and reusing, and waste reduction, however, small practices were made to enhance reuse of consumables and deal with wastes discarded and recoverability.

Recommendations for Improvement

The organizations should establish Green IT vision, and framework to propagate green growth, structured processes, and management approach coupled with informatization methods from the initial phase of planning and deployment. More specifically, the organizations should increase the awareness on reducing business footprint and related emissions. Establishing a structured approach to measure, monitor, and analyze business footprint is needed while supporting mechanisms should be in place to slowly increase the awareness and education of the employees within organizations. Also, by recognizing that Green IT performance is necessary to achieve long-term sustainability, an institutionalization of performance management systems incorporating Green IT could further actions, training, and education in all aspects of its implementation.

In the area of institutionalizing Green IT practices, the organizations should further design effective and efficient processes in deploying software applications and encourage telecommuting activities to reduce transport footprint and related costs. Optimization of business procedures could further minimize associated costs. Reviewing and simplification of work procedures and its integration with existing main business processes should be considered to reducing duplicate information. Also, integrated communication systems and mobile office practices should be in place to promote better collaboration, participation, and major reduction of traveling footprint.

Concerning office environment, the organizations should assess and utilize energy-efficient IT equipment and devices. The use of automated power management systems should be in place as well

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

as expand the desktop virtualization utilization in office environments. The organizations should also consider introducing print management solutions as company-wide implementation in conjunction with an efficient toner management solution, reducing printing consumptions and further the adoption of paperless business activities. Also, the organizations should introduce the use of intelligent lighting systems, highly efficient heating and air-conditioning technology in a centralized and controlled facility. Likewise, assessing the potential of moving to a green certified building, office environment and facility would allow provisions for natural lighting systems and access to advanced facility management solutions. Hence, it could allow continuous measurement of power consumption and savings.

In the area of IT procurement, the organizations should assess and enhance existing policies about the purchase and use of energy-efficient and environment-friendly IT infrastructure and its associated equipment, and consider advanced energy-efficiency management solutions. Procedures should be in place to effectively monitor IT lifecycle management along with measuring its efficiency and introducing integrated data resource management systems for IT assets and end of life management. Detailed implementation guidelines on 4R (reuse, reduce, recycle, recover) practices could further end of life management practices within the organizations as well as placing more rigorous rules in using consumables. Moreover, consideration and assessment activities are needed to look at suppliers' procurement activities, participation in environment programs and the establishment of performance management could further assist organizations in monitoring carbon footprint associated with procurement life cycle.

Regarding data center operations, the organizations should take actions on establishing guidelines and management systems that optimize the allocation of data resources. Further consideration on server virtualization should be slowly extended to all the key aspects of business operations. Also, using efficient storage solutions, recovery and backup systems could result in efficient data management while introducing converge network, connectivity, and utilization of wireless network, as well as real-time power and energy monitoring solutions, are needed, and enhancing the physical setup and space of data centers to allow constant evaluation and optimization of energy use.

To further corporate citizenship, organizations should consider monitoring waste disposal activities, continuous IT asset audits including discarded items, recycled and reused resources, and a mechanism to manage items that are sold. Top management should also explore on establishing regular recycling and reuse programs for employees and encourage participation to environment programs could further increase awareness and education. Rewards and incentives systems should be in place to recognize employees' efforts in helping the organizations to reduce its business footprint are highly recommended.

Overall, a strategic strategy recommendation is needed to further the update of Green IT in the manufacturing industry in the Philippines. As the Philippine government recently participated in the Paris agreement on reducing per country carbon footprint and environmental protection programs, it is necessary to take the following steps (a) establishing a national committee on introducing green growth and Green IT policies, implementation guidelines, performance, and monitoring systems; (b) structuring and creating stringent policies and regulatory programs aiming to promote Green IT procurement across industries, and require enterprise level Green IT agenda with its long–term strategy; (c) establishing an education, awareness and promotion programs through Green IT capacity building and training with rewards and awards systems; (d) setting up a support systems through technical assistance, financial budget allocation, and collaborations with social enterprises aiming to further environment sustainability through green growth.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

CONCLUSION

This study is an initial attempt to explore, assess and understand Green IT maturity within the Philippine manufacturing industry. The results indicate that there is likely lower level of Green IT maturity. Thus, Green IT is highly recommended. A Green IT framework and structure are needed for systematic management and further the update of Green IT within organizations. An emphasis on Green IT efforts, programs, and initiatives requires adopting newly developed advanced technologies to manage environment-friendly resources efficiently. Therefore, the Philippine government requires further efforts to enhance Green IT performance across industries. Developed countries all over the world have been proactively making efforts to introduce and adopt greener processes within their society, thus, assessing the Green IT maturity is the initial step towards building a green society.

Despite the contributions of this research, it is not free from limitations, thus, this study considers research possibilities to contribute to Green IT adoption as key area of inquiry in the computing, environment, and sustainability discipline including (a) studies on exploring the motivational drivers, factors, and antecedents could further understanding of the decision-makers intent to adopt Green IT, more particularly in the developing countries, such as the Philippines, with its initial attempt to introduce Green IT through voluntary enterprise level programs and practices, future studies can offer new insights as to how decision-makers perceive corporate culture and environment as consideration in introducing Green IT within organizations. (b) conduct cross-industry maturity assessment studies to identify the laggards and mature adopters of Green IT, compare, and explore the issues and challenges experienced by various industries, and recommend a suitable framework that assists them in slowly enhancing the adoption of Green IT practices, and periodically monitor and evaluate the performance. (c) explore the potential roles of industry associations and social enterprises for collaborations and participation in promoting business and environment sustainability initiatives. It can further offer new knowledge on the level of involvement and acceptance of Green IT as a strategy to attain long term environmental protection and resource conservation; (d) and develop a Green IT maturity indicators and ranking systems for the Philippine government.

REFERENCES

Ainin, S., Naqshbandi, M. M., & Dezdar, S. (2016). Impact of adoption of Green IT practices on organizational performance. *Quality & Quantity*, *50*(5), 1929–1948. doi:10.100711135-015-0244-7

Aldaba, R. (2014). The Philippine Manufacturing Industry Roadmap: Agenda for New Industrial Policy, High Productivity Jobs, and Inclusive Growth. P*hilippine Institute for Development Studies Discussion Paper Series*.

Anthony, B. J. (2016). Green Information Systems Integration in Information Technology Based Organizations: An Academic Literature Review. *Journal of Soft Computing and Decision Support Systems*, *3*(6), 45–66.

Arimura, T. H., Darnall, N., & Katayama, H. (2011). Is ISO 14001 a gateway to more advanced voluntary action? The case of green supply chain management. *Journal of Environmental Economics and Management*, *61*(2), 170–182. doi:10.1016/j.jeem.2010.11.003

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Ateetanan, P., & Usanavasin, S. (2015) Assessing Green IT Maturity and Recommendation of Improvement for Government Agencies in Thailand. *Journal of Business Administration and Languages.*

Banister, D., Newson, C., & Ledbury, M. (2007). The Costs of Transport on the Environment–the role of teleworking in reducing carbon emissions. *Transport Studies Unit, Oxford University.* Retrieved from http://www.tsu.ox.ac.uk/pubs/1024-banister-etal.pdf

Batungbacal, B. (2016). Philippine Manufacturing Revisited. Retrieved from https://philippinemanufacturing.wordpress.com/category/status-of-manufacturing/

Beloglazov, A., Abawajy, J., & Buyya, R. (2012). Energy-aware resource allocation heuristics for efficient management of data centers for cloud computing. *Future Generation Computer Systems*, *28*(5), 755–768. doi:10.1016/j.future.2011.04.017

Beloglazov, A., & Buyya, R. (2010, May). Energy efficient resource management in virtualized cloud data centers. In *Proceedings of the 2010 10th IEEE/ACM international conference on cluster, cloud and grid computing* (pp. 826-831). IEEE Computer Society. 10.1109/CCGRID.2010.46

Bokolo, A. J., & Noraini, C. P. (2015). A Framework for Adoption and Implementation of Green IT/IS Practice in IT Governance. In *Proceedings of Third International Conference on Green Computing, Technology and Innovation (ICGCTI2015)*, Serdang, Malaysia (pp. 38-48).

Cabinet Office of the UK. (2008). "Greening government ICT: efficient, sustainable, responsible.

Cai, S., Chen, X., & Bose, I. (2013). Exploring the role of IT for environmental sustainability in China: An empirical analysis. *International Journal of Production Economics*, *146*(2), 491–500. doi:10.1016/j.ijpe.2013.01.030

Choudhary, M., & Seth, N. (2011). Integration of green practices in supply chain environment the practices of inbound, operational, outbound and reverse logistics. *International Journal of Engineering Science and Technology*, *3*(6), 4995–4993.

Chuang, S. P., & Huang, S. J. (2016). The effect of environmental corporate social responsibility on environmental performance and business competitiveness: The mediation of green information technology capital. *Journal of Business Ethics*.

Chugh, R., Wibowo, S., & Grandhi, S. (2016). Environmentally sustainable Information and Communication Technology usage: Awareness and practices of Indian Information and Communication Technology professionals. *Journal of Cleaner Production*, *131*, 435–446. doi:10.1016/j.jclepro.2016.05.004

Dangelico, R. M., & Pujari, D. (2010). Mainstreaming green product innovation: Why and how companies integrate environmental sustainability. *Journal of Business Ethics*, *95*(3), 471–486. doi:10.100710551-010-0434-0

Dao, V., Langella, I., & Carbo, J. (2011). From green to sustainability: Information Technology and an integrated sustainability framework. *The Journal of Strategic Information Systems*, *20*(1), 63–79. doi:10.1016/j.jsis.2011.01.002

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

de Sousa Jabbour, A. B. L., Jabbour, C. J. C., Latan, H., Teixeira, A. A., & de Oliveira, J. H. C. (2014). Quality management, environmental management maturity, green supply chain practices and green performance of Brazilian companies with ISO 14001 certification: Direct and indirect effects. *Transportation Research Part E, Logistics and Transportation Review*, *67*, 39–51. doi:10.1016/j.tre.2014.03.005

Deng, Q., & Ji, S. (2015). Organizational Green IT Adoption: Concept and Evidence. *Sustainability*, *7*(12), 16737–16755. doi:10.3390u71215843

Department of Trade Industry. (2016). Securing the Future of Philippine Industries. Retrieved from http://industry.gov.ph/category/manufacturing/

Desai, M., & Bhatia, V. (2011). Green IT Maturity Model: How does your Organization Stack up? *SETLabs Briefings*, *9*(1), 49–56.

Dezdar, S. (2017). Green Information Technology Adoption: Influencing Factors and Extension of Theory of Planned Behavior. *Social Responsibility Journal, 13*(2).

Diabat, A., Khodaverdi, R., & Olfat, L. (2013, September). An exploration of green supply chain practices and performances in an automotive industry. *International Journal of Advanced Manufacturing Technology*, *68*(1-4), 949–961. doi:10.100700170-013-4955-4

Dick, G. N., & Burns, M. (2011, March). Green IT in small business: an exploratory study. In *Proceedings of the Southern Association of Information System Conference*, Atlanta, GA, March 25th-26.

Dwivedy, M., & Mittal, R. K. (2013). Willingness of residents to participate in e-waste recycling in India. *Environmental Development*, *6*, 48–68. doi:10.1016/j.envdev.2013.03.001

Eltayeb, T. K., Zailani, S., & Ramayah, T. (2011). Green supply chain initiatives among certified companies in Malaysia and environmental sustainability: Investigating the outcomes. *Resources, Conservation and Recycling*, *55*(5), 495–506. doi:10.1016/j.resconrec.2010.09.003

Gholami, R., Molla, A., Goswami, S., & Brewster, C. (2017). Green information systems use in social enterprise: The case of a community-led eco-localization website in the West Midlands region of the UK. *Information Systems Frontiers*.

Gholami, R., Watson, R. T., Molla, A., Hasan, H., & Bjørn-Andersen, N. (2016). Information systems solutions for environmental sustainability: How can we do more? *Journal of the Association for Information Systems*, *17*(8), 521.

Giret, A., Trentesaux, D., & Prabhu, V. (2015). Sustainability in manufacturing operations scheduling: A state of the art review. *Journal of Manufacturing Systems*, *37*, 126–140. doi:10.1016/j.jmsy.2015.08.002

Gutterer, B. (2015). *Promotion of Green Economic Development (ProGED) Projects: Greening the Philippine Manufacturing Industry Roadmap. Deutsche Gesellschaft fur Internationale Zusammenarbeit (GIZ)*. GmbH Registered Offices.

Hanelt, A., Busse, S., & Kolbe, L. M. (2016). Driving business transformation toward sustainability: Exploring the impact of supporting IS on the performance contribution of eco-innovations. *Information Systems Journal*.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Hba, R., Bakkas, A., Manouar, A. E., & Idrissi, M. A. J. (2016). Eco-Strategy: Towards a New Generation Managerial Model Based on Green IT and CSR. arXiv:1605.03107

Hernandez, A. A., & Ona, S. E. (2016). Green IT Adoption: Lessons from the Philippines Business Process Outsourcing Industry. *International Journal of Social Ecology and Sustainable Development*, *7*(1), 1–34. doi:10.4018/IJSESD.2016010101

Hersch, R. D., & Bonecutter, C. R. (2008). The business case for a greener IT agenda. *Accenture Outlook 2008, the Journal of High-performance Business*.

Hoang, G., Molla, A., & Poon, P. L. How do environmental enterprise systems contribute to sustainability value? A practitioner-oriented framework. In *Proceedings of the Australasian Conference on Information Systems*.

Houy, C., Reiter, M., Fettke, P., & Loos, P. (2010, September). Towards green BPM–sustainability and resource efficiency through business process management. In *Proceedings of the International Conference on Business Process Management* (pp. 501-510). Springer Berlin Heidelberg.

Lee, Y. C., & Zomaya, A. Y. (2012). Energy efficient utilization of resources in cloud computing systems. *The Journal of Supercomputing*, *60*(2), 268–280. doi:10.100711227-010-0421-3

Loeser, F., Recker, J., Brocke, J. V., Molla, A., & Zarnekow, R. (2017). How IT executives create organizational benefits by translating environmental strategies into Green IS initiatives. *Information Systems Journal*, *27*(4), 503–553. doi:10.1111/isj.12136

Molla, A. (2009). The extent of Green IT adoption and its driving and inhibiting factors: An exploratory study. *Journal of Information Science and Technology*, *6*(4), 1–21.

Molla, A., Abareshi, A., & Cooper, V. (2014). Green IT beliefs and pro-environmental IT practices among IT professionals. *Information Technology & People*, *27*(2), 129–154. doi:10.1108/ITP-10-2012-0109

Molla, A., & Cooper, V. (2014). Greening data centres: The motivation, expectancy and ability drivers.

Molla, A., Cooper, V., & Pittayachawan, S. (2011). The Green IT readiness (G-readiness) of organizations: an exploratory analysis of a construct and instrument.

Murugesan, S., & Gangadharan, G. R. (2012). *Harnessing green IT: Principles and practices*. Wiley Publishing. doi:10.1002/9781118305393

Naumann, S., Dick, M., Kern, E., & Johann, T. (2011). The greensoft model: A reference model for green and sustainable software and its engineering. *Sustainable Computing: Informatics and Systems*, *1*(4), 294–304.

Nguyen, T. A., & Aiello, M. (2013). Energy intelligent buildings based on user activity: A survey. *Energy and Building*, *56*, 244–257. doi:10.1016/j.enbuild.2012.09.005

Ninlawan, C., Seksan, P., Tossapol, K., & Pilada, W. (2010, March). The implementation of green supply chain management practices in electronics industry. In *Proceedings of the international multiconference of engineers and computer scientists* (Vol. 3, pp. 17-19).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Nowak, A., Leymann, F., & Mietzner, R. (2010, December). Towards green business process reengineering. In *Proceedings of the International Conference on Service-Oriented Computing* (pp. 187-192). Springer Berlin Heidelberg.

NSTDA. (2011). APECTEL*: Study Workshop on Best Practices Transfer of Green ICT for Sustainable Growth*.

Official Gazette. (2015). Manufacturing Sector Grew in 2015. Retrieved from http://www.gov.ph/2016/02/10/manufacturing-sector-grew-in-2015/

Papagianni, C., Leivadeas, A., Papavassiliou, S., Maglaris, V., Cervello-Pastor, C., & Monje, A. (2013). On the optimal allocation of virtual resources in cloud computing networks. *IEEE Transactions on Computers*, *62*(6), 1060–1071. doi:10.1109/TC.2013.31

Park, S. H., Eo, J., & Lee, J. J. (2012). Assessing and Managing an Organization's Green IT Maturity. *MIS Quarterly Executive*, *11*(3).

Philippine Statistics Authority. (2016). Manufacturing. Retrieved from https://web0.psa.gov.ph/statistics/survey/data-by-industry/manufacturing

Ramayah, T., Siew, K. K., Ahmad, N. H., Halim, H. A., & May-Chiun, L. (2013). An Exploratory Study of Green IT Adoption Issues among SMEs. *Life Science Journal*, *10*(12), 246–255.

Ruth, S. (2011). Invited Paper: Reducing ICT-related Carbon Emissions: An Exemplar for Global Energy Policy? *IETE Technical Review*, *28*(3), 207–211. doi:10.4103/0256-4602.81229

Sarkis, J., Helms, M. M., & Hervani, A. A. (2010). Reverse logistics and social sustainability. *Corporate Social Responsibility and Environmental Management*, *17*(6), 337–354. doi:10.1002/csr.220

Savita, K. S., Dominic, P. D. D., & Ramayah, T. (2016). The Drivers, Practices and Outcomes of Green Supply Chain Management: Insights from ISO14001 Manufacturing Firms in Malaysia. *International Journal of Information Systems and Supply Chain Management*, *9*(2), 35–60. doi:10.4018/IJISSCM.2016040103

Schwartz, T., Betz, M., Ramirez, L., & Stevens, G. (2010, October). Sustainable energy practices at work: understanding the role of workers in energy conservation. In *Proceedings of the 6th Nordic Conference on Human-Computer Interaction: Extending Boundaries* (pp. 452-462). ACM. 10.1145/1868914.1868966

Seuring, S., & Gold, S. (2013). Sustainability management beyond corporate boundaries: From stakeholders to performance. *Journal of Cleaner Production*, *56*, 1–6. doi:10.1016/j.jclepro.2012.11.033

Steigerwald, V. (2015). *Greening the Philippine Manufacturing Roadmap Process. Deutsche Gesellschaft fur Internationale Zusammenarbeit (GIZ).* GmbH Registered Offices.

Thongmak, M. (2013). A systematic framework for sustainable ICTs in developing countries. *International Journal of Information Technologies and Systems Approach*, *6*(1), 1–19. doi:10.4018/jitsa.2013010101

Vom Brocke, J., Seidel, S., & Recker, J. (Eds.). (2012). *Green business process management: towards the sustainable enterprise*. Springer Science & Business Media. doi:10.1007/978-3-642-27488-6

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Wang, L., Wang, Z., & Yang, R. (2012). Intelligent multiagent control system for energy and comfort management in smart and sustainable buildings. *IEEE Transactions on Smart Grid*, *3*(2), 605–617. doi:10.1109/TSG.2011.2178044 PMID:23243488

Winkler, H. (2011). Closed-loop production systems—A sustainable supply chain approach. *CIRP Journal of Manufacturing Science and Technology*, *4*(3), 243–246. doi:10.1016/j.cirpj.2011.05.001

Younge, A. J., Von Laszewski, G., Wang, L., Lopez-Alarcon, S., & Carithers, W. (2010, August). Efficient resource management for cloud computing environments. In *Proceedings of the Green Computing Conference, 2010 International* (pp. 357-364). IEEE. 10.1109/GREENCOMP.2010.5598294

Zhang, J., & Liang, X. J. (2012). Promoting green ICT in China: A framework based on innovation system approaches. *Telecommunications Policy*, *36*(10), 997–1013. doi:10.1016/j.telpol.2012.09.001

This research was previously published in the International Journal of Sociotechnology and Knowledge Development (IJSKD), 9(2); edited by Constance Kampf and José Abdelnour-Nocera, pages 37-55, copyright year 2017 by IGI Publishing (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 64
Assessing the Green Supply Chain Management for the United Arab Emirates Construction Industry

Sreejith Balasubramanian
University of Wollongong – Dubai, UAE

Balan Sundarakani
University of Wollongong – Dubai, UAE

ABSTRACT

The United Arab Emirates (UAE) construction industry has been witnessing an unprecedented growth in the last two decades. As a result, the sector is facing a major challenge of reducing the carbon footprint and thus creating major concern for the governments and the environmental agencies in the UAE. The chapter discusses the role of Green Supply Chain Management (GSCM) in achieving sustainability in the UAE construction industry. The various stages of GSCM applicable to the construction industry are critically assessed along with green performance measures in achieving environmental, economic and operational performance. Finally, the chapter provides a list of recommendations that could be used by practitioners and policy makers in implementing and measuring sustainability practices in the construction industry.

INTRODUCTION

Environmental pollution and climate change are the main challenges faced by mankind in the 21st century. Increasing carbon emissions from the various stationary and non-stationary facilities are the main cause of global warming and rise in sea level. Hence the carbon footprint quantification, analysis and reduction are considered as the key to identification and mitigation of emissions in every industry. One of the main industries from a sustainability perspective is the construction sector. According to United Nations Environmental Program (UNEP, 2007) report, the construction sector is responsible for 30%

DOI: 10.4018/978-1-5225-7915-1.ch064

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

of the world greenhouse gas (GHG) emissions. The increased growth in construction industry has led to increased GHG emissions due to higher energy consumption, embodied emission from the production of steel, cement etc., and from the combustion of petrol and diesel from related transportation from construction activities. In addition, construction industry waste makes a significant percentage of the total waste generated in many cities around the world (Li and Zhang, 2012). Hence, there is an urgent need to reduce the environmental impacts of the sector, especially in developing economies like United Arab Emirates (UAE), where the construction is the main contributor of environmental emissions.

Background to the United Arab Emirates (UAE) Construction Sector

During the last decade, UAE has witnessed an unprecedented construction boom, in which the sector on average had grown 10-12 precent, and is the major contributor of environmental pollution. As of 2010, the total construction projects in UAE had an estimated worth of $958bn and is expected to grow by 9.6% annually between 2010 and 2014 (Deloitte Middle East, 2010). According to the 'UAE construction Industry Outlook (2012)' report, UAE accounted for nearly 20.3% of total construction industry in the Gulf Cooperation Council (GCC) having outpaced Saudi Arabia in 2008 in becoming the region's largest construction market. Even during the global financial recession (2009-2012), the sector managed to record strong growth and contributed approximately 8% to the country's GDP in 2009 to over 14% in 2012. Unfortunately, this unprecedented construction boom had largely contributed to UAE becoming one of the top countries in terms of per capita carbon emissions. UAE was ranked 4th, 6th and 1st place in terms of per capita carbon emission in the year 2006, 2008 and 2010 respectively (World Bank Report, 2012), with per capita carbon emission estimated at 22.6 metric tons in 2010. As a result, there is increasing pressure on UAE by global environmental bodies to cut down carbon emissions and per capita energy spending.

Green Initiatives in the United Arab Emirates (UAE) Construction Sector

Due to growing international pressure, UAE government has taken number of green initiatives to promote sustainability in the build environment. For e.g., Abu Dhabi Urban planning Council in 2010 introduced 'Pearl Rating System' a framework for sustainable design and construction in which consideration and documentation of sustainability aspects of new buildings is mandatory. Dubai Electricity and Water Authority (DEWA, 2011) announced the green building guidelines which covers aspects such as site selection, usage of construction materials, waste management and indoor environment quality. The World Energy Forum 2012 and World Future Energy Summit 2013 were hosted by UAE in a bid to create awareness and promote sustainable living in the UAE. These are already some evidences of the green projects in the UAE construction sector. For example, Masdar City is the world's first planned carbon neutral city located in the city of Abu Dhabi. However, these ad-hoc government initiatives and projects alone are not sufficient to green the UAE construction sector. To green the UAE construction sector, the sector needs to be looked at from a holistic perspective. The concept of GSCM, which offers a holistic approach, can be applied for greening the UAE construction sector.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Evolution of Green Supply Chain Management (GSCM)

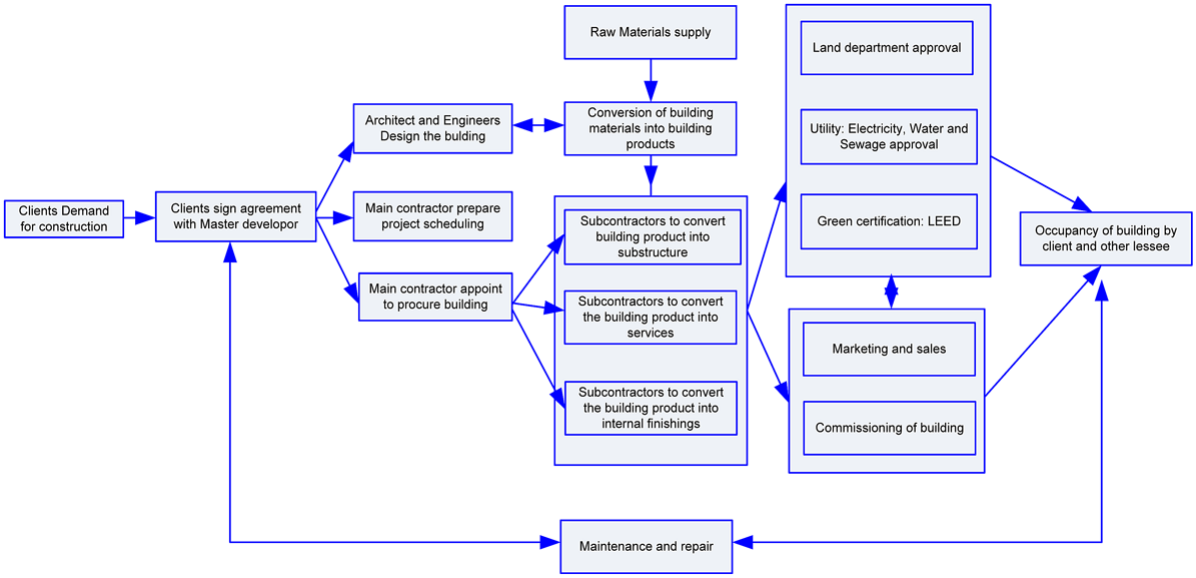
From a supply chain standpoint of view to ensure future generations will have resources, we need to look into the supply chain and understand its implications on the environment. The environmental impacts of supply chain process have been an issue for many years. Traditionally supply chain management focused primarily on time, quality and cost. Supply chain management (SCM) has been viewed as process where raw materials are converted into final products, then delivered to the end customer (Beamon, 1999). However, in the mid 1990's as SCM evolved, practices such as just-in-time (JIT), lean supply chain, total quality management (TQM), are adopted by organizations to enhance the operational efficiency of the supply chain. However, increasing concern of environmental issues has led to number of independent studies on eco-friendly design (Chandra, 1991), life cycle analysis (Penev, 1995), waste management (Roy & Whelan, 1992), green manufacturing (Van & Salomon, 1997; Guide & Srivastava, 1998), green transportation (Gendreau & Dejax, 1993) and reverse logistics (Kelly & Silver, 1989; Pohlen & Farris, 1992) and together played a pivotal role in the evolution of GSCM, to counter the environmental impacts of supply chain processes in an organization. Having said, GSCM is not the only term used by researchers and practitioners. A review of recent literature in sustainability shows that supply chain environmental management (SCEM), sustainable supply chain management (SSCM), environmental supply chain management (ESCM) are used and often interchangeably. However, a closer investigation revealed that related concepts such as SSCM and ESCM are broader and incorporates the social dimension of sustainability, while GSCM primarily focuses on the environmental dimension along with operational and economic dimensions. The scope of the book chapter is narrowed to GSCM to focus on the environmental issues of construction. According to (Srivastava, 2007), GSCM can be defined as ''Integrating environmental thinking into supply chain management, including product design, material sourcing and selection, manufacturing processes, delivery of the final product to the consumers as well as end-of-life management of the product after its useful life'' (p.12)

Importance of Green Supply Chain Management (GSCM) in the United Arab Emirates (UAE) Construction Sector

The environmental considerations are under looked and often neglected by firms in the UAE construction sector. A typical UAE construction supply chain is shown in Figure 1. Typically the construction project is awarded to a main contractor by the client/developer. Habitually, neither the main contractor nor the suppliers are involved in the planning or design stage of the construction supply chain. Developer hires the consultant and architect for the master planning and design and then hires the main contractor who will be responsible for the entire construction and commissioning of the building. The potential of GSCM in the UAE construction industry is enormous. An end to end GSCM can reduce emission across all stages of the supply chain. Support of all the stakeholders is required to implement GSCM. For instance, developer requirement for green buildings will be conceptualized by the architect in the form of green building design. The requirements of the green building design is tendered and awarded to the main contractor, who takes the responsibility to implement the green project. The main contractor should possess the sufficient knowledge of GSCM to implement as per tender specification. Moreover, the other activities undertaken by the main contractors such as project scheduling can forecast the op-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 1. A typical UAE construction supply network



erational improvement resulting from implementing GSCM. However, the integration of GSCM into the construction sector is a complex undertaking. This chapter attempts to integrate the various aspects of GSCM in the UAE construction sector.

Methodology

Due to the limited number studies in green supply chain management (GSCM) in construction, a systematic evaluation of existing literature GSCM from other sectors which has witnessed considerable research in GSCM over the last decade was executed to synthesise the various GSCM aspects relevant to the United Arab Emirates (UAE) construction industry. A comprehensive understanding of the UAE construction sector is achieved through industry and government reports, published company annual reports and newsletters along with number of discussions with industry experts. The findings from the literature collated the various aspects of GSCM that is necessary for the implementation of GSCM for the UAE construction sector. The various GSCM aspects identified include factors that influence construction firms to implement GSCM practices (drivers), the various green supply chain stages for greening the construction sector, environmental, economic and operational benefits of GSCM and challenges faced by the sector in implementing GSCM. The rest of chapter discusses the various aspects of GSCM in detail.

POTENTIAL DRIVING FACTORS TO THE ADOPTION OF GREEN SUPPLY CHAIN MANAGEMENT (GSCM) IN THE UNITED ARAB EMIRATES (UAE)

Driving factors of GSCM adoption for firms include both internal and external factors.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Internal Drivers

Internal drivers are forces that arise within the organization. The various internal drivers in the adoption of GSCM are as follows;

Commitment to Improve Environmental Performance

Environmental performance is considered as a major agenda in the company policy Similar to corporate social responsibility, corporate environmental responsibility is considered by firms to reduce the adverse environmental impacts of their activities (Simpson et al., 2007). However, the extend of commitment depends on the environmental values of the founder or owner (Wycherley, 1999) and support and involvement of top management (Min & Galle, 2001).

Desire to Achieve Economic Benefits

Commitment to GSCM may not be driven by environmental responsibility or regulatory compliance. Increasing number for firms has identified it as a potential management strategy to achieve economic benefits. Previous studies have identified that green practices can lead to cost reduction and savings (Dhanda & Hill, 2005; Fassoula, 2005; Richey et al., 2005).

Improve Corporate Brand Image

Adopting GSCM can improve the corporate brand image resulting in increased market share by winning new projects (Francesco & Fabio, 2010). Recent studies show that firms are using GSCM as a springboard to reach environmental conscious customers (Faisal, 2012). Wycherley (1999) identified the benefits of improved corporate brand image in the case of Body Shop International, one of the early adopters of GSCM.

To Achieve Competitive Advantage

A proactive GSCM strategy can be used by firms to differentiate themselves from their competitors (Rao & Holt 2005). Competitive advantage can be in the form of cost reductions, preferential treatment and subsidies from government and for securing stakeholder approval in environmental projects (Faisal, 2012). To extend of competitive advantage will be more in the region where GSCM is still at infancy stage (Francesco & Fabio, 2010).

Improving Supply Chain Efficiency

In additional to improvement in cost reduction and brand image, organizations are prompted to implement GSCM practices to improve supply chain efficiency. Previous studies such as Lippman (2001) and Lee (2008) identified that adoption of GSCM practices leads to reduction in cycle time and cost, and improved quality. In addition, it can lead to decreased inventory level and improved capacity utilization (Zhu et al., 2005; Zhu et al., 2008).

Table 1 summarizes the various internal drivers of GSCM and its relevance to the United Arab Emirates (UAE) construction sector.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

External Drivers

External drivers are external pressures faced by the firms to implement GSCM. The various external drivers in the adoption of GSCM are as follows;

Government Regulation and Legislation

In GSCM, the role of government and legislation plays a vital role. This is considered as the mother of all drivers and leaves no option for a firm but to comply with it or exit the market. Numerous studies have identified government regulation and legislation as the main driver of GSCM (Beamon, 1999; Hall, 2001; Min & Galle, 2001; Zhu & Sarkis, 2006; Walker et al., 2008; Schneiderman; 2009),

Client Pressure

Environmental commitment of client/developer can drive firms to implement GSCM practices. For instance in the construction sector, environmental commitment of the developer can influence contractors, which in turn can influence sub-contractors and suppliers. Hence the pressure is typically exerted from top to bottom in the supply chain (Walton et al., 1998; Handfield et al., 1997; Hall, 2001). Similarly, studies have shown that large clients can influence small and medium stakeholders in the supply chain to implement GSCM practices (Chen, 2010; Lee, 2008).

Consumer Pressure

Consumer behaviour studies in 1990's found that consumers are increasingly aware of the environmental impact of the products they consume (Roberts, 1996). The individual consumer's belief that they can contribute to environmental causes have led to environmental purchases (Berry & Rondinelli, 1998; Buckholz, 1991). Berns et al. (2009) found that consumer concern about sustainability is a significant driver for firms to adopt GSCM. Lo & Leung (2000) identified the increasing environmental awareness of young customers.

Table 2 summarizes the various external drivers of GSCM and its relevance to the United Arab Emirates (UAE) construction sector.

Table 1. Internal drivers of GSCM relevant to UAE construction sector

Drivers of GSCM	Implications to UAE Construction Sector
1. Commitment to improve environmental performance	Incorporating sustainability strategy as a part of organizational strategy
2. Achieve economic benefits	Substantial opportunities to reduce construction costs through reduction in energy, water, materials and through waste management and recycling
3. Improve corporate brand image and hence winning new contacts.	Improve corporate brand image and hence attract foreign investments and buyers.
4. Proactive approach to achieve competitive advantage	Differentiation for companies in the highly competitive UAE construction market
5. Improving supply chain efficiency.	Improve construction productivity, reduce project time, improve quality in the fast paced UAE construction sector

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 2. External drivers of GSCM relevant to UAE construction Industry

Drivers of GSCM	Implications to the UAE Construction Industry
1. Government regulation and legislation	Compliance to green design guidelines and regulation
2. Client pressure	To meet the environmental requirements in the tender documentation
3. Consumer Pressure	Customer desire for green buildings

PROPOSED GREEN SUPPLY CHAIN MANGEMENT (GSCM) STAGES APPLICABLE TO THE UNITED ARAB EMIRATES (UAE) CONSTRUCTION INDUSTRY

Reduction in carbon emission can be achieved from all functional stages of the construction supply chain such as design, purchasing and construction. Therefore for greening the construction sector, it is necessary to green the various phases of the integrated supply chain. The proposed stages identified from the literature include green design, green purchasing, green distribution and green construction (offsite and onsite) and waste management. However, extend of implementation of these supply chain phases depends on the internal and external driving forces as explained in detail in the previous section. Depending on the influence of these drivers, GSCM strategy is adopted organizationally and is reflected in the firm's vision and mission. However, prior to implementation of supply chain practices such as green design and green construction, firms have to ensure they have the necessary internal environment such as environmental management systems (EMS) and ISO 14001 implementation to efficiently implement supply chain practices. Organizations also have to conduct cost benefit analysis on the benefits and costs associated with the implementation of GSCM practices. Performance measurement post implementation will enable organizations to re-assess the cost-benefit analysis for continuous improvement.

Figure 2 shows the designed green supply chain applicable to the United Arab Emirates (UAE) construction sector. Figure 2 is developed by integrating the various GSCM stages indentified from the literature to the UAE construction supply chain as identified in Figure 1.

The various GSCM practices are explained in detail in the following section.

Internal Environmental Management (IEM)

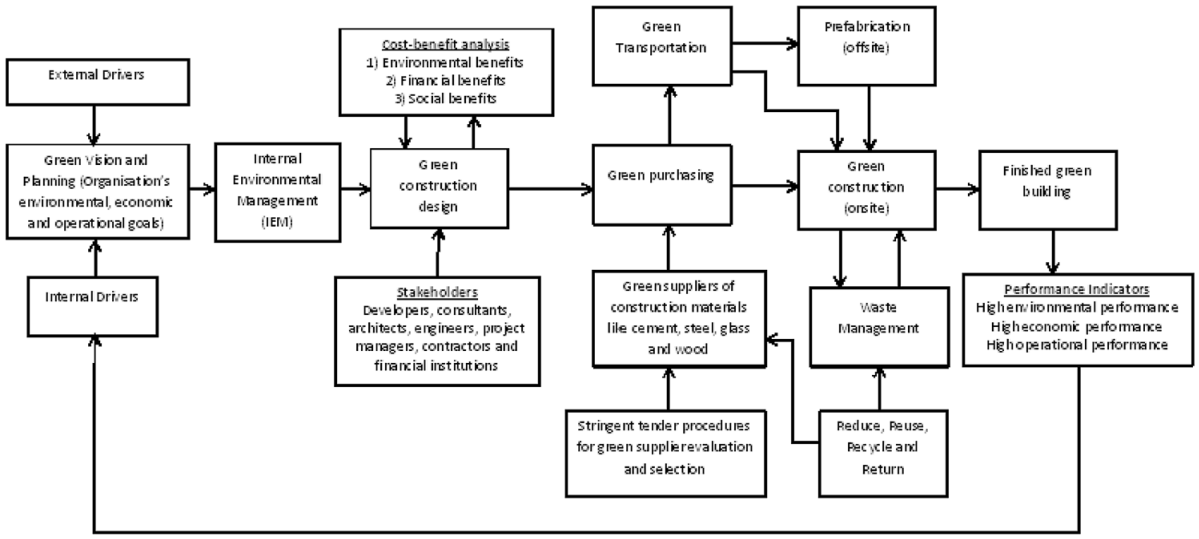
IEM is the practice of developing green supply chain management as a strategic organizational imperative through commitment and support from senior and mid-level managers (Zhu et al., 2008). IEM is a prerequisite for all the GSCM practices and should be part of the overall strategy for the successful implementation of GSCM practices (Murray, 2000). Earlier studies have also shown that management commitment to environmental strategy is necessary to implement GSCM (Byrne & Deeb, 1993; Klassen & McLaughlin, 1993). However, it was Zhu et al., (2008) who defined IEM and validated the factors with IEM.

The identified factors for IEM are:

- Cooperation, commitment and communication between top management, senior and middle managers for GSCM.
- Implementation of EMS and ISO14001 certification.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 2. Green supply chain stages applicable to the UAE construction sector



- Environmental compliance auditing programs.
- Cross-functional integration for environmental improvement.

Green Design

Green design refers to environmental conscious design of products and services (Fiksel, 1996). It considers design issues associated with carbon emission, waste management and environmental pollutions. Srivastava (2007) identified life cycle analysis (LCA) is critical in green design concept. Green design includes low material consumption design, selection of environmentally friendly materials, and substitution of hazardous material (Gungor & Gupta, 1999; Tibben-Lembke, 2002). However recent literatures incorporate design of products for reuse and recycle (Zhu et al., 2008). Green-design requires that manufacturers design products that minimize consumption of materials and energy, that facilitate the reuse, recycle, and recovery of component materials and parts, and that avoids or reduces the use of hazardous products within the manufacturing process (Zhu et al., 2008).

Identified factors for green design are:

- Design of products for reduced consumption of material energy.
- Design of products for reuse, recycle, and recovery of material and/or component parts.
- Selection of environmentally-friendly raw materials with low embodied energy.
- Substitution of environmentally hazardous materials.

For the construction sector, implementing green building design requires attention from the conceptual stage of the building design. It could utilize innovative technology and architectural concepts to incorporate design features to reduce material use, promote low energy consumption materials, promote recycled materials such as recycled concrete, wood, steel and plastic, promote end of life recovery of materials, promote alternative source of energy like solar or wind energy, site selection for construction,

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

efficient floor space utilization, energy efficient lighting and cooling technology, reduction in the use of hazardous materials, use of onsite water and solid waste treatment, proper ventilation, promote usage of precast or offsite manufactured materials in controlled environment to reduce onsite construction etc. An effective green building design shall consider the construction phase, operational phase, maintenance and renovation phase and end of life demolition and recovery.

Some of the relevant practices in green building design are:

- Shape and orientation of the building.
- Reducing primary heat losses through the building envelope.
- Reduced cooling loads.
- Introducing energy saving measures and energy creation systems.

Green Purchasing

Green purchasing is important aspect of GSCM. It addresses the requirement of green design. Green purchasing in GSCM is more than mere supplier selection. It involves stringent supplier environmental assessment criteria, environmental audit of suppliers, information and knowledge sharing with suppliers such as trainings and seminars to develop their own environmental programs such as ISO 14001 to improve environmental performance of suppliers (Min & Galle, 1997; Rao, 2004; Rao & Holt, 2005; Zhu et al, 2005; 2007; 2008)

Identified practices in green purchasing relevant to the construction sector are:

- Suppliers environmental assessment as prequalification criteria.
- Guiding suppliers to set up their own environmental programs such as Suppliers' ISO14000 certification.
- Environmental audit for suppliers' internal management.
- Providing design specification to suppliers that include environmental specifications for purchases.
- Bringing together suppliers in the same industry to share their know-how and problems.
- Urging and pressuring suppliers to take environmental actions.
- Information and knowledge sharing to suppliers.

Construction firms in UAE should monitor and evaluate the environmental performance of suppliers. In addition, sharing design specifications to suppliers in advance and urging suppliers to consider environmental actions can improve the environmental performance of the supply chain. Construction firms can also cooperate with suppliers for the purpose of developing products that are environmentally sustainable.

Green Distribution

Green distribution typically consists of green packaging and green transportation. Both the factors are interconnected as green packaging have a direct impact on transportation. Green packaging involves reducing the size, shape and weight of packaging, and the use of environmentally friendly materials. It can be defined as a way to package products that minimizes impact to the environment (Kassaye, 2001).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

In addition, green packaging is the easiest and foremost practice an organization can adopt in GSCM (Shi & Kane, 1996). By switching to green packaging, organizations will allow their products to gain public image (Kassaye, 2001). Ho et al. (2009) identified green packaging can reduce material usage, improve space utilization and reduce the handling time. Green transportation is the use of environmentally-friendly transportation system such as type and mode of transport such as sea, land and air transport and use of alternative fuel vehicles.

The identified factors for green distribution are:

- Reduced size of packaging.
- Use of environmental friendly packaging materials.
- Better shape for space utilization and handling.
- Use of environmentally friendly mode of transport options.
- Use of alternative fuel options.

Green Construction

Green construction means using sustainable principles and technology in the construction process such as cleaner technologies and automation in the construction process. The other green construction practices include on site usage of energy efficient vehicles and machineries, offsite fabrication of materials in a controlled environment to reduce construction waste and energy usage and use of project management techniques in the construction process to achieve efficiency in the construction process. In addition, having skilled labourers increases the efficiency of the construction process and enables reduction in construction waste. Further, practices such as onsite segregation of construction waste, re-use and recycling can further improve the performance of onsite construction.

Waste Management

It is an important aspect of GSCM. In the UK, construction and demolition waste contributed to 47.6 million tonnes in (UK Gov, 2010). In the US according to EPA (2003), 170 million tonnes of waste have been generated. The UAE is not far behind and is considered as the biggest producers of per capita construction waste in the world behind US. The construction industry in the UAE contributes to 75% of the total waste in the country (UAE Interact, 2007). The construction waste generated in the UAE in 2007 is 27.7 million tonnes compared to 10.6 million tonnes in 2006 (Alkhafaf, 2008). The figures indicates construction waste minimization is very important to reduce emissions and in promoting sustainable development. The Building Research Establishment (1978) defined waste as the 'difference between material ordered and those placed for fixing on building projects'. However waste generation from construction activities is much complex and therefore understanding the source of waste is important to minimize it. Research by (Rounce, 1998; Ekanayake & Ofori, 2000; Keys et al., 2000; Ekanayake & Ofori, 2004; El-Sayegh, 2008) identified improper design as the major cause of construction waste. The labour intensive nature of the construction activity implies, unskilled labourers employed in the construction contribute to excessive waste generation. Lingard et al. (2000) defined the origins of construction waste as procurement, handling, operations and culture.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

GREEN PERFORMANCE MEASURES

GSCM management strives to achieve environmental, economic and operational performance. Although environmental performance is the important aspect of GSCM, the latter two are equally important to achieve business performance and act as intrinsic motivators for firms for adopting GSCM and to stay competitive in the industry. However in most cases, the extend of environmental, economic and operational performance achieved is not measured. Hence, performance measurement is an important aspect of GSCM for continuous improvement, to justify investment in GSCM, to publish the measures in annual reports and to benchmark with peers and industry average.

Environmental Performance Measures

Zhu et al. (2008) defined environmental performance in GSCM as the ability to reduce air emissions, effluent waste, and solid wastes and the ability to decrease consumption of hazardous and toxic materials. The key environmental performance indicators relevant to construction sector identified from the literature and its implication to United Arab Emirates (UAE) construction sector are given in Table 3.

Economic Performance

Economic performance is important for organizations adopting GSCM. From a management perspective, economic performance represents yield of the profit. For evaluating economic performance in GSCM, this study identified direct benefits such as the decrease of cost for energy consumption, material purchasing, waste treatment, and waste disposal (Zhu et al., 2007; 2008). However, GSCM economic performance also include indirect long term benefits such as new market opportunities, increase product price, increased profit margin, increased sales and market share and improved corporate image (Rao, 2002; Rao & Holt, 2005). The key environmental performance indicators and its implication to UAE construction sector are given in Table 4.

Table 3. Environmental performance measures relevant to UAE construction industry

Environmental Performance	Implications to UAE Construction Industry
1. Reduction in energy consumption	Reduction in electricity consumption, reduction in fuel consumption, reduction in embodied energy of materials etc.
2. Reduction in raw materials	Reduction in raw material consumption such as steel, glass, cement etc.
3. Reduction in solid and effluent waste	Reduction in solid and effluent waste during construction site preparation and onsite construction activities.
4. Reduction in air emissions	Reduction in greenhouse gas emission (GHG) due to onsite construction activities and transportation
5. Reduction in water consumptions	Reduction in water consumption during the construction process
6. Reduction in consumption of hazardous/harmful/toxic materials	Reduction in the use of hazardous materials like lead and sulphate based paints and adhesives
7. Decrease in frequency of environmental accidents	Reduction in environmental accidents like fire, breakage of underground pipes, leakage of hazardous materials etc.

Source: (Zhu et al., 2005; 2007; 2008)

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Operational Performance

Operational performance is the foundation of the traditional supply chain. It is imperative that GSCM adoption should not compromise the operational performance of the supply chain. Operational performance of GSCM is identical to operational performance measurement of any supply chain and includes overall efficiency of the supply chain, quality improvement, productivity improvement and asset utilization. Studies by (Ru-Jen et al., 2011; Sang et al., 2012) indicates GSCM can improve cycle time and reduce project duration along with increase in value to customer. The key operational performance indicators are given in Table 5.

POTENTIAL GREEN SUPPLY CHAIN MANAGEMENT (GSCM) CHALLENGES PERCEIVED BY THE CONSTRUCTION INDUSTRY IN THE UNITED ARAB EMIRATES (UAE)

Although there are factors prompting organizations to adopt GSCM, the implementation of GSCM is not easy as firms have to overcome number of challenges. The challenges would be much higher for developing economies like UAE, where GSCM is still at infancy stage. Identifying and overcoming the challenges are key for the sector to overcome the status quo and to implement GSCM. Similar to drivers, challenges faced by firms can be classified as internal and external challenges.

Internal Challenges

Internal challenges are challenges faced within the organization. The identified internal challenges relevant to the construction sector are;

Table 4. Economic performance measures relevant to UAE construction industry

Economic Performance	Implications to UAE Construction Industry
1. Increase in sales and market share	Increase in the sales of green building projects, Increase in market share through entry to new foreign markets and new environmental conscious buyers.
2. Increase in product price	Higher rent or selling price for buildings
3. Increase in profit margin	Overall increase in profit from green projects.
5. Cost savings - Decrease of cost for energy consumption - Decrease of fee for waste treatment - Decrease of fee for waste discharge - Decrease of fine for environmental accidents - Decrease of cost for materials purchasing	Overall reduction in cost in the construction supply chain through reduction in energy, material consumption and waste. Reduction in fines from environmental accidents.

Source: Rao (2002), Rao and Holt (2005), Ru-Jen et al. (2011), Zhu et al. (2008)

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 5. Operational performance measures relevant to UAE construction industry

Operational Performance	Implications to UAE Construction Industry
1. Improvement in overall efficiency of the supply chain	Measuring the improvement in the overall efficiency of the construction supply chain
2. Improvement in quality	Improvement in the quality of the construction process
3. Improvement in productivity	Improvement in the productivity of the construction process
4. Improvement in cycle time	Reduction in transportation time for inbound and outbound logistics
5. Reduction in project completion time	Reduction in the construction project handover time.
6. Increased value to customer	Return on investments for the customer through reduced operational cost, reduction, improved indoor air quality, improved safety etc.
7. Improved asset utilization	Optimization of construction resources, reduction in inventory etc.

Source: Rao (2002), Rao and Holt (2005), Ru-Jen et al. (2011), Sang et al. (2012)

Lack of Knowledge, Training, and Awareness of GSCM

Studies have acknowledged that lack of knowledge and training (Cooper et al., 2000; Bowen et al., 2001), lack of experience (Yu Lin & Hui, 2008) are all important challenges to overcome for the adoption of GSCM. Rettab and Ben (2008) identified lack of knowledge as the primary inhibitor of organizations in UAE for adopting GSCM. Balasubramanian (2012) identified lack of knowledge and experience as an important inhibitor for GSCM in the UAE construction industry.

Lack of Top Management Commitment

Lack of top management support and commitment is one of the main challenges of GSCM. Zhu and Sarkis (2007) identified the importance of top management in the implementation of GSCM practices. Similarly, Ravi & Shankar (2005) mentioned the importance of continuous support from top management for organization wide implementation of GSCM strategy. Balasubramanian (2012) identified lack of top management support as one of the challenges faced by the UAE construction sector.

Fear of High Initial Investment

Many organizations carry the conception that huge investment is required for implementing GSCM practices. In addition, companies are aware for the fact that implementation of GSCM will not deliver immediate financial benefits, and hence many companies are reluctant to invest on GSCM (Nidumolu et al., 2009). For instance, green materials tend to be more expensive and increase the product's overall cost (Koplin et al, 2007; Hoffman, 2008). Several studies have identified high cost as the major challenge faced by organizations (Min & Galle, 2001; Alkhidir & Zailani, 2009).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Lack of Environmental Management Systems, ISO 14001, and Information Technology

An efficient environmental management system (EMS) is necessary for implementing GSCM. EMS promotes communication and knowledge sharing between clients, designers, suppliers and contractors. Balasubramanian (2012) identified lack of EMS leads to lack of understanding among stakeholders. EMS certified with ISO 14001 is very important for firms moving towards sustainability. Toshi et al. (2011) identified a positive relationship between Japanese firm's ISO 14001 certification and GSCM practices and found that ISO 14001 significantly promotes GSCM activities. Studies have found that it is difficult to implement GSCM without a proper environmental management system (Stevels, 2002). Similarly, information technology supports collaborative supply chain processes and enhances supply chain performance (Rogers et al., 1998). An advanced information and technology system is necessary for supporting the GSCM during various stages of product life cycle. It can be useful for product development programs encompassing the design for environment, recovery and reuse. Efficient information systems are needed for tracking and tracing the returns of product, linking with the previous sales (Ravi & Shankar, 2005). It is required to handle information's flows associated with both forward and backward flow of materials and other resources to manage green supply chain efficiently (AlKhidir & Zailani, 2009). Construction sector being traditionally a backward industry with poor IT infrastructure vis-à-vis other sectors, is one of the reasons for its poor environmental performance.

Lack of Sustainable Organizational Culture

Sustainable culture within the organisation is important for GSCM. Long term sustainable vision, informal and improved internal communication enable organizations to adopt green practices (Yu Lin & Hui Ho, 2008). Training and awareness are important for achieving successful implementation of GSCM in any organization (Ravi & Shankar, 2005). Management may encourage employees to learn green information and may provide rewards for green employees (Hsu & Hu, 2008). This is relevant for the UAE construction sector, considering the fact that UAE is relatively new to the concept of green.

Resistance to Change

Adopting and implementing GSCM involves change in the normal business processes, re-aligning the responsibilities, learning new technologies like ISO 14001, etc. Organizations and employees resist these changes and new technology adoption. Previous studies have identified in their research 'resistance to change' as a major challenge for environmental innovation such as GSCM (Hosseini, 2007; Hsu et al., 2008; Digalwar et al., 2004). The identified internal challenges and its relevance to the UAE constructions sector are provided in Table 6.

Table 6 summarizes the various internal challenges of GSCM and its implication to the UAE construction industry.

External Challenges

External challenges are outside industry challenges faced by the organization. The identified external challenges relevant to the construction sector are;

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 6. Internal GSCM challenges relevant to UAE construction sector

Internal Challenges of GSCM	Implications to UAE Construction Industry
1. Lack of knowledge and awareness of GSCM	Government and the industry should conduct GSCM trainings and awareness sessions, conferences and seminars to improve knowledge and awareness of stakeholders in the construction
2. Lack of top management commitment	Government and the industry should recognize leaders in GSCM and would encourage GSCM commitment among other industry leaders
3. Fear of high investment cost.	Perceived high initial investment in the construction sector for green practices
5. Lack of EMS and IT infrastructure	Government regulations and leading clients should make it mandatory for all construction firms to implement EMS and to have a standard IT infrastructure requirements
7. Lack of sustainable organizational culture	Top management and HR department should create a sustainable culture to adopt the concept of GSCM at all employee levels

Lack of Government Support

Lack of government support can hinder the adoption of GSCM. There is increasing need for government to provide industry friendly policies to promote GSCM rather than mandating firms to adopt GSCM. Government should facilitate a win-win situation of GSCM adopters by providing incentives, preferential treatment, best practices awards, and recognition for sustainable leaders and organizations. Lack of these can discourage firms in adopting GSCM. Presently in the UAE construction sector there is little support from government. Numerous studies have highlighted the importance for government support for GSCM (Hosseini, 2007; Hsu et al., 2008; Mudgal et al., 2009; Mudgal et al., 2010; Srivastava, 2007)

Lack of Skilled Professionals

GSCM requires skilled professionals both inside the organization as well as throughout the supply chain. Skilled professionals can adapt to the changes quickly, learn new technologies, share ideas and solve environmental problems (Yu Lin & Hui Ho, 2008). Balasubramanian (2012) identified lack of skilled professionals as an important inhibitor of GSCM in the UAE construction sector.

Lack of Trust and Commitment of Suppliers

Trust and commitment of suppliers play an important role in GSCM. Previous studies have identified lack of commitment and trust as the major challenges facing firms to implement GSCM practices (Wycherley, 1999; Walker et al., 2008). Lack of trust and commitment of suppliers is also a challenge for the construction sector, because of the one off nature of the construction projects.

Perceived Lack of Demand for Sustainable Solutions

Customers demand for low prices. Considering the financial crisis of 2008 and afterwards, there is lack of demand for sustainable solutions as customer are not willing to pay more for sustainable solutions. Orsato (2006) identified customer desire for low prices can lead to lack of sustainable practices. Bala-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

subramanian (2012) identified the lack of demand as a major inhibitor to the adoption of GSCM in the UAE construction sector.

Table 7 summarizes the various external challenges of GSCM and its implication to the UAE construction industry.

The various aspects of GSCM relevant to the construction sector is discussed. Although, more empirical investigation is required to obtain more insights on the various aspects discussed, the chapter provides an initial investigation into the potential GSCM aspects that is relevant for the UAE construction sector.

KEY TAKE AWAY POINTS FOR PRACTITIONERS

The following questions are important for practitioners while implementing GSCM.

Does Adoption of GSCM Improve Economic Performance?

The social responsibility of any business is to be profitable. Economic performance is important for organizations to sustain in the competitive environment. Before adopting GSCM, organizations much do a cost-benefit analysis to understand the financial benefits of GSCM along with achieving environmental and operational benefits. Analysis such as life cycle assessment (LCA), total cost of ownership (TCO) etc. are key to the implementation of GSCM. If the answer is 'Yes' then it's a win-win situation for the environment and business. Most cases organizations having sustainable vision often settle for trade-off between environmental and economic performance.

Is Profitability the Only Concern of SCM?

This may be the case in the past; however the present and future supply chain needs to fulfil the requirements or regulations of governments, NGO or sometimes customers. So achieving environmental performance and social performance is important to sustain business. So organizations need to implement environmental measures to stay competitive in the business, hence profitability is not the only concern of SCM. Implementing GSCM is no longer an option but a must in the future.

Table 7. External GSCM challenges relevant to UAE construction sector

Internal Challenges of GSCM	Implications to UAE Construction Industry
1. Lack of government support.	Government should provide support in the form of preferential treatment, incentives, subsidies and best practices award to encourage adoption of GSCM
2. Lack of skilled professionals.	Organizations should attract skilled green professionals from around the world and retain them to implement GSCM
3.Lack of trust and commitment of suppliers	Construction stakeholders should focus on having long term relationships with suppliers
4. Perceived lack of demand for sustainable solutions.	Construction industry should clearly articulate the benefits of green buildings and hence customers will be willing to pay higher for green buildings

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Are You Measuring the Environmental, Economic, and Operational Performance of the Supply Chain?

Measuring the performance of the supply chain is important in closing the loop of the supply chain. Implementing GSCM is a continuous process and it requires performance measures to understand the weak links in the supply chain in order to improve the performance. Key performance indicators are important for the successful implementation of GSCM. Green balanced score measures would probably an alternative method organisation can use to measure their Return on Assets (ROA).

Which Organizational Strategy Would You Choose? Proactive or Reactive Strategy?

Proactive organizations will have strong sustainable vision with environmental leaders having the confidence to adopt GSCM. These organizations often have strong financial and human resource capabilities. Proactive organizations will try to achieve first mover benefits, preferential treatment and government incentives and also try to improve the operational efficiency of the supply chain. Hence these companies have long term vision to improve their economic and environmental performance. They will also incorporate necessary internal environmental management changes to implement GSCM practices.

Reactive organizations respond to government rules and regulations, compliance to client specifications, stakeholder pressure and competition to improve their environmental performance. The implement GSCM to achieve minimum compliance with no long term vision. From a government perspective, a balance should be kept to promote proactive GSCM practices such as incentives and subsidies and at the same time tighten the rules and regulations to ensure organizations consider GSCM in their organizational strategy.

For implementing GSCM, integrating GSCM practices with construction industry practices is the best way to move forward. Similarly different industry requires different GSCM approaches. All the stakeholders should be incorporated and study should focus on the end to end supply chain.

CONCLUSION

As the construction sector grows, we are depleting more and more natural resources and in the process harming the environment. It is important that we look into sustainable management practices such as GSCM to reduce the environment impact of the construction sector. Considering the fact that GSCM in construction is still at infancy, present study will significantly contribute to filling the knowledge gap of GSCM in the United Arab Emirates (UAE) constructions sector and for construction sector in general. Some of the significant contributions of the study include identifying the potential drivers and challenges faced by the construction industry in the UAE and in general for implementing GSCM. The various stages in the supply chain for reducing the environmental impacts is identified such as design, purchasing, transportation and onsite and offsite construction. The importance of having an internal environmental management (IEM) for implementing GSCM is identified. Finally, performance measures namely environmental, economic and operational is identified to assess the performance improvement post GSCM implementation. However, considering the fact that present study is largely derived from the literature, the various aspects identified are more indicative than conclusive. Hence, more studies

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

and empirical research is required to validate the various aspects identified in the study. Future studies can also focus on identifying the difference in GSCM implementation among the various construction stakeholders such as developers, consultants, architects, main contractor, subcontractor, and suppliers. Stakeholder analysis is important to ensure all stakeholders are coherent in implementing GSCM. Further, future studies can use case studies on large companies that have implemented GSCM practices to find evidence on the improvement in performance. Such empirical evidence is critical for imparting confidence among construction stakeholders to engage in GSCM.

REFERENCES

Balasubramanian, S. (2012). A Hierarchical Framework of Barriers to Green Supply Chain Management in the Construction Sector. *Journal of Sustainable Development*, *5*(10), 1913-9063.

Beamon, M. (1999). Designing the green Supply Chain. *Logistics Information Management*, *12*(4), 332–342. doi:10.1108/09576059910284159

Ben Brik, A., Mellahi, K., & Rettab, B. (2013). Drivers of Green Supply Chain in Emerging Economies. *Thunderbird International Business Review*, *55*(2), 123–136. doi:10.1002/tie.21531

Berns, M., Townend, A., Khayat, Z., Balagopal, B., Reeves, M., Hopkins, M. & Kruschwitz, N. (2009). The business of sustainability.What it means to managers now. *MIT Sloan Management Review*, 20–26.

Berry, M. A., & Rondinelli, D. A. (1998). Proactive corporate environment management: A new industrial revolution. *The Academy of Management Executive*, *12*(2), 38–50.

Blackburn, J. D., Guide, V. D. R. Jr, Souza, G. C., & Van Wassenhove, L. N. (2004). Reverse Supply Chains for Commercial Returns. *California Management Review*, *46*(2), 6–22. doi:10.2307/41166207

Buckholz, R. (1991). Corporate responsibility and the good society: From economics to ecology. *Business Horizons*, *34*(4), 19–31. doi:10.1016/0007-6813(91)90003-E

Byrne, P. M., & Deeb, A. (1993). Logistics must meet the 'green' challenge. *Transportation & Distribution*, *34*(2), 33–37.

Carter, C. R., & Dresner, M. (2001). Purchasing's Role in Environmental Management: Cross-Functional Development of Grounded Theory. *Journal of Supply Chain Management*, *37*(2), 12–27. doi:10.1111/j.1745-493X.2001.tb00102.x

Chan, R. Y. K., & Lau, L. B. Y. (2001). Explaining green purchasing behaviour: A cross-cultural study on American and Chinese consumers. *Journal of International Consumer Marketing*, *14*(2/3), 9–41.

Dhanda, K. K., & Hill, R. P. (2005). The role of information technology and systems in reverse logistics: A case study. *International Journal of Technology Management*, *31*(1/2), 140–151. doi:10.1504/IJTM.2005.006628

Digalwar, A. K., & Metri, B. A. (2004). Performance Measurement Framework for World Class Manufacturing. *International Journal of Applied Management and Technology*, *3*(2), 83–101.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Drumwright, M. (1994). Socially Responsible Organisational Buying: Environmental Concern as a Non-economic Buying Criterion. *Journal of Marketing*, *58*(3), 1–19. doi:10.2307/1252307

Dubai Electricity and Water Authority. (2011). *Green Buildings Regulations and Specifications.* Retrieved on October 12,2012, from http://www.dewa.gov.ae/images/greenbuilding_eng.pdf

Fassoula, E. (2005). Reverse logistics as a means of reducing the cost of quality. *Total Quality Management and Business Excellence*, *16*(5), 631–643. doi:10.1080/14783360500077575

Ferguson, M. E., & Toktay, L. B. (2006). The Effect of Competition on Recovery Strategies. *Production and Operations Management*, *15*(3), 351–368. doi:10.1111/j.1937-5956.2006.tb00250.x

Francesco, T., & Fabio, I. (2010). Shadows and lights of GSCM (Green Supply Chain Management): Determinants and effects of these practices based on a multi-national study. *Journal of Cleaner Production*, *18*(10), 953–962.

González-Benito, J., & González-Benito, O. (2005). A study of the motivations for the environmental transformation of companies. *Industrial Marketing Management*, *34*(5), 462–475. doi:10.1016/j.indmarman.2004.08.005

Gonzalo, F., & Fernando, R. (2010). A methodology to identify sustainability indicators in construction project management—Application to infrastructure projects in Spain. *Ecological Indicators*, *10*(6), 1193–1201. doi:10.1016/j.ecolind.2010.04.009

Gorane, S. J., & Ravi, K. (2013). Modelling the SCM enablers: An integrated ISM-fuzzy MICMAC approach. *Asia Pacific Journal of Marketing and Logistics*, *25*(2), 263–286. doi:10.1108/13555851311314059

Gungor, A., & Gupta, S. M. (1999). Issues in environmentally conscious manufacturing and product recovery: A survey. *Computers & Industrial Engineering*, *36*(4), 811–853. doi:10.1016/S0360-8352(99)00167-9

Ho, J.C., & Shalishali, M.K., Tseng, T.L. & Ang, D.S. (2009). Opportunities in green supply chain management. *The Coastal Business Journal*, *8*(1), 18–31.

Hoffman, A. J. (2008). From Heresy to Dogma: An Institutional History of Corporate Environmentalism. Stanford Business Books.

Holt, D., & Ghobadian, A. (2009). An empirical study of green supply chain management practices amongst UK manufacturers. *Journal of Manufacturing Technology Management*, *20*(7), 933–956. doi:10.1108/17410380910984212

Hosseini, A. (2007). Identification of Green Management of system's factors: - A Conceptualized Model. *International Journal of Management Science and Engineering Management*, *2*(3), 221–228.

Hsu, C. W., & Hu, A. H. (2008). Green Supply Chain Management in the Electronic Industry. *International Journal of Science and Technology*, *5*(2), 205–216.

Jonatan, P., & Marcel, D. (2009). Overcoming Barriers to Sustainability: An Explanation of Residential Builders Reluctance to Adopt Clean Technologies. *Business Strategy and the Environment*, *18*(8), 515–527. doi:10.1002/bse.615

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Kam, B., Smyrnios, G.C. & Walker, R.H. (2003). Strategic business operations, freight transport and eco-efficiency: a conceptual model. *Greening the Supply Chain, Greenleaf, Sheffield*

Klassen, R. D., & McLaughlin, C. P. (1993). TQM and environmental excellence in manufacturing. *Industrial Management & Data Systems*, *93*(6), 14–22. doi:10.1108/02635579310040924

Lee, S. (2008). Drivers for the participation of small and medium-sized suppliers in green supply chain initiatives. *Supply Chain Management: An International Journal*, *13*(3), 185–198. doi:10.1108/13598540810871235

Lee, S., & Klassen, R. D. (2008). Drivers and enablers that foster environmental management capabilities in small- and medium-sized suppliers in supply chains. *Production and Operations Management*, *17*(6), 573–586. doi:10.3401/poms.1080.0063

Lippman, S. (2001). Supply Chain Environmental Management. *Environmental Quality Management*, *11*(2), 11–14. doi:10.1002/tqem.1301

Lo, C. W., & Leung, S. W. (2000). Environmental agency and public opinion in Guangzhou: The limits of a popular approach to environmental governance. *The China Quarterly*, *163*, 677–704. doi:10.1017/S0305741000014612

Maxwell, D., & Van der Vorst, R. (2003). Developing sustainable products and services'. *Journal of Cleaner Production*, *11*(8), 883–895. doi:10.1016/S0959-6526(02)00164-6

Min, H., & Galle, W. (1997). Green purchasing strategies: Trends and implications. *International Journal of Purchasing and Materials*, *4*, 410–417.

Min, H., & Galle, W. P. (2001). Green purchasing practices of US firms'. *International Journal of Operations & Production Management*, *21*(9), 1222–1238. doi:10.1108/EUM0000000005923

Mudgal, R. K., Shankar, R., Talib, P., & Raj, T. (2009). Greening the supply chain practices: An Indian perspective of enablers' relationships. *International Journal of Advanced Operations Management*, *1*(2/3), 151–176. doi:10.1504/IJAOM.2009.030671

Nidumolu, R., Prahalad, C. K., & Rangaswami, M. R. (2009). Why Sustainability is now the key driver of innovation. *Harvard Business Review*, *87*(9), 56–64.

Ninlawan, C., Seksan, P., Tossapol, K., & Pilada, W. (2010). The implementation of Green Supply Chain Management Practices in Electronic Industry. *Proceedings of the International MultiConference of Engineers and Computer Scientists.*

Orsato, R. (2006). Competitive environmental strategies: When does it pay to be green? *California Management Review*, *48*(2), 127–143. doi:10.2307/41166341

Paulraj, A. (2009). Environmental motivations: A classification scheme and its impact on environmental strategies and practices. *Business Strategy and the Environment*, *18*(7), 453–468. doi:10.1002/bse.612

Rao, P. (2002). Greening the supply chain: A new initiative in South East Asia. *International Journal of Operations & Production Management*, *22*(6), 632–655. doi:10.1108/01443570210427668

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Rao, P., & Holt, D. (2005). Do green supply chains lead to competitiveness and economic performance? *International Journal of Operations & Production Management*, *25*(9), 898–916. doi:10.1108/01443570510613956

Ravi, V. & Shankar, R. (2005). Analysis of interactions among the barriers of reverse logistics. *International Journal of Technological Forecasting and Social Change, 72*(8), 1011-1029.

Rettab, B., & Ben Brik, A. (2008). *Green Supply Chain in Dubai. Dubai Chamber Centre for Responsible Business, Dubai.* Retrieved October 14, 2012, from http://www.dubaichamber.com/wp.../GREEN-SUPPLY-CHAIN-IN-DUBAI.pdf

Richey, R. G., Stefan, E. G., & Patricia, J. D. (2005). The role of resource commitment and innovation in reverse logistics performance. *International Journal of Physical Distribution & Logistics Management*, *35*(4), 233–257. doi:10.1108/09600030510599913

Roberts, J. (1996). Green consumers in the 1990s: Profile and implications for advertising. *Journal of Business Research*, *36*(3), 217–231. doi:10.1016/0148-2963(95)00150-6

Ru-Jen, L., Rong-Huei, C., & Thi-Hang, N. (2011). Green supply chain management performance in automobile manufacturing industry under uncertainty. *Procedia: Social and Behavioral Sciences*, *25*, 233–245. doi:10.1016/j.sbspro.2011.10.544

Sang, M. L., Sung, T. K., & Donghyun, C. (2012). Green supply chain management and organizational performance. *Industrial Management & Data Systems*, *112*(8), 1148–1180. doi:10.1108/02635571211264609

Sarkis, J. (2003). A strategic decision framework for green supply chain management. *Journal of Cleaner Production*, *11*(4), 397–409. doi:10.1016/S0959-6526(02)00062-8

Sharma, S., & Vredenburg, H. (1998). Proactive corporate environmental strategy and the development of competitively valuable organizational capabilities. *Strategic Management Journal*, *19*(8), 729–753. doi:10.1002/(SICI)1097-0266(199808)19:8<729::AID-SMJ967>3.0.CO;2-4

Simpson, D., Power, D., & Samson, D. (2007). Greening the automotive supply chain: A relationship perspective. *International Journal of Operations & Production Management*, *27*(1), 28–48. doi:10.1108/01443570710714529

Sourani, A., & Sohail, M. (2011). Barriers to addressing sustainable construction in public procurement strategies. *Engineering Sustainability*, *164*(4), 229–237. doi:10.1680/ensu.2011.164.4.229

Srivastava, S. K. (2007). Green supply chain management: A state-of-the-art literature review. *International Journal of Management Reviews*, *9*(1), 53–80. doi:10.1111/j.1468-2370.2007.00202.x

Tibben-Lembke, R. S. (2002). Life after death: Reverse logistics and the product life cycle. *International Journal of Physical Distribution & Logistics Management*, *32*(3), 223–244. doi:10.1108/09600030210426548

Tseng, M. (2013). Modeling sustainable production indicators with linguistic preferences. *Journal of Cleaner Production*, *40*, 46–56. doi:10.1016/j.jclepro.2010.11.019

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

United Nations Environmental Program. (2007). *Building Standards and Climate Change: Status, Challenges and Opportunities*. Retrieved October 30, 2012, from http://unep.fr/shared/publications/.../DTIx0916xPA-BuildingsClimate.pdf

Vachon, S. (2007). Green supply chain practices and the selection of environmental technologies. *International Journal of Production Research*, *45*(18/19), 4357–4379. doi:10.1080/00207540701440303

Walker, H., Di Sisto, L., & McBain, D. (2008). Drivers and barriers to environmental supply chain management practices: Lessons from the public and private sectors. *Journal of Purchasing and Supply Management*, *14*(1), 69–85. doi:10.1016/j.pursup.2008.01.007

Wang, G., Wang, Y., & Zhao, T. (2008). Analysis of interactions among the barriers to energy saving in China. *Energy Policy*, *36*(6), 1879–1889. doi:10.1016/j.enpol.2008.02.006

WBR. (2009). *World Bank Report of United Arab Emirates.* Retrieved November 12, 2012, from http://data.worldbank.org/country/united-arab-emirates

Wycherley, I. (1999). Greening supply chains: The case of the Body Shop International. *Business Strategy and the Environment*, *8*(2), 120–127. doi:10.1002/(SICI)1099-0836(199903/04)8:2<120::AID-BSE188>3.0.CO;2-X

Yu Lin, C., & Hui Ho, Y. (2008). An Empirical Study on Logistics services provider, intention to adopt Green Innovations. *Journal of Technology*. *Management and Innovation*, *3*(1), 17–26.

Zhu, Q., & Sarkis, J. (2006). An inter-sectoral comparison of green supply chain management in China: Drivers and practices. *Journal of Cleaner Production*, *14*(5), 472–486. doi:10.1016/j.jclepro.2005.01.003

Zhu, Q., Sarkis, J., & Kee-hung, L. (2007). Green supply chain management: Pressures, practices and performance within the Chinese automobile industry. *Journal of Cleaner Production*, *15*(11-12), 1041–1052. doi:10.1016/j.jclepro.2006.05.021

Zhu, Q., Sarkis, J., & Lai, K. (2008). Confirmation of a measurement model for green supply chain management practices implementation. *International Journal of Production Economics*, *111*(2), 261–273. doi:10.1016/j.ijpe.2006.11.029

This research was previously published in Green Supply Chain Management for Sustainable Business Practice edited by Mehmood Khan, Matloub Hussain, and Mian M. Ajmal, pages 83-110, copyright year 2017 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 65
Evaluation of Financial and Economic Effects on Green Supply Chain Management With Multi-Criteria Decision-Making Approach:
Evidence From Companies Listed in BIST

Hasan Dinçer
İstanbul Medipol University, Turkey

Serhat Yuksel
Istanbul Medipol University, Turkey

Tuba Bozaykut-Buk
Istanbul Medipol University, Turkey

ABSTRACT

This chapter aims to analyze the financial and economic effects on green supply chain management of the food and beverages industry. For the research purpose, the fuzzy DEMATEL and fuzzy MOORA methods are used for the integrated model construction. The main stages of the green supply chain are considered as the dimensions and the selected performance measures are listed as a set of criteria for each dimension. Accordingly, 21 food and beverage companies listed in Istanbul Stock Exchange (BIST) are employed to measure the performance of green supply chain processes. It is concluded that low pollution is the most important criterion whereas alternatives has the least weight. Reverse logistic is also second most significant criterion which means that these companies give importance to reduce their costs. It is also found out that there is not a certain correlation between green supply chain management performances with the profitability of the firms. However, it can be seen that bigger firms have higher green supply chain management performance than the smaller firms.

DOI: 10.4018/978-1-5225-7915-1.ch065

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

INTRODUCTION

The interconnectedness of customer satisfaction and firm performance make green supply chain management (GSCM) as one of the most discussed and analyzed topics during the last decade. The foremost reasons behind the popularity of GSCM are the increase in the environmental awareness (Sari, 2017), the share of logistic costs in the finished products (Nikbakhsh, 2009), meeting stakeholder needs (Srivastava, 2007) and social sustainability (Fahimnia et. al., 2015). Also, these motives refer to the driving forces to adopt GSCM practices for competitive superiority. Moreover for firms, institutional pressures like ISO4001 certification indicate environmental management as a strategic issue for both economic and environmental performance (Diabat and Govindan, 2011). Thereby, greening through environmental standards is a factor of market success (Min and Galle, 1997) by enhancing competitiveness, resource productivity and innovation (Porter and van der Linde, 1995).

Through globalization, firms' coordination in the supply chains turns out to be the most critical business success factor (Lambert et. al., 1998). As a consequence, the management philosophy that starts with logistics management evolving to GSCM is an outcome of global markets and "globalization of supply" (Mentzer et. al., 2001:2). Besides globalization of supply, GSCM develops for predicting, minimizing and preventing environmental harms given by supply chain operations (Beamon, 1999; Sari, 2017). Thereby as an attempt to form an ecological nature for an organization, green supply chains (GSC) refers to "developed and advanced form of traditional supply chains with a special aim of reducing the environmental harm given during a product's life cycle" (Mishra et.al, 2017:86). Parallel to these, GSCM comprises elements of both corporate environmental management and supply chain management (Srivastava, 2007; Laari et. al., 2017). In line with this thinking, GSCM consists of numerous R activities (e.g. reduce, re-use, and recycle) (Sirvastara, 2007). These R activities provide firms to coordinate their purchasing, production and distribution processes in an environmentally-friendly manner for a better economic, ecological, operational, and social performance (Geng et. al., 2017).

Therefore, it is of paramount importance to determine the key factors of GSCM and measure GSCM performance in terms of these components. Concordantly, the current study aims (1) to present a literature review of determinants of GSCM, (2) to examine key components of green supply chain management and develop a multidimensional model for GSCM performance (3) to test the model through fuzzy-based decision making methodology, (4) to show which dimensions and criteria are more critical for a sustainable GSCM performance (5) help decision makers and researchers develop appropriate guidelines for GSCM success.

In line with these given aims, the paper continues with relevant literature on GSCM, its dimensions and its effects on firm performance. Following literature, the research methodology and the application of this methodology on 21 Food and Beverage companies listed in Istanbul Stock Exchange is discussed. Finally, the findings together with future implications are given.

THEORETICAL BACKGROUND

Supply Chain Management

As a management philosophy, supply chain management (SCM) has evolved from logistics management with a claim to enlarge the boundaries of the traditional understanding of logistics. Standing from this

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

stance, SCM is defined by the Council of Logistics Management in 1986 as "the process of planning, implementing, and controlling the efficient, cost-effective flow and storage of raw materials, in-process inventory, finished goods, and related information flow from point-of-origin to point-of-consumption for the purpose of conforming to customer requirements" (Lambert and Cooper, 2000:67). The definition of the Council of Logistics Management directs two important points. The first is to incorporate business operations with the support of external firms in the supply chain and the second is to involve customers to these operations for an understanding of customer needs (Cooper et. al., 1997).

Besides being a management philosophy, the supply chain is also evaluated as a process through which the flow of information starts from suppliers and ends with customers. Parallel to this approach, a supply chain is the dynamic network of firms that exchanges information, money or materials for production (Jain et. al., 2009) and as a network of firms, a supply chain generally includes suppliers, manufacturers, distributors, retailers and customers. Thereby, the main objective of supply chain management (SCM) "is to provide right product to the right customers at the right cost, right time, right quality, right form and right quantity" (Chin et. al., 2015). Also managing the supply chain includes integrating "key business processes from end-user through original suppliers that provide products, services, and information that add value for customers and other stakeholders" (Lambert et. al., 1998).

Similarly to successfully implement SCM, all firms in the chain are to be interconnected by embracing a process approach and organizing functions as key processes for their operations (Lambert et. al., 1998). More to that, SCM that designs each key process to meet customer requirements aims to minimize costs, enhance customer satisfaction and have a competitive advantage (Mentzer et. al., 2001). To reach these objectives, the perspective of being "green" has recently added to the activities of SCM. Therefore, procurement, manufacturing, distribution and logistics activities are reorganized and extended with an environmentally-conscious attitude.

Green Supply Chain Management

GSCM can be defined as "the sum of green purchasing, green manufacturing and material management, green distribution and marketing, and reverse logistics" (Mishra et. al. 2017: 86). As the definition clearly points out GSCM combines economic, social and environmental goals within its scope (Kafa et. al. 2013). One of the critical key terms for GSCM success is sustainability (Dubey et. al., 2015) and hence, being green is mostly associated with being "sustainable" (Baines et. al., 2012). The business sustainability covers meeting current and future economic, social and environmental demands in a proactive manner for future success. That's to say, being sustainable means that operations are conducted regarding current and future needs of people and nature. Concordantly, the sustainability vision is mentioned within Triple Bottom Line (3BL) framework that determines "organizational and societal success through the three Ps of people, planet and profit" (Baines et. al., 2012:60).

Generally, firms adopt GSCM practices in three manners (Agi and Nishant, 2017). The first one is related with market based pressures and includes adopting voluntary proactive strategies to improve corporate brand, meet environmental regulations, influence customers and hence to have a competitive superiority over others in the market (Agi and Nishant, 2017). The second is associated with legal, governmental regulations set for environment. And the third manner emerges as a result of customer or supply chain partners' needs for environment sensitive products or processes.

For being sustainable, GSCM covers all business partners and GSCM efficiency can't be attained only to the lead company. In line with this, GSCM is to form the synergetic bond between partners and

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

has to assure all partners' success together with increased environmental/economic performance and competitiveness (Rao and Holt, 2005). Therefore, to keep their business operations green, each partner in the chain has to be aware that GSCM practices would enhance their economic performance. The reducing costs, increasing profits and the synergetic cooperation of suppliers in decision making processes are the main drivers for adopting GSCM practices in the chain (Rao and Holt, 2005).

Additionally, numerous studies point out that adopting GSCM practices positively influences performance of companies. For instance, better environmental and operational performance is achieved if green perspective is carried on from production to recycling (Jabbour et. al., 2015). Environmental performance is an outcome of environmental management (Albertini, 2015), while operational performance is the degree to meet customer needs. Current consumers are becoming more environmentally conscious and more inclined to buy environmentally-friendly products. Within this framework, GSCM practices influence consumers' approach to the firm and its products; and in return increase the firm's competitiveness and economic performance (Andiç et. al., 2012). Consequently, making the supply chain "green" reduces the harms given to the environment, and affirms the environmentally-friendly image that can respond to the needs of today's environmentally concerned consumers.

Determinants of Green Supply Chain Management

Researchers have given remarkable attention to determine the main elements of GSCM. The first thing to be noticed in the related literature is that much of the studies categorize determinants of GSCM as internal and external factors (Sarkis, 2003). Internal GSCM practices refer to firm's environmentally-friendly activities (Azevedo et. al., 2011). On the other hand, external elements take a strategic stance because organizations act based on actors and changes in their environment (Mintzberg, 1994). From the perspective of GSCM, partners in the supply chain and the level of greenness in their operations come to the fore as critical factors of GSCM success. External GSCM activities also include environmental monitoring and environmental collaboration (Vachon and Klassen, 2006). Environmental monitoring is related with supplier and material selection; whereas environmental collaboration is associated with helping suppliers' to develop their environmental qualifications (Vachon and Klassen, 2006). More to that, institutional norms (Zhu et. al. 2007; Sarkis et. al. 2011) like governmental regulations and customer requirements (Laosirihongthong et. al., 2013) can be regarded as other significant external elements for adopting GSCM practices. To the numerous studies, influence of institutional pressures is closely related with market dynamics and governmental regulations (Srivastava, 2007; Laosirihongthong et. al., 2013). A proper example can be the widely adoption of ISO 14001 because of customer pressure (Vachon 2007).

To prove these forces empirically, numerous studies are conducted. For instance, Laosirihongthong et. al. (2013) proved that legislation and regulation is the most important driving force for GSCM implementation by Thai manufacturers. On the other hand besides government regulations, Kafa et. al. (2013) determine stakeholder pressures, economic interests, and ecological interests of firms as important forces of GSCM practices. Among the studies on GSCM performance factors, Sarkis (2003) takes product life cycle, operational life cycle, performance measures, and environmentally influential organizational policy elements for GSCM achievement. Moreover, Sarkis (2003) also highlights the importance of combining organizational processes like reduce or reuse both with all the supply chain activities and the product life cycle. Similarly, Zhu and Sarkis (2004) determine internal environmental management, external GSCM, investment recovery, and eco-design as critical GSCM practices to have a sustainable environmental and economic performance. Following that studies, Zhu et. al. (2008) analyze variables

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

to measure GSCM practices as internal environmental management, green purchasing, eco-design, cooperation with customers and investment recovery.

In their study on the critical factors influencing the adoption of GSC practices in Chinese firms, Lin and Ho (2011) classify the determinants of GSCM as technological, organizational and environmental. The technological factors include "relative advantage, compatibility, complexity", organizational factors are "organizational supports, quality human resources, company size" and "customer pressures, regulatory pressures, government supports, environmental uncertainty" are the environmental factors (2011:69). Following Lin and Ho (2011), Kuei et. al. (2015) also show evidence that relative advantage, quality of human resources, and customer pressure are positively related to the green practice adoption for focal firms; on the other hand, customer demands, and regulation are significant factors for sustainability for upstream firms.

A recent study by Dubey et. al. (2015:74-5) lists these factors as enablers of GSCM: a. total quality management implementations, b. a strong supplier relationship management with a focus on being 'cleaner' and 'greener" c. green technology adoption for efficiency in GSCM processes, d. institutional pressures such as ISO 14001 certification, e. top management commitment and practices for green supply chain, f. reduction in carbon emissions (RCE) for a better environmental performance, g. customer relationship management managing for sustainability, h. increase in market share as a symbol for customer loyalty and i. increase in profitability as a result of "focus on R's as reduction, reuse, reselling, repair, recycling, and reverse logistics".

Along with these studies, Wu and Chang (2015) focus on dimensions of supplier management, product recycling, organization involvement and life cycle management through a case study conducted on electrical and electronic industries in Taiwan. The study results show that organization involvement dimension that includes factors as green design, top management support, environmental policy, cross-function integration, manpower involvement, effective communication platform within companies and with suppliers, establishing an environmental risk management system for GSCM, supplier evaluation and selection is the most critical dimension in GSCM. Among these factors, top management support and environmental policy for GSCM are found out to be the two critical factors in organization involvement.

Questioning the factors for implementing GSCM practices, Agi and Nashart (2017) specify 19 factors and categorize these 19 factors into two groups as organizational factors and inter-organizational factors. Organizational factors refer to structural features, organizational processes and activities (e.g. use of information technology, capabilities of purchasing department, size of the company, functional integration, top management commitment, employees' education and training), while inter-organizational factors represent the relationships, activities and processes in the supply chain (e.g. cooperation and support from SC partners, information and knowledge sharing with SC partners, assessing and monitoring supplier performance and practicing supplier selection, trustful relationships with SC partners).

Besides these studies, it can be stated that GSCM covers many operational dimensions extending traditional supply chain management with an environmental perspective through material selection, manufacturing processes, delivery of the products including reverse logistics, and the recovery of the product by recycling or res-using after it concludes its life cycle (Srivastava, 2007). All these processes are interrelated and work in accordance for improved GSCM performance. For instance, selection process is closely related with recovery process as selection of an environmentally-friendly material would also refer that this material would easily be recycled (Mishra et. al., 2012). Following previous studies, the current research's dimensions and criteria based on GSCM functions can be seen at Table 1.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 1. Proposed dimensions and criteria of green supply chain management

Dimensions	Criteria	Supported Literature
Material Selection	**Sustainability**	Almeida et. al. (2017), Zhu and He (2017), Min and Galle (1997), Rao and Holt (2005), Zhang et. al. (2017)
	Low Pollution	Franzoni (2011), Khoshnava et. al. (2016), Sun et. al. (2017)
Manufacturing	**Reduced Energy**	Bhattacharya et. al. (2015), Tao et. al. (2016), Kucukvar et. al. (2016), Hsu et. al. (2013)
	Clean Technology	Klassen and Whybark, (1999), Vachon (2007), Baines et. al. (2012)
	Reduce Waste	Harveni et. al. (2005), Deif (2011), Islam et. al. (2017)
Distribution	**Combined Transport**	Bukold (1993), Jensen et. al. (2001), Jensen (2008), Martinsen and Björklund (2012)
	Alternatives	Onat et. al. (2015), Mierlo et. al. (2017), Doll et. al. (2017)
	Reverse Logistics	Sarkis (2003), New and Westbrook (2004), Wells and Seitz, (2005), Mishra et. al. (2012), Ayvaz et. al. (2015)
Recovery	**Recycling**	Johnson and Wang (1995), Mishra et. al. (2012), Misni and Lee (2017)
	Reuse	Thierry et. al. (1995), Kriwet et. al. (1995), Ferrer (1997), Krikke et. al. (1999)

The details of the dimensions will be explained in the following sections together with a discussion on the application of Turkish food and beverages firms listed in Istanbul Stock Exchange.

DECISION MAKING IN GSCM

Material Selection

Ecologically responsive material selection, also called as sustainable material selection (Zhang et. al., 2017), aims to select suitable materials for a product to reduce environmental damages given in operations (Tao et. al. 2016). GSCM literature points out product design and product life-cycle as two significant factors related with the material selection and production process (Srivastava, 2007). The use of resources, production style, transportation and distribution of products can differ through their life cycles. From the GSCM point of view, life-cycle evaluation is critical as it includes the decision-making process related with which materials to be used at the beginning of the production process to the disposal or recycle processes (Almeida, 2017; Srivastava, 2007; Akkucuk, 2016).

Business sustainability refers to administrating business operations with the concern for well-being of society, economy and environment (Hassini et. al., 2012). From the perspective of sustainability, purchasing green material would enhance the reduction of waste material (Rao and Holt, 2005) and hence firms are developing environment oriented purchasing strategies to supply their materials from partners that would produce environmentally-friendly materials (Min and Galle, 1997). Therefore, through adopting a proactive approach at the product design by design environmentally-friendly products would inhibit most of the harm a product can give to the environment (Büyüközkan and Çifci, 2012). Moreover at the beginning of purchasing, firms should consider the disposal of given materials for minimizing waste and hazardous material (Walker et. al., 2008). For instance, firms like Coca-Cola, PepsiCo adopted green packaging programs by introducing recyclable and reusable packages (Min and Galle, 1997). Thereby,

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

it is of paramount importance for firms to take environment into consideration when buying materials and designing packaging (Min and Galle, 1997). More to these, selecting the appropriate material would help to take precautions against climate change and pollution. For instance, especially for the construction firms, selecting green materials would minimize the indoor pollution which can influence the life quality to a highest degree (Franzoni, 2011; Khoshnava et. al., 2016; Sun et. al., 2017).

Manufacturing

The main reasons behind adopting environmentally sensitive manufacturing are to enhance production efficiency, to reduce pollution or carbon footprint through advanced technologies and to conform to national or international legislations (Bhattacharya et. al., 2015). In line with these targets, the clean (sometimes called as lean) manufacturing can be described as "a modern manufacturing mode that takes into consideration resource consumption and the environmental impact" (He et. al. 2007). Manufacturing, itself, is a waste generation process and hereby greening the manufacturing is to minimize or to eliminate every kind of waste (Hervani et. al. 2005; Akkucuk, 2015). Moreover, energy consumption is one of the biggest concerns for production processes and sustainable manufacturing refers to low-carbon and efficient use of energy (Kucukvar et. al., 201&). Using renewable energy like biomass or hydropower power instead of fossil fuels can be an example in this context to increase the sustainability, reduce the energy and carbon emissions and thereby reduce the total costs.

The main purpose of a cleaner production is to have sustainable development by minimizing the hazardous effects on the environment. From this perspective, the classical perspective to green manufacturing was to minimize pollution through pollution control technologies through 70s (Baines et. al., 2012). In the following decade, a more proactive approach was adopted through clean technologies that focus on efficient use of energy through resource control at the source (Vachon, 2007). Therefore, to minimize the use of energy and other resource consumption through using clean technologies requires a proactive manufacturing approach. Thereby, this approach consists of production processes with little or no waste or pollution through less resource consumption and less cost (Deif, 2011). Environmentally- friendly manufacturing also includes re-manufacturing and lean manufacturing with a target of minimizing wastes and environmental pollution through using clean technologies and not using hazardous materials during manufacturing (Islam et. al., 2017).

Distribution

Distribution refers to packaging, transportation and logistics activities (Rao and Holt, 2005). For greening distribution, firms can redesign their logistic network and plan the network for ecological development (Wu and Dunn, 1995). The main concerns for green distribution is to "reduce transportation costs and the amount of CO_2 emissions, product distribution time from manufacturers to retailers of products and to increase the levels of delivery rate" for customer satisfaction and sustainable development (Mohammed and Wang, 2017).Thereby, environmentally-responsible logistics refers to "fewer movements, less material handling, shorter travel distances, more direct deliveries and better space utilization" (Kim and Min, 2011). Also, route planning, fuel reduction (Mishra et. al., 2012), fewer transports, better space utilization (Sarkis, 1999) are among the factors for planning transportation, storage and inventory or material handling with decreased costs.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Transportation in the supply chain has been the process with the highest impacts on the environment (Wu and Dunn, 1995; Pazirandeh and Jafari, 2013) as it is accountable for up to 30% of global greenhouse gases due to excessive use of fossil fuels (Doll et. al., 2017). From the perspective of GSCM, logistics managers can plan transportation routes and modes in order to have fewer trips and use less fossil fuels from a variety of distribution options. For instance, to minimize the carbon emissions released alternative transportation modes are being used (e.g. using rail and shipping inland waterway transport (IWT) and short sear shipping (SSS) instead of road (Doll et. al., 2017). Further, using bio fuels and renewable energy, modern vehicles with less emission, more direct transports with well-planned routines are the main tools for sustainable distribution (Martinsen and Björklund, 2012). Additionally, combined transport, using more than one transport mode, has attracted the attention to prevent truck emissions (Bukold, 1993) and it becomes a noteworthy distribution method overlapping society's environmental sensibilities with firms' environmental strategies (Jensen, 2008).

Another dimension of distribution is reverse logistics referring to transporting used products back to the firm for re-manufacturing. Hence, reverse logistics is mainly related with recovery processes together with waste management and it is critical for creating value for products used or harmed (Afshari et. al., 2014; Gencer and Akkucuk, 2016). The reverse logistics is also closely related with the closed loop supply chain as the main idea in the loop is to return all the scrap, returns or unusable materials back to the traditional production process including both reverse and forward supply chains so as to minimize the use of natural resources and eliminate the waste (Wells and Seitz, 2005).

Recovery

Green manufacturing differs from the classical production thinking in its approach to the post-delivery of the goods and the green recovery process of goods delivered both in the market and the environment (Srinivas, 2014). Similarly, organizations adopting green manufacturing have already selected environmentally-friendly materials and used clean technologies for manufacturing processes but they also consider recovery or reuse of their products that would benefit planet, people and profit.

As the final step in the supply chain, recovery process can be defined as a combination of remanufacture, re-use and recycle (Johnson and Wang, 1995). Re-use can have various forms as direct re-use, repair, recycling, and remanufacturing (Thierry et. al., 1995). Moreover, re-use can be applied to assemblies, components and materials (Ferrer 1997; Krikke et. al. 1999; Kriwet et. al. 1995). Another important recovery operation is re-cycling and it is the process of producing new raw material from wastes (Misni and Lee, 2017). Further, if the returned product has no option of remanufactured then it is recycled. Similar to re-use, recycling process works with two principles of maximizing the resource use and minimizing the costs of the process (Mishra et. al., 2012). Consequently, recycling not only reduces costs and greenhouse gas emissions, but it also helps to minimize the use of environmental and organizational resources.

Turkish Green Supply Chain Management Practices

In 2016 Environmental Performance Index (EPI) that ranks countries on protection of human health and protection of ecosystems, Finland with its carbon-neutral society claim is ranked at the top of the list followed by Sweden, Denmark, and Slovenia. On the other side of the list, Somalia appears as the last country in the list (180th) and before Somalia comes Eritrea, Madagascar, Niger, and Afghanistan. In the

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

list, Turkey is ranked 99 among 180 countries and its place in EPI indicates that Turkey has a mediocre performance and has to improve its ecological performance to reach its European counterparts. Additionally, another report, "Trends in Global CO_2 emissions: 2016 Report" (Oliver et. al. 2016), indicates that Turkey's greenhouse gas (GHG) emissions as CO_2 equivalent were 360 million tons in 2015 where China and United States had 10,720 and 5,180 million tons, respectively.

Though having a large emerging market, Turkey has been recently got engaged in environmental issues, and lately become ecologically responsive to these issues' criticality for sustainability of organizations and society. Parallel to European Union candidacy and compliance to the union's environmental acquis, Turkey has introduced new legislations and institutional practices as National Environmental Action Plan (NEAP) (European Environment Agency, 2016). For instance, Turkey is required to implement the EU waste electric and electronic equipment directive for EU candidacy (WEEE Directive', 2002/96/EC). However, in the case of electric waste, authorities (e.g. World Bank) suggest that Turkey has to form its own national standards and regulations that would support international standards for green operations.

When regionally examined, it is recorded that Turkish regional manufacturing is responsible for approximately 40–60% of total Turkey's carbon emissions (Kucukvar et. al., 2016). In the country scope, 99.8% of Turkish business environment consists of small and medium-sized Enterprises (SMEs) and these SMEs are accountable for nearly 70 percent of all industrial pollution (Agan et. al., 2013). Some industries are determined as more polluting sectors as food and beverages, textiles and metal products based on water and energy consumption, the amount of hazardous waste generated, and greenhouse gases (GHGs) emissions (Aksoy and Gonel,2015).

To both business environments and academic circles in Turkey, GSCM refers to a new management approach that becomes recently salient (Büyüközkan and Vardaroğlu, 2008; Camgöz-Akdağ and Aksoy, 2014). Therefore, the academic interest in GSCM practices in Turkey is limited with a dearth of studies and is still in the preliminary stage. These few studies are worth mentioning for understanding the motives and barriers of GSCM practices developing in the country. For example, a study conducted by Andiç et. al. (2012) on the forces affecting GSCM practices in Turkey, find out customer demand as the most influential driver for GSCM practices. Confirming Andiç et. al. (2012), Tatoglu et. al. (2015) find out that stakeholder pressures as the most important dimension of corporate environmental policies followed by environmental management practices, and the dimension of sources of greenhouse gas emissions is found out to be less influential factor. Agan et. al. (2013) within a sample of 500 SMEs, examined SMEs' environmental processes (disposal, reduction, recycling, design) on firm performance. The study findings prove that the most influential driver for GSCM practices for Turkish SMEs is expected benefits and soft performance expectations like image, reputation, and brand. Also, SMEs with ISO 14001 certification are found out to have better performance related with environmental processes, while disposal, design. Further, SMEs with environmental management systems are also found to have better performances. Based on their findings, Agan et. al. (2013) offer cooperation between firms in the supply chain as a critical factor to cope with pollution besides the government forced regulations. Similar to Agan et. al.'s study (2013), Sabegh et. al. (2016) on their research on inter-organizational relations and their influences on GSCM practices show that manufacturing and logistics firms have different perceptions related with GSCM and hence they need cooperation and some experiences to fully adopt GSCM premises (Sabegh et. al., 2016).

Besides all these factors related with the newly adopted GSCM, studies point some barriers for Turkish firms. The awareness and knowledge of environmental issues is still lacking both in the society and industry basis that foster the thinking that GSCM is a cost center rather than a profitability source

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

(Andiç et. al., 2012; Saridoğan, 2012). In line with this thinking, firms also don't indulge in research and development activities that would enhance their environmental performance. Together with these, the inefficiency of governmental penalties and control on waste management and related operations or on the recording of carbon footprint of operations are the other factors that result in misguided actions.

Therefore inferred from the previous studies, it is suggested that GSCM practices in Turkish food and beverages industry, one of the most polluting sectors, requires attention and as to the knowledge of authors there is no study analyzing the GSCM performance determinants for the industry.

Turkish Food and Beverages Industry

According to the information given at the website of The Republic of Turkey Prime Ministry Investment Support and Promotion Agency (ISPAT), Turkey is the world's 7th largest agricultural producer and 6.1 percent of the country's GDP in 2016 is created by agriculture and food industry. Also, the overall GDP provided by agriculture and food industry "increased 40 percent from 2002 to 2016 and will be predicted as USD 52.3 billion in 2016. Globally, Turkey exported 1,781 kinds of agricultural products to more than 190 countries in 2016, accounting for an export volume of USD 16.9 billion" (http://www.invest.gov.tr/en-US/theagency/Pages/OurServices.aspx: 06.08.2017).

According to Business Monitor International's Turkey Food and Beverages Report (2017), Turkey has a promising long-term consumer market and the largest firm is Nestlé whereas PepsiCo, Mondelez, The Coca-Cola Company, Mars, and AB InBev are among the top 10 food and beverage companies in the country. Besides these firms, Anadolu Efes, Danone, Çaykur, Pınar Su are the top beverage firms. More to that, trends of processed foods and growing health consciousness are started to be felt in the sector. The report (2017:15) signals that growth is expected in the industry especially due to "youthful demographics, rising incomes and increased participation of women in the labor force". On the opposite side of the coin, inflation rates, the depreciation in the national monetary unit, geographical location and international relations in terms of exporting (e.g. Russia) appear as negative factors for the development of food industry, and increasing taxes with falling tourism arrivals are hindrances for beverages.

Parallel to these, according to "National Greenhouse Gas Inventory Report:1990-2014" prepared by Turkish statistical institute, food processing, beverages and tobacco were evaluated together and as a category's share of GHG emissions as CO_2 eq.in the Turkish manufacturing industry is 7.2% in 2014 while it was at its peak with 8.3% in 1990. Also to the report, the changes of emissions in the industry is attained to emissions in this sector is due to increasing electricity produced by auto producer together with increasing consumption in solid and liquid fuels.

Food and beverages industry covers use of fertilizers, herbicides and pesticides in farming techniques as well as water pollution, packaging types as factors that cam impede or enhance the hazards given by the industry to the environment (Jackson and Singh, 2015). According to the studies, the environmental hazards by food and beverages can be categorized into three groups (Davies and Konisky, 2000; Wang et. al., 2013). The first group addresses the "environmental impacts of the services given by restaurants including energy consumption, solid waste generation, air emissions, water emissions, food safety-foodborne diseases, and refrigerants" (Wang et. al., 2013:86). The second group implies the impacts caused by downstream actors in the chain as suppliers, manufacturers and farms. Lastly, the downstream harms caused by other businesses and consumers (e.g. using too much napkins). Therefore, excessive use of energy, water, food, and detergents is among the main causes of pollution and a hindrance to

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

sustainability in food and beverages industry (Wang et. al., 2013). However, as mentioned before, Turkish agriculture and food industry generally consists of SMEs (Seyfettinoğlu, 2016; BIM, 2007) that don't have the required budget and motivation to invest highly in research and development activities to increase the value created through their supply chains. Consequently, all these make GSCM practices and environmental management in food and beverages industry critical.

METHODOLOGY

Experts are appointed and annual reports and related news are considered to provide the linguistic assessment regarding the companies. Proposed dimensions and criteria are illustrated in the following table.

Fuzzy DEMATEL

DEMATEL method refers to the first letters of "The Decision-Making Trial and Evaluation Laboratory". This method was developed by Geneva Research Institute within the scope of Science and Human Relations Program. This program was performed for the periods between 1972 and 1976. DEMATEL method is mainly used to give decisions in a very complex situation (Shieh et. al., 2010). In other words, this method aims to rank the alternatives according to their importance. In addition to this situation, it is also very beneficial to identify cause and effect relationship among the criteria. In this situation, the criteria, which influence others very much, belong to cause criteria group. On the other side, the criteria are included in effect criteria group if they are affected by others. The main reason is that these criteria have lower importance in comparison with others. When the opinions of the experts are linguistic, in such a case, fuzzy DEMATEL method is taken into the consideration. The steps of this method are detailed as following (Tseng, 2009).

Step 1: The goal of the situation is identified. In other words, the purpose of the decision to solve the problem is determined.

Step 2: The criteria is defined for evaluation. These criteria aim to analyze causal relationship. In addition to this situation, fuzzy linguistic scale is also determined. This scale helps to solve uncertainty conditions by considering following aspects.

- No
- Low
- Medium
- High
- Very High

Step 3: Decision makers evaluate the criteria. In this situation, the number of the experts who share their opinions is referred to "p". Furthermore, "Ž" shows fuzzy matrixes obtained according to the views of these experts. The details of average fuzzy matrix are given below. In this matrix, $\check{Z}_{ij} = (l_{ij}, m_{ij}, u_{ij})$ refers to the triangular fuzzy numbers (Dinçer et. al., 2017).

$$\breve{Z} = \frac{\breve{Z}^1 \oplus \breve{Z}^2 \oplus \ldots \oplus \breve{Z}^p}{p}$$

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

$$\breve{Z} = \begin{bmatrix} 0 & \cdots & \breve{Z}_{1n} \\ \vdots & \ddots & \vdots \\ \breve{Z}_{n1} & \cdots & 0 \end{bmatrix}$$

Step 4: The direct relation fuzzy matrix is normalized. The details of this matrix and equations used in the calculation process are emphasized as following.

$$\bar{\mathrm{X}} = \begin{bmatrix} \bar{\mathrm{X}}_{11} & \cdots & \bar{\mathrm{X}}_{1n} \\ \vdots & \ddots & \vdots \\ \bar{\mathrm{X}}_{n1} & \cdots & \bar{\mathrm{X}}_{nn} \end{bmatrix}$$

$$\bar{\mathrm{X}}_{ij} = \frac{\breve{Z}_{ij}}{r}\left(\frac{\mathrm{l}_{ij}}{r}, \frac{\mathrm{m}_{ij}}{r}, \frac{\mathrm{u}_{ij}}{r}\right)$$

$$r = max_{1 \le i \le n}\left(\sum_{j=i}^{n} u_{ij}\right)$$

Step 5: Total relation fuzzy matrix is calculated as below.

$$\mathrm{d} = \begin{bmatrix} \breve{\mathrm{t}}_{11} & \cdots & \breve{\mathrm{t}}_{1n} \\ \vdots & \ddots & \vdots \\ \breve{\mathrm{t}}_{n1} & \cdots & \breve{\mathrm{t}}_{nn} \end{bmatrix}$$

$\breve{\mathrm{t}}_{ij} = (\mathrm{l}''_{ij}, \mathrm{m}''_{ij}, \mathrm{u}''_{ij})$

$$l''_{ij} = X_l \times \left(1 - X_l\right)^{-1}$$

$$m''_{ij} = X_m \times \left(1 - X_m\right)^{-1}$$

$$u''_{ij} = X_u \times \left(1 - X_u\right)^{-1}$$

In this calculation, following matrixes are used.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

$$X_l = \begin{bmatrix} 0 & \cdots & \mathrm{l}'_{1n} \\ \vdots & \ddots & \vdots \\ \mathrm{l}'_{n1} & \cdots & 0 \end{bmatrix} \qquad X_m = \begin{bmatrix} 0 & \cdots & \mathrm{m}'_{1n} \\ \vdots & \ddots & \vdots \\ \mathrm{m}'_{n1} & \cdots & 0 \end{bmatrix} \qquad X_u = \begin{bmatrix} 0 & \cdots & \mathrm{u}'_{1n} \\ \vdots & \ddots & \vdots \\ \mathrm{u}'_{n1} & \cdots & 0 \end{bmatrix}$$

Step 6: $\left(\breve{D}_i + \breve{R}_i\right)^{def}$ and $\left(\breve{D}_i + \breve{R}_i\right)^{def}$ are calculated. In this process, fuzzy numbers become defuzzied and the following matrix is obtained.

$$\mathrm{d}^{def} = \begin{bmatrix} \breve{\mathrm{t}}_{11}^{def} & \cdots & \breve{\mathrm{t}}_{1n}^{def} \\ \vdots & \ddots & \vdots \\ \breve{\mathrm{t}}_{n1}^{def} & \cdots & \breve{\mathrm{t}}_{nn}^{def} \end{bmatrix}$$

Some studies in which DEMATEL method is used are detailed on Table 2.

As it can be seen from Table 2, most of the studies, which considers MOORA method, are related to selecting the best alternative. For example, Mirmousa and Dehnavi (2016) made a study to select the

Table 2. Featured studies with DEMATEL approach

Authors	Scope	Results
Mirmousa and Dehnavi (2016)	Iran	The financial stability index is the most significant criterion to select the best supplier.
Büyüközkan and Güleryüz (2016)	Turkey	They created a model which is very helpful to select the most efficient renewable energy resources.
Supeeket et. al. (2016)	Thailand	It is understood that completeness of treatment is the most important aspect to evaluate hospital supply chain performance.
Su et. al. (2016)	Taiwan	Recycling and reusing are important factors for selecting the suppliers.
Gigovic et. al. (2016)	Serbia	They developed a model which can evaluate the sites for ecotourism development in Serbia.
Psndey and Kumar (2017)	Literature Review	They updated the model of Chou and others that was developed in 2012 which is related to the evaluation of criteria for human resource management.
Song and Cao (2017)	Case Study	They proposed a product and service model which can identify the weights of each requirement.
Sharma et. al. (2017)	Literature Review	They created a system for flying aerial vehicles which decreases the delays about 25%.
Büyüközkan et. al. (2017)	Turkey	They developed a model which makes an evaluation to select the best CRM partners.
George-Ufot et. al. (2017)	Nigeria	Corruption, theft and inadequate planning are the critical factors that affect electricity consumption.
Luthra et. al. (2017)	India	Government regulations play a very critical role for sustainable production and consumption system.
Tooranloo et. al. (2017)	Iran	Environmental factors are the most significant issues for the success of sustainable human resource management.
Tsai (2018)	China	Compensation, promotion and supervisors are significant influencing factors in order to improve the job satisfaction of R&D personnel.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

best supplier in Iranian market. They reached the conclusion that the financial stability index is the most important criterion for this purpose. Similar to this study, Su et. al. (2016) also made an analysis for Taiwan and identified that recycling and reusing are the most significant factors for supplier selection. In addition, Büyüközkan et. al. (2017) proposed a model that makes an evaluation to select the best CRM partners. Moreover, Büyüközkan and Güleryüz (2016) developed a model for Turkey to select the most efficient renewable energy resources.

Furthermore, it can also be seen that some studies focused on the evaluation of the performance. For instance, Supeeket et. al. (2016) made a study to evaluate the supply chain performance for hospital in Thailand. According to the results of this analysis, it is defined that completeness of treatment is the most important aspect for this situation. Additionally, Psndey and Kumar (2017) tried to make evaluation for human resource management. Similar to this study, Tooranloo et. al. (2017) also focused on human resource management and identified that environmental factors are the most significant issues for this situation.

Moreover, it is understood that some other studies aimed to determine the influencing factors of some issues. For example, George-Ufot et. al. (2017) made an analysis for Nigeria to identify the determinants of electricity consumption. They reached a conclusion that corruption, theft and inadequate planning are the most critical factors. In addition to this study, Luthra et. al. (2017) tried to understand the factors affect production and consumption system in India. They defined that government regulations play an essential role. Tsai (2018) also focused on the determinants of job satisfaction of R&D personnel in China. It was identified that compensation, promotion and supervisors are significant influencing factors for this aspect.

Fuzzy MOORA

MOORA method refers to the Multi-Objective Optimization on the basis of Ratio Analysis. It was developed by Brauers and Zavadskas in 2006. It is a decision making technique which depends on the ratio analysis. In other words, it makes an optimization to solve the complex problems by considering some limitations (Brauers and Zavadskas, 2006). MOORA method has many advantages in comparison with other approaches. First of all, it takes shorter time to make analysis by using MOORA method. In addition to this situation, it is very simple to implement MOORA method. The steps of this method are explained below (Dinçer, 2015).

Step 1: Fuzzy decision matrix is created. Within this framework, various alternatives are considered in this matrix which is shown below. In this matrix, "X_{ij}" refers to the value of the criterion i for alternative j. Additionally, "X_{ij}^{l}", "X_{ij}^{m}", "X_{ij}^{n}" represent lower, middle and upper values.

$$X_{ij} = \begin{bmatrix} (X_{11}^{\ l}, X_{11}^{\ m}, X_{11}^{\ n}) & \cdots & (X_{1n}^{\ l}, X_{1n}^{\ m}, X_{1n}^{\ n}) \\ \vdots & \ddots & \vdots \\ (X_{m1}^{\ l}, X_{m1}^{\ m}, X_{m1}^{\ n}) & \cdots & (X_{mn}^{\ l}, X_{mn}^{\ m}, X_{mn}^{\ n}) \end{bmatrix}$$

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Step 2: The matrix is normalized. In order to achieve this objective, following matrix is taken into the consideration. In this equation, X_{ij} shows the normalized value of criterion i for alternative j. On the other side, all alternatives are stated on the denominator (Karande and Chakraborty, 2012).

$$r_{ij}^{l} = \frac{X_{ij}^{\ l}}{\sqrt{\sum_{j=1}^{m} (X_{ij}^{\ l})^2 + (X_{ij}^{\ m})^2 + (X_{ij}^{\ n})^2}}$$

$$r_{ij}^{m} = \frac{X_{ij}^{\ m}}{\sqrt{\sum_{j=1}^{m} (X_{ij}^{\ l})^2 + (X_{ij}^{\ m})^2 + (X_{ij}^{\ n})^2}}$$

$$r_{ij}^{n} = \frac{X_{ij}^{\ n}}{\sqrt{\sum_{j=1}^{m} (X_{ij}^{\ l})^2 + (X_{ij}^{\ m})^2 + (X_{ij}^{\ n})^2}}$$

Step 3: Weighted results of the alternatives are identified by considering the importance of them. This process is detailed below.

$$v_{ij}^{l} = W_j r_{ij}^{\ l}$$

$$v_{ij}^{m} = W_j r_{ij}^{\ m}$$

$$v_{ij}^{n} = W_j r_{ij}^{\ n}$$

Step 4: Ratings of beneficial and non-beneficial criteria are determined. On the following 6 equations, first three represent beneficial criteria whereas the last three show non-beneficial criteria.

$$S_i^{+l} = \sum_{j=1}^{n} v_{ij}^{\ l}$$

$$S_i^{+m} = \sum_{j=1}^{n} v_{ij}^{\ m}$$

$$S_i^{+n} = \sum_{j=1}^{n} v_{ij}^{\ n}$$

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

$$S_i^{-l} = \sum_{j=1}^{n} v_{ij}^{\ l}$$

$$S_i^{-m} = \sum_{j=1}^{n} v_{ij}^{\ m}$$

$$S_i^{-n} = \sum_{j=1}^{n} v_{ij}^{\ n}$$

Step 5: Overall performance index (Si) is calculated. The details are given on the following equation.

$$S_i\left(S_i^{+},S_i^{-}\right) = \sqrt{\frac{1}{3}\left[\left(S_i^{+l} - S_i^{-l}\right)^2 + \left(S_i^{+m} - S_i^{-m}\right)^2 + \left(S_i^{+n} - S_i^{-n}\right)^2\right]}$$

Step 6: Alternatives are listed as according to their performance results.

MOORA is so popular in the literature that many researchers used this method in their analysis. Some of these works are demonstrated in Table 3.

Table 3. Featured studies with MOORA approach

Authors	Scope	Results
Karande and Chakraborty (2012)	Case Study	They created a method to select the most efficient materials.
Patel and Manilya (2015)	Case Study	With respect to the selection the optimal value of the output, both MOORA and ANP method work effectively.
Akkaya et. al. (2015)	Turkey	They concluded that technology, software/informatics and finance are most commonly preferred sectors for industrial engineering.
Gupta and Singh (2016)	India	They developed a method to rank the criteria which may influence service quality of the retailers.
Dinçer et. al. (2016)	Turkey	There is a positive relationship between the size and the performance of Turkish banks
Matawale et. al. (2016)	India	They developed a methodology in order to select the best supplier in agile supply chain.
Gupta et. al. (2017)	India	A new method was developed with the aim of measuring and evaluating the strategies related to data distribution.
Dinçer et. al. (2017)	European Union	They reached the conclusion that the airline companies, which have profitability and efficiency, are more successful.
Mavi et. al. (2017)	Iran	Quality, health, safety and recycling are the most significant factors with respect to the logistic provider selection.
Bircan et. al. (2017)	Turkey	CO_2 emission, price and luggage volume are very critical factors so as to select a rent a car firm.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 3 shows that MOORA method is mainly used to select the best alternative. For example, Dinçer et. al. (2016) tried to evaluate the performance of deposit banks in Turkey. They reached a conclusion that there is a positive relationship between the size and the performance of Turkish banks. In addition to this study, Matawale et. al. (2016) proposed a method in order to select the best supplier in India. Moreover, Mavi et. al. (2017) focused on the best logistic provider selection in Iran. They identified that quality, health, safety and recycling are the most significant factors.

Furthermore, Bircan et. al. (2017) tried to select the best rent a car firm in Turkey. They reached a conclusion that CO2 emission, price and luggage volume are very critical factors for this aspect. Dinçer et. al. (2017) also aimed to evaluate the performance of European airline companies. They determined that the airline companies, which have profitability and efficiency, are more successful in comparison with others. Gupta et. al. (2017) also focused on developing a new method in order to measure and evaluate the strategies related to data distribution. Akkaya et. al. (2015) also used MOORA method to select the best sectors for industrial engineering and concluded that technology, software/informatics and finance are most commonly preferred sectors.

AN APPLICATION ON BIST

The purpose of the study is to analyze the multidimensional points of the green supply chain management using a fuzzy-based decision making methodology. For this purpose, the fuzzy DEMATEL and fuzzy MOORA methods have been used for the integrated model construction. The main stages of the green supply chain have been considered as the dimensions and the selected performance measures have been listed a set of criteria for each dimension. Accordingly, 21 Food and Beverage companies listed in Istanbul Stock Exchange have been employed to measure the performance of green supply chain processes. Experts have been appointed and annual reports and related news have been considered to provide the linguistic assessment regarding the companies. The financial situation of these 21 firms as of 2016 is shared on Table 4.

The application initiates by defining the multi-criteria decision-making problem to construct the dimensions and criteria of green supply chain management for the companies listed in the BIST food beverage index as seen in Table 1. Decision makers have been appointed to determine the linguistic evaluations for each criterion and the firm. The proposed model has been defined for ranking the alternative firms.

Accordingly, the Fuzzy DEMATEL and Fuzzy MOORA methods have been integrated for the novel hybrid decision making approach. The methodology begins by constructing the direct fuzzy relation matrix provided from the decision-making group. The second step continues by the initial and normalized direct-relation fuzzy matrix respectively. At the following stage of the Fuzzy DEMATEL, the total influence matrix and the total-relation fuzzy matrix have been employed to attain the crisp values. The final step of the fuzzy DEMATEL has been defined by the defuzzied total-relation matrix to determine the weights of the key components of green supply chain management. The results have been presented in Table 5-8.

Linguistic scales have been appointed for each criterion by using No influence (N), Low influence (L), Medium influence (M), High influence (H), Very high influence (VH) and the scales have been

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 4. Basic financial information of selected firms

Firm	Total Assets (TL)	Total Profit or Loss (TL)	Return on Assets
A1	294,042,194	15,227,319	0.052
A2	153,483,677	981,801	0.006
A3	1,110,737,612	62,415,065	0.056
A4	691,466,792	64,700,560	0.094
A5	546,963,372	59,689,181	0.109
A6	551,870,110	-8,606,371	-0.016
A7	604,820,268	-73,770,826	-0.122
A8	107,858,304	-6,246,356	-0.058
A9	207,835,834	-10,644,729	-0.051
A10	29,670,032	-832,007	-0.028
A11	111,557,216	-6,447,353	-0.058
A12	25,628,559	-40,055	-0.002
A13	52,345,285	61,502	0.001
A14	568,647,893	14,796,725	0.026
A15	94,206,031	3,068,840	0.033
A16	933,593,147	60,019,544	0.064
A17	10,455,946	22,391	0.002
A18	86,709,590	9,887,534	0.114
A19	1,285,558	236,890	0.184
A20	5,526,188,949	242,004,730	0.044
A21	205,912,354	-21,421,595	-0.104

converted to the triangular fuzzy numbers to evaluate the relative importance of the criteria (Uygun et al. 2015). The evaluation results can be seen in Table 5.

Initial direct-relation fuzzy matrix has been normalized in table 5.

Table 7 represents the total influence matrix using the crisp matrices.

Table 8 illustrates the total cause and effects of the criteria between each other with the defuzzied values. The results show that C2 is the most important factor in the green supply chain management while C7 has the least weight in the criteria. However, C9 influences the other criteria most dominantly as C7 is the most influenced factor among the criteria.

The second phase of the integrated model continues with the Fuzzy MOORA method. Firstly, the linguistic scales have been appointed for each firm and the fuzzy decision matrix has been provided in table 9. And then, the weighted normalized values have been calculated to attain the overall ratings of beneficial and non-beneficial criteria for each firm.

The final ranking results are presented in table 10.

Table 10 demonstrates that A21 is the best firm while A2 has the worst performance in BIST food beverage index according to the key components of the green supply chain management.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 5. The initial direct-relation fuzzy matrix

Criteria	C1			C2			C3			C4			C5			C6			C7			C8			C9			C10		
C1	0,0	0,0	0,0	0,0	0,3	0,5	0,5	0,8	1,0	0,0	0,3	0,5	0,0	0,3	0,5	0,3	0,5	0,8	0,3	0,5	0,8	0,3	0,5	0,8	0,0	0,3	0,5	0,3	0,5	0,8
C2	0,3	0,5	0,8	0,0	0,0	0,0	0,5	0,8	1,0	0,5	0,8	1,0	0,5	0,8	1,0	0,3	0,5	0,8	0,3	0,5	0,8	0,3	0,5	0,8	0,5	0,8	1,0	0,3	0,5	0,8
C3	0,5	0,8	1,0	0,3	0,5	0,8	0,0	0,0	0,0	0,3	0,5	0,8	0,3	0,5	0,8	0,0	0,3	0,5	0,0	0,3	0,5	0,0	0,3	0,5	0,0	0,3	0,5	0,0	0,3	0,5
C4	0,5	0,8	1,0	0,3	0,5	0,8	0,3	0,5	0,8	0,0	0,0	0,0	0,3	0,5	0,8	0,0	0,3	0,5	0,0	0,3	0,5	0,0	0,3	0,5	0,0	0,3	0,5	0,0	0,3	0,5
C5	0,5	0,8	1,0	0,3	0,5	0,8	0,3	0,5	0,8	0,3	0,5	0,8	0,0	0,0	0,0	0,0	0,3	0,5	0,0	0,3	0,5	0,0	0,3	0,5	0,0	0,3	0,5	0,0	0,3	0,5
C6	0,0	0,3	0,5	0,3	0,5	0,8	0,3	0,5	0,8	0,3	0,5	0,8	0,3	0,5	0,8	0,0	0,0	0,0	0,5	0,8	1,0	0,5	0,8	1,0	0,0	0,3	0,5	0,5	0,8	1,0
C7	0,0	0,3	0,5	0,0	0,0	0,3	0,0	0,0	0,3	0,0	0,0	0,3	0,0	0,0	0,3	0,5	0,8	1,0	0,0	0,0	0,0	0,0	0,3	0,5	0,0	0,3	0,5	0,0	0,3	0,5
C8	0,5	0,8	1,0	0,5	0,8	1,0	0,5	0,8	1,0	0,5	0,8	1,0	0,5	0,8	1,0	0,3	0,5	0,8	0,3	0,5	0,8	0,0	0,0	0,0	0,3	0,5	0,8	0,3	0,5	0,8
C9	0,5	0,8	1,0	0,3	0,5	0,8	0,3	0,5	0,8	0,3	0,5	0,8	0,3	0,5	0,8	0,5	0,8	1,0	0,5	0,8	1,0	0,5	0,8	1,0	0,0	0,0	0,0	0,3	0,5	0,8
C10	0,5	0,8	1,0	0,3	0,5	0,8	0,3	0,5	0,8	0,3	0,5	0,8	0,3	0,5	0,8	0,5	0,8	1,0	0,5	0,8	1,0	0,5	0,8	1,0	0,3	0,5	0,8	0,0	0,0	0,0

Table 6. Normalized direct-relation fuzzy matrix

Criteria	C1			C2			C3			C4			C5			C6			C7			C8			C9			C10		
C1	0,0	0,0	0,0	0,0	0,0	0,1	0,1	0,1	0,1	0,0	0,0	0,1	0,0	0,0	0,1	0,0	0,1	0,1	0,0	0,1	0,1	0,0	0,1	0,1	0,0	0,0	0,1	0,0	0,1	0,1
C2	0,0	0,1	0,1	0,0	0,0	0,0	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,0	0,1	0,1	0,0	0,1	0,1	0,0	0,1	0,1	0,1	0,1	0,1	0,0	0,1	0,1
C3	0,1	0,1	0,1	0,0	0,1	0,1	0,0	0,0	0,0	0,0	0,1	0,1	0,0	0,1	0,1	0,0	0,0	0,1	0,0	0,0	0,1	0,0	0,0	0,1	0,0	0,0	0,1	0,0	0,0	0,1
C4	0,1	0,1	0,1	0,0	0,1	0,1	0,0	0,1	0,1	0,0	0,0	0,0	0,0	0,1	0,1	0,0	0,0	0,1	0,0	0,0	0,1	0,0	0,0	0,1	0,0	0,0	0,1	0,0	0,0	0,1
C5	0,1	0,1	0,1	0,0	0,1	0,1	0,0	0,1	0,1	0,0	0,1	0,1	0,0	0,0	0,0	0,0	0,0	0,1	0,0	0,0	0,1	0,0	0,0	0,1	0,0	0,0	0,1	0,0	0,0	0,1
C6	0,0	0,0	0,1	0,0	0,1	0,1	0,0	0,1	0,1	0,0	0,1	0,1	0,0	0,1	0,1	0,0	0,0	0,0	0,1	0,1	0,1	0,1	0,1	0,1	0,0	0,0	0,1	0,1	0,1	0,1
C7	0,0	0,0	0,1	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,1	0,1	0,1	0,0	0,0	0,0	0,0	0,0	0,1	0,0	0,0	0,1	0,0	0,0	0,1
C8	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,0	0,1	0,1	0,0	0,1	0,1	0,0	0,0	0,0	0,0	0,1	0,1	0,0	0,1	0,1
C9	0,1	0,1	0,1	0,0	0,1	0,1	0,0	0,1	0,1	0,0	0,1	0,1	0,0	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,0	0,0	0,0	0,0	0,1	0,1
C10	0,1	0,1	0,1	0,0	0,1	0,1	0,0	0,1	0,1	0,0	0,1	0,1	0,0	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,0	0,1	0,1	0,0	0,0	0,0

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 7. The total-relation fuzzy matrix

Criteria	C1			C2			C3			C4			C5			C6			C7			C8			C9			C10		
C1	0,0	0,1	0,4	0,0	0,1	0,4	0,1	0,1	0,5	0,0	0,1	0,4	0,0	0,1	0,4	0,0	0,1	0,4	0,0	0,1	0,4	0,0	0,1	0,4	0,0	0,1	0,3	0,0	0,1	0,4
C2	0,1	0,2	0,6	0,0	0,1	0,4	0,1	0,2	0,6	0,1	0,2	0,5	0,1	0,2	0,5	0,1	0,1	0,5	0,1	0,1	0,5	0,1	0,1	0,5	0,1	0,1	0,5	0,0	0,1	0,5
C3	0,1	0,2	0,5	0,0	0,1	0,4	0,0	0,1	0,3	0,0	0,1	0,4	0,0	0,1	0,4	0,0	0,1	0,4	0,0	0,1	0,4	0,0	0,1	0,4	0,0	0,1	0,3	0,0	0,1	0,4
C4	0,1	0,2	0,5	0,0	0,1	0,4	0,0	0,1	0,4	0,0	0,1	0,3	0,0	0,1	0,4	0,0	0,1	0,4	0,0	0,1	0,4	0,0	0,1	0,4	0,0	0,1	0,3	0,0	0,1	0,4
C5	0,1	0,2	0,5	0,0	0,1	0,4	0,0	0,1	0,4	0,0	0,1	0,4	0,0	0,1	0,3	0,0	0,1	0,4	0,0	0,1	0,4	0,0	0,1	0,4	0,0	0,1	0,3	0,0	0,1	0,4
C6	0,0	0,1	0,5	0,0	0,1	0,5	0,0	0,1	0,5	0,0	0,1	0,5	0,0	0,1	0,5	0,0	0,1	0,4	0,1	0,2	0,5	0,1	0,2	0,5	0,0	0,1	0,4	0,1	0,1	0,5
C7	0,0	0,1	0,3	0,0	0,0	0,3	0,0	0,0	0,3	0,0	0,0	0,3	0,0	0,0	0,3	0,1	0,1	0,4	0,0	0,0	0,2	0,0	0,1	0,3	0,0	0,1	0,3	0,0	0,1	0,3
C8	0,1	0,2	0,6	0,1	0,2	0,5	0,1	0,2	0,6	0,1	0,2	0,5	0,1	0,2	0,5	0,0	0,1	0,5	0,0	0,1	0,5	0,0	0,1	0,4	0,0	0,1	0,5	0,0	0,1	0,5
C9	0,1	0,2	0,6	0,0	0,1	0,5	0,1	0,1	0,5	0,0	0,1	0,5	0,0	0,1	0,5	0,1	0,2	0,5	0,1	0,2	0,5	0,1	0,2	0,5	0,0	0,1	0,4	0,0	0,1	0,5
C10	0,1	0,2	0,6	0,0	0,1	0,5	0,1	0,1	0,5	0,0	0,1	0,5	0,0	0,1	0,5	0,1	0,2	0,5	0,1	0,2	0,5	0,1	0,2	0,5	0,0	0,1	0,4	0,0	0,1	0,4

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 8. Total impact-relationship degrees and the weights for the criteria

Criteria				$\tilde{D}_i^{def} - \tilde{R}_i^{def}$	Weights
C1	1,452	1,989	3,442	-0,537	0,108
C2	2,019	1,569	3,587	0,450	0,112
C3	1,394	1,799	3,193	-0,405	0,100
C4	1,393	1,634	3,027	-0,241	0,095
C5	1,392	1,547	2,939	-0,155	0,092
C6	1,749	1,619	3,368	0,130	0,106
C7	0,886	1,619	2,505	-0,732	0,079
C8	1,940	1,538	3,478	0,401	0,109
C9	1,843	1,231	3,074	0,611	0,096
C10	1,879	1,402	3,281	0,477	0,103

DISCUSSION AND CONCLUSION

Environmental pollution is a crucial concept in the world especially in the last years. Within this scope, it can be said that some companies increase this pollution because of their operations. On the other side, there are also some groups which announce the importance of environmental pollution. Nowadays, it can be observed that consciousness of most of the companies regarding the pollution increased. They focus on green supply chain management activities to contribute to the solution of this problem.

Indeed, green supply chain management activities have many economic and the financial advantages to these companies. First of all, by applying the activities, such as recycling, reuse and reverse logistic, they can have a chance to reduce their costs. In addition to this advantage, companies can also increase the image in the eyes of the customers by adopting some green supply chain management activities like low pollution, clean technology and reduce waste. Since customers prefer these companies due to these factors, they can increase their revenues.

This study aims to evaluate financial and economic effects on green supply chain management. Within this framework, 21 different companies listed in BIST food beverage index are taken into the consideration. In addition to this situation, the fuzzy DEMATEL and fuzzy MOORA methods are used to achieve this objective. Moreover, by analyzing similar studies in the literature, 10 different criteria are identified which may show the performance of green supply chain management.

In the analysis process, first of all, the importance of these 10 criteria is determined with the help of fuzzy DEMATEL method. As a result of this analysis, it is identified that “low pollution” is the most important criterion for these companies. On the other side, the criterion of “alternatives” has the least weight. This condition gives information that food and beverage companies mainly focus on saving their image in the public eye. The main reason behind this situation is that they can be more preferred by the customers while having an image that does not pollute the environment.

According to the results of fuzzy MOORA analysis, it is defined that there is not a strict correlation between the profitability of the companies and green supply chain management performance. For example, A21 has the highest performance with respect to the green supply chain management. However,

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 9. Fuzzy decision matrix

Firms	C1			C2			C3			C4			C5			C6			C7			C8			C9			C10		
A1	0,5	0,75	1	0,75	1	1	0,5	0,75	1	0,75	1	1	0,25	0,5	0,75	0,75	1	1	0,75	1	1	0,5	0,75	1	0,75	1	1	0,5	0,75	1
A2	0,25	0,5	0,75	0,5	0,75	1	0,5	0,75	1	0,5	0,75	1	0,5	0,75	1	0,25	0,5	0,75	0,75	1	1	0,25	0,5	0,75	0,5	0,75	1	0,25	0,5	0,75
A3	0,75	1	1	0,5	0,75	1	0,5	0,75	1	0,5	0,75	1	0,25	0,5	0,75	0,75	1	1	0,75	1	1	0,5	0,75	1	0,5	0,75	1	0,25	0,5	0,75
A4	0,75	1	1	0,75	1	1	0,5	0,75	1	0,75	1	1	0,5	0,75	1	0,75	1	1	0,75	1	1	0,5	0,75	1	0,75	1	1	0,25	0,5	0,75
A5	0,75	1	1	0,75	1	1	0,5	0,75	1	0,75	1	1	0,5	0,75	1	0,75	1	1	0,75	1	1	0,5	0,75	1	0,75	1	1	0,25	0,5	0,75
A6	0,5	0,75	1	0,5	0,75	1	0,5	0,75	1	0,5	0,75	1	0,5	0,75	1	0,5	0,75	1	0,75	1	1	0,25	0,5	0,75	0,5	0,75	1	0,25	0,5	0,75
A7	0,5	0,75	1	0,5	0,75	1	0,5	0,75	1	0,5	0,75	1	0,25	0,5	0,75	0,5	0,75	1	0,5	0,75	1	0,25	0,5	0,75	0,75	1	1	0,25	0,5	0,75
A8	0,25	0,5	0,75	0,5	0,75	1	0,25	0,5	0,75	0,5	0,75	1	0,25	0,5	0,75	0,25	0,5	0,75	0,5	0,75	1	0,25	0,5	0,75	0,5	0,75	1	0,5	0,75	1
A9	0,25	0,5	0,75	0,5	0,75	1	0,5	0,75	1	0,5	0,75	1	0,25	0,5	0,75	0,75	1	1	0,75	1	1	0,5	0,75	1	0,75	1	1	0,5	0,75	1
A10	0,25	0,5	0,75	0,25	0,5	0,75	0,25	0,5	0,75	0,25	0,5	0,75	0,5	0,75	1	0,25	0,5	0,75	0,5	0,75	1	0,25	0,5	0,75	0,5	0,75	1	0,25	0,5	0,75
A11	0,25	0,5	0,75	0,25	0,5	0,75	0,25	0,5	0,75	0,25	0,5	0,75	0,25	0,5	0,75	0,5	0,75	1	0,5	0,75	1	0,25	0,5	0,75	0,5	0,75	1	0,5	0,75	1
A12	0,25	0,5	0,75	0,5	0,75	1	0,5	0,75	1	0,5	0,75	1	0,25	0,5	0,75	0,75	1	1	0,25	0,5	0,75	0,25	0,5	0,75	0,75	1	1	0,5	0,75	1
A13	0,25	0,5	0,75	0,5	0,75	1	0,25	0,5	0,75	0,5	0,75	1	0,5	0,75	1	0,25	0,5	0,75	0,5	0,75	1	0,25	0,5	0,75	0,75	1	1	0,5	0,75	1
A14	0,25	0,5	0,75	0,5	0,75	1	0,25	0,5	0,75	0,5	0,75	1	0,5	0,75	1	0,5	0,75	1	0,5	0,75	1	0,25	0,5	0,75	0,5	0,75	1	0,5	0,75	1
A15	0,25	0,5	0,75	0,25	0,5	0,75	0,25	0,5	0,75	0,5	0,75	1	0,25	0,5	0,75	0,5	0,75	1	0,25	0,5	0,75	0,25	0,5	0,75	0,75	1	1	0,25	0,5	0,75
A16	0,5	0,75	1	0,75	1	1	0,5	0,75	1	0,75	1	1	0,5	0,75	1	0,75	1	1	0,5	0,75	1	0,5	0,75	1	0,75	1	1	0,5	0,75	1
A17	0,75	1	1	0,75	1	1	0,5	0,75	1	0,75	1	1	0,5	0,75	1	0,75	1	1	0,25	0,5	0,75	0,25	0,5	0,75	0,75	1	1	0,25	0,5	0,75
A18	0,25	0,5	0,75	0,5	0,75	1	0,25	0,5	0,75	0,5	0,75	1	0,25	0,5	0,75	0,25	0,5	0,75	0,5	0,75	1	0,25	0,5	0,75	0,75	1	1	0,5	0,75	1
A19	0,5	0,75	1	0,75	1	1	0,5	0,75	1	0,75	1	1	0,5	0,75	1	0,75	1	1	0,25	0,5	0,75	0,25	0,5	0,75	0,75	1	1	0,25	0,5	0,75
A20	0,75	1	1	0,75	1	1	0,5	0,75	1	0,75	1	1	0,5	0,75	1	0,75	1	1	0,75	1	1	0,5	0,75	1	0,75	1	1	0,5	0,75	1
A21	0,75	1	1	0,75	1	1	0,25	0,5	0,75	0,75	1	1	0,5	0,75	1	0,75	1	1	0,5	0,75	1	0,5	0,75	1	0,75	1	1	0,5	0,75	1

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 10. The ranking of alternatives

Alternatives	The Values of S_i	Ranking
A1	0,0596	2
A2	0,0333	21
A3	0,0560	4
A4	0,0535	7
A5	0,0535	7
A6	0,0416	18
A7	0,0459	12
A8	0,0446	14
A9	0,0554	5
A10	0,0367	20
A11	0,0492	9
A12	0,0453	13
A13	0,0423	17
A14	0,0445	15
A15	0,0470	10
A16	0,0536	6
A17	0,0433	16
A18	0,0464	11
A19	0,0407	19
A20	0,0583	3
A21	0,0608	1

it has a significant loss in 2016. On the other side, it can also be said that bigger firms have higher green supply chain management performance than the smaller firms. For instance, the companies, which have the highest total assets value, are ranked as the third, fourth and sixth position. Nevertheless, A10 and A19 are the companies that have low green supply chain management performance and lower size in comparison with other firms.

REFERENCES

Agan, Y., Acar, M. F., & Borodin, A. (2013). Drivers of environmental processes and their impact on performance: A study of Turkish SMEs. *Journal of Cleaner Production*, *51*, 23–33. doi:10.1016/j.jclepro.2012.12.043

Agi, M. A., & Nishant, R. (2017). Understanding influential factors on implementing green supply chain management practices: An interpretive structural modelling analysis. *Journal of Environmental Management*, *188*, 351–363. doi:10.1016/j.jenvman.2016.11.081 PMID:28006744

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Akkaya, G., Turanoğlu, B., & Öztaş, S. (2015). An integrated fuzzy AHP and fuzzy MOORA approach to the problem of industrial engineering sector choosing. *Expert Systems with Applications*, *42*(24), 9565–9573. doi:10.1016/j.eswa.2015.07.061

Albertini, E. (2017). What we know about environmental policy: An inductive typology of the research. *Business Strategy and the Environment*, *26*(3), 277–287. doi:10.1002/bse.1913

Almeida, C. M. V. B., Rodrigues, A. J. M., Agostinho, F., & Giannetti, B. F. (2017). Material selection for environmental responsibility: The case of soft drinks packaging in Brazil. *Journal of Cleaner Production*, *142*, 173–179. doi:10.1016/j.jclepro.2016.04.130

Afshari, H., Sharafi, M., ElMekkawy, T., & Peng, Q. (2014). Optimizing multi-objective dynamic facility location decisions within green distribution network design. *Procedia Cirp*, *17*, 675–679. doi:10.1016/j.procir.2014.01.147

Akkucuk, U. (Ed.). (2015). *Handbook of Research on Waste Management Techniques for Sustainability*. IGI Global.

Akkucuk, U. (Ed.). (2016). *Ethics and Sustainability in Global Supply Chain Management*. IGI Global.

Aksoy, T., & Gonel, F. (2015). How green is my industry? The case of Turkey. *World Journal of Science. Technology and Sustainable Development*, *12*(2), 119–128.

Andiç, E., Yurt, Ö., & Baltacıoğlu, T. (2012). Green supply chains: Efforts and potential applications for the Turkish market. *Resources, Conservation and Recycling*, *58*, 50–68. doi:10.1016/j.resconrec.2011.10.008

Azevedo, S. G., Carvalho, H., & Machado, V. C. (2011). The influence of green practices on supply chain performance: A case study approach. *Transportation Research Part E, Logistics and Transportation Review*, *47*(6), 850–871. doi:10.1016/j.tre.2011.05.017

Baines, T., Brown, S., Benedettini, O., & Ball, P. (2012). Examining green production and its role within the competitive strategy of manufacturers. *Journal of Industrial Engineering and Management*, *5*(1), 53–87. doi:10.3926/jiem.405

Bhattacharya, A., Dey, P. K., & Ho, W. (2015). Green manufacturing supply chain design and operations decision support. *International Journal of Production Research*, *53*(21), 6339–6343. doi:10.1080/00207543.2015.1065021

Bircan, H., Arslan, R., & Eleroğlu, H. (2017, February). AHS İle Ağırlıklandırılmış MOORA ve VIKOR Yöntemiyle Araç Seçimi; Rent a Car Firması Uygulaması. In *ICPESS (International Congress on Politic, Economic and Social Studies)* (No. 2). Academic Press.

Beamon, B. M. (1999). Designing the green supply chain. *Logistics Information Management*, *12*(4), 332–342. doi:10.1108/09576059910284159

BMI. (2016). *Emerging Europe: Food and Drink*. London: BMI Research.

BMI. (2017). Turkey Food & Drink Report. BMI Research.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Brauers, W. K. M., & Zavadskas, E. K. (2006). The MOORA Method and Its Application to Privatization in a Transition Economy. *Control and Cybernetics*, *35*, 445–469.

Bukold, S. (1993). Logistics by combined transport: Barriers to market entry and strategies of main suppliers. *International Journal of Physical Distribution & Logistics Management*, *23*(4), 24–34. doi:10.1108/09600039310041482

Büyüközkan, G., & Çifçi, G. (2012). Evaluation of the green supply chain management practices: A fuzzy ANP approach. *Production Planning and Control*, *23*(6), 405–418. doi:10.1080/09537287.2011.561814

Büyüközkan, G., & Güleryüz, S. (2016). An integrated DEMATEL-ANP approach for renewable energy resources selection in Turkey. *International Journal of Production Economics*, *182*, 435–448. doi:10.1016/j.ijpe.2016.09.015

Büyüközkan, G., Güleryüz, S., & Karpak, B. (2017). A new combined IF-DEMATEL and IF-ANP approach for CRM partner evaluation. *International Journal of Production Economics*, *191*, 194–206. doi:10.1016/j.ijpe.2017.05.012

Camgöz-Akdag, H., & Aksoy, H. M. (2014, January). Green Supply Chain Management for Electric and Electronic Equipment: Case Study for Turkey. *Proceedings of the International Annual Conference of the American Society for Engineering Management*, 1-12.

Chin, T. A., Tat, H. H., & Sulaiman, Z. (2015). Green supply chain management, environmental collaboration and sustainability performance. *Procedia CIRP*, *26*, 695–699. doi:10.1016/j.procir.2014.07.035

Cooper, M. C., Lambert, D. M., & Pagh, J. D. (1997). Supply chain management: More than a new name for logistics. *International Journal of Logistics Management*, *8*(1), 1–14. doi:10.1108/09574099710805556

Davies, T., & Konisky, D. M. (2000). *Environmental implications of the foodservice and food retail industries*. Washington, DC: Resources for the Future.

Deif, A. M. (2011). A system model for green manufacturing. *Journal of Cleaner Production*, *19*(14), 1553–1559. doi:10.1016/j.jclepro.2011.05.022

Diabat, A., & Govindan, K. (2011). An analysis of the drivers affecting the implementation of green supply chain management. *Resources, Conservation and Recycling*, *55*(6), 659–667. doi:10.1016/j.resconrec.2010.12.002

Dinçer, H. (2015). Profit-based stock selection approach in banking sector using Fuzzy AHP and MOORA method. *Global Business and Economics Research Journal*, *4*(2), 1–26.

Dinçer, H., Hacıoğlu, Ü., & Yüksel, S. (2016). Performance Assessment of Deposit Banks with CAMELS Analysis using Fuzzy ANP-MOORA Approaches and an Application on Turkish Banking Sector. *Asian Journal of Research in Business Economics and Management*, *6*(2), 32–56. doi:10.5958/2249-7307.2016.00009.8

Dinçer, H., Hacıoğlu, Ü., & Yüksel, S. (2017). Balanced scorecard based performance measurement of European airlines using a hybrid multicriteria decision making approach under the fuzzy environment. *Journal of Air Transport Management*, *63*, 17–33. doi:10.1016/j.jairtraman.2017.05.005

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Doll, C., Köhler, J., Maibach, M., Schade, W., Mader, S., Horvat, D., . . . Kochsiek, J. (2017). *The Grand Challenge: Pathways Towards Climate Neutral Freight Corridors*. Working paper 2 within the study "LowCarb RFC – Low Carbon Rail Freight Transport in Europe," Fraunhofer ISI and IML, INFRAS, M-Five, University of Antwerp, Karlsruhe.

Dubey, R., Gunasekaran, A., & Ali, S. S. (2015). Exploring the relationship between leadership, operational practices, institutional pressures and environmental performance: A framework for green supply chain. *International Journal of Production Economics*, *160*, 120–132. doi:10.1016/j.ijpe.2014.10.001

Fahimnia, B., Sarkis, J., & Davarzani, H. (2015). Green supply chain management: A review and bibliometric analysis. *International Journal of Production Economics*, *162*, 101–114. doi:10.1016/j.ijpe.2015.01.003

Ferrer, G. (1997). The economics of tire remanufacturing. *Resources, Conservation and Recycling*, *19*(4), 221–255. doi:10.1016/S0921-3449(96)01181-0

Franzoni, E. (2011). Materials selection for green buildings: Which tools for engineers and architects? *Procedia Engineering*, *21*, 883–890. doi:10.1016/j.proeng.2011.11.2090

Gencer, Y. G., & Akkucuk, U. (2016). *Product Recalls as an Important Category of Reverse Logistics.* DEStech Transactions on Environment, Energy and Earth Science.

Geng, R., Mansouri, S. A., & Aktas, E. (2017). The relationship between green supply chain management and performance: A meta-analysis of empirical evidences in Asian emerging economies. *International Journal of Production Economics*, *183*, 245–258. doi:10.1016/j.ijpe.2016.10.008

George-Ufot, G., Qu, Y., & Orji, I. J. (2017). Sustainable lifestyle factors influencing industries' electric consumption patterns using Fuzzy logic and DEMATEL: The Nigerian perspective. *Journal of Cleaner Production*, *162*, 624–634. doi:10.1016/j.jclepro.2017.05.188

Gigović, L., Pamučar, D., Lukić, D., & Marković, S. (2016). GIS-Fuzzy DEMATEL MCDA model for the evaluation of the sites for ecotourism development: A case study of "Dunavski ključ" region, Serbia. *Land Use Policy*, *58*, 348–365. doi:10.1016/j.landusepol.2016.07.030

Gupta, V., Kapur, P. K., & Kumar, D. (2017). Measuring and evaluating data distribution strategies using an integrated approach of fuzzy based MOORA and AHP. *Life Cycle Reliability and Safety Engineering*, *6*(1), 37–45. doi:10.100741872-017-0004-x

Gupta, T. K., & Singh, V. (2016). Ranking the Factors Affecting the Service Quality of Retailer by SDV-MOORA Technique. *Journal of Automation and Automobile Engineering*, *1*(1).

Hassini, E., Surti, C., & Searcy, C. (2012). A literature review and a case study of sustainable supply chains with a focus on metrics. *International Journal of Production Economics*, *140*(1), 69–82. doi:10.1016/j.ijpe.2012.01.042

He, Y., Liu, F., Cao, H., & Zhang, H. (2007). Process planning support system for green manufacturing and its application. *Frontiers of Mechanical Engineering in China*, *2*(1), 104–109. doi:10.100711465-007-0018-6

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Hervani, A. A., Helms, M. M., & Sarkis, J. (2005). Performance measurement for green supply chain management. *Benchmarking. International Journal (Toronto, Ont.)*, *12*(4), 330–335.

Islam, S., Karia, N., Fauzi, F. B. A., & Soliman, M. S. M. (2017). "A review on green supply chain aspects and practices", Management and Marketing. *Challenges for the Knowledge Society*, *12*(1), 12–36.

Jabbour, A. B. L. D. S., Frascareli, F. C. D. O., & Jabbour, C. J. C. (2015). Green supply chain management and firms' performance: Understanding potential relationships and the role of green sourcing and some other green practices. *Resources, Conservation and Recycling, 104*(Part B), 366-374.

Jackson, L. A., & Singh, D. (2015). Environmental rankings and financial performance: An analysis of firms in the US food and beverage supply chain. *Tourism Management Perspectives*, *14*, 25–33. doi:10.1016/j.tmp.2015.02.002

Jain, V., Wadhwa, S., & Deshmukh, S. G. (2009). Select supplier-related issues in modelling a dynamic supply chain: Potential, challenges and direction for future research. *International Journal of Production Research*, *47*(11), 3013–3039. doi:10.1080/00207540701769958

Jensen, A., Brigelius, L., & Flodn, J. (2001). Strategic simulation of combined transport in a competitive market: a two-step model. *Selected Proceedings of the 9th World Conference on Transport Research*.

Jensen, A. (2008). Designing intermodal transport systems: A conceptual and methodological framework. *The Future of Intermodal Freight Transport: Operations, Design and Policy*, 187.

Johnson, M. R., & Wang, M. H. (1995). Planning product disassembly for material recovery opportunities. *International Journal of Production Research*, *33*(11), 3119–3142. doi:10.1080/00207549508904864

Kafa, N., Hani, Y., & El Mhamedi, A. (2013). Sustainability performance measurement for green supply chain management. *IFAC Proceedings Volumes, 46*(24), 71-78. 10.3182/20130911-3-BR-3021.00050

Karande, P., & Chakraborty, S. (2012). A Fuzzy-MOORA approach for ERP system selection. *Decision Science Letters*, *1*(1), 11–21. doi:10.5267/j.dsl.2012.07.001

Karande, P., & Chakraborty, S. (2012). Application of multi-objective optimization on the basis of ratio analysis (MOORA) method for materials selection. *Materials & Design*, *37*, 317–324. doi:10.1016/j.matdes.2012.01.013

Khoshnava, S. M., Rostami, R., Valipour, A., Ismail, M., & Rahmat, A. R. (2016). (forthcoming). Rank of green building material criteria based on the three pillars of sustainability using the hybrid multi criteria decision making method. *Journal of Cleaner Production*, 1–18.

Klassen, R. D., & Whybark, D. C. (1999). The impact of environmental technologies on manufacturing performance. *Academy of Management Journal*, *42*(6), 599–615. doi:10.2307/256982

Kim, I., & Min, H. (2011). Measuring supply chain efficiency from a green perspective. *Management Research Review*, *34*(11), 1169–1189. doi:10.1108/01409171111178738

Kucukvar, M., Cansev, B., Egilmez, G., Onat, N. C., & Samadi, H. (2016). Energy-climate-manufacturing nexus: New insights from the regional and global supply chains of manufacturing industries. *Applied Energy*, *184*, 889–904. doi:10.1016/j.apenergy.2016.03.068

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Krikke, H. R., Kooi, E. J., & Schuur, P. C. (1999). Network design in reverse logistics: a quantitative model. In *New trends in distribution logistics* (pp. 45–61). Berlin: Springer. doi:10.1007/978-3-642-58568-5_3

Kriwet, A., Zussman, E., & Seliger, G. (1995). Systematic integration of design-for-recycling into product design. *International Journal of Production Economics*, *38*(1), 15–22. doi:10.1016/0925-5273(95)99062-A

Kuei, C. H., Madu, C. N., Chow, W. S., & Chen, Y. (2015). Determinants and associated performance improvement of green supply chain management in China. *Journal of Cleaner Production*, *95*, 163–173. doi:10.1016/j.jclepro.2015.02.030

Laari, S., Töyli, J., & Ojala, L. (2017). Supply chain perspective on competitive strategies and green supply chain management strategies. *Journal of Cleaner Production*, *141*, 1303–1315. doi:10.1016/j.jclepro.2016.09.114

Lambert, D. M., Cooper, M. C., & Pagh, J. D. (1998). Supply chain management: Implementation issues and research opportunities. *International Journal of Logistics Management*, *9*(2), 1–20. doi:10.1108/09574099810805807

Lambert, D. M., & Cooper, M. C. (2000). Issues in supply chain management. *Industrial Marketing Management*, *29*(1), 65–83. doi:10.1016/S0019-8501(99)00113-3

Laosirihongthong, T., Adebanjo, D., & Choon Tan, K. (2013). Green supply chain management practices and performance. *Industrial Management & Data Systems*, *113*(8), 1088–1109. doi:10.1108/IMDS-04-2013-0164

Lin, C. Y., & Ho, Y. H. (2011). Determinants of green practice adoption for logistics companies in China. *Journal of Business Ethics*, *98*(1), 67–83. doi:10.100710551-010-0535-9

Luthra, S., Govindan, K., & Mangla, S. K. (2017). Structural model for sustainable consumption and production adoption—A grey-DEMATEL based approach. *Resources, Conservation and Recycling*, *125*, 198–207. doi:10.1016/j.resconrec.2017.02.018

Martinsen, U., & Björklund, M. (2012). Matches and gaps in the green logistics market. *International Journal of Physical Distribution & Logistics Management*, *42*(6), 562–583. doi:10.1108/09600031211250596

Matawale, C. R., Matawale, C. R., Datta, S., Datta, S., Mahapatra, S. S., & Mahapatra, S. S. (2016). Supplier selection in agile supply chain: Application potential of FMLMCDM approach in comparison with Fuzzy-TOPSIS and Fuzzy-MOORA. *Benchmarking: An International Journal*, *23*(7), 2027–2060. doi:10.1108/BIJ-07-2015-0067

Mavi, R. K., Goh, M., & Zarbakhshnia, N. (2017). Sustainable third-party reverse logistic provider selection with fuzzy SWARA and fuzzy MOORA in plastic industry. *International Journal of Advanced Manufacturing Technology*, 1–18.

Mentzer, J. T., DeWitt, W., Keebler, J. S., Min, S., Nix, N. W., Smith, C. D., & Zacharia, Z. G. (2001). Defining supply chain management. *Journal of Business Logistics*, *22*(2), 1–25. doi:10.1002/j.2158-1592.2001.tb00001.x

Min, H., & Galle, W. P. (1997). Green purchasing strategies: Trends and implications. *The Journal of Supply Chain Management*, *33*(2), 10–17.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Mintzberg, H. (1994). The fall and rise of strategic planning. *Harvard Business Review*, *72*(1), 107–114.

Mirmousa, S., & Dehnavi, H. D. (2016). Development of Criteria of Selecting the Supplier by Using the Fuzzy DEMATEL Method. *Procedia: Social and Behavioral Sciences*, *230*, 281–289. doi:10.1016/j.sbspro.2016.09.036

Mishra, N., Kumar, V., & Chan, F. T. (2012). A multi-agent architecture for reverse logistics in a green supply chain. *International Journal of Production Research*, *50*(9), 2396–2406.

Mishra, D., Gunasekaran, A., Papadopoulos, T., & Hazen, B. (2017). Green supply chain performance measures: A review and bibliometric analysis. Sustainable Production and Consumption, 10, 85–99. doi:10.1016/j.spc.2017.01.003

Misni, F., & Lee, L. S. (2017). A Review on Strategic, Tactical and Operational Decision Planning in Reverse Logistics of Green Supply Chain Network Design. *Journal of Computer and Communications*, *5*(08), 83–104. doi:10.4236/jcc.2017.58007

Mohammed, A., & Wang, Q. (2017). The fuzzy multi-objective distribution planner for a green meat supply chain. *International Journal of Production Economics*, *184*, 47–58. doi:10.1016/j.ijpe.2016.11.016

Nikbakhsh, E. (2009). Green supply chain management. In R. Zanjirani Farahani & ... (Eds.), *Supply chain and logistics in national, international and governmental environment* (pp. 195–220). Physica-Verlag HD. doi:10.1007/978-3-7908-2156-7_9

Oliver, J.G., Janssens-Maenhout, G., Muntean, M., & Peters, J.A. (2016). *Trends in global CO2 emissions: 2016 Report.* PBL Publishers.

Onat, N. C., Gumus, S., Kucukvar, M., & Tatari, O. (2015). Application of the TOPSIS and intuitionistic fuzzy set approaches for ranking the life cycle sustainability performance of alternative vehicle technologies. *Sustain Prod Consumption*, *6*, 12–25. doi:10.1016/j.spc.2015.12.003

Pandey, A., & Kumar, A. (2017). Commentary on "Evaluating the criteria for human resource for science and technology (HRST) based on an integrated fuzzy AHP and fuzzy DEMATEL approach". *Applied Soft Computing*, *51*, 351–352. doi:10.1016/j.asoc.2016.12.008

Patel, J. D., & Maniya, K. D. (2015). Application of AHP/MOORA method to select wire cut electrical discharge machining process parameter to cut EN31 alloys steel with brasswire. *Materials Today: Proceedings*, *2*(4-5), 2496–2503. doi:10.1016/j.matpr.2015.07.193

Pazirandeh, A., & Jafari, H. (2013). Making sense of green logistics. *International Journal of Productivity and Performance Management*, *62*(8), 889–904. doi:10.1108/IJPPM-03-2013-0059

Porter, M. E., & Van der Linde, C. (1995). Toward a new conception of the environment-competitiveness relationship. *The Journal of Economic Perspectives*, *9*(4), 97–118. doi:10.1257/jep.9.4.97

Rao, P., & Holt, D. (2005). Do green supply chains lead to competitiveness and economic performance? *International Journal of Operations & Production Management*, *25*(9), 898–916. doi:10.1108/01443570510613956

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Sabegh, M. H. Z., OzturkOglu, Y., & Kim, T. (2016). Green Supply Chain Management Practices' Effect on the Performance of Turkish Business Relationships. *International Journal of Supply and Operations Management*, *2*(4), 982.

Sari, K. (2017). A novel multi-criteria decision framework for evaluating green supply chain management practices. *Computers & Industrial Engineering*, *105*, 338–347. doi:10.1016/j.cie.2017.01.016

Saridogan, M. (2012). The impact of green supply chain management on transportation cost reduction in Turkey. *International Review of Management and Marketing*, *2*(2), 112.

Sarkis, J. (1999). A methodological framework for evaluating environmentally conscious manufacturing programs. *Computers & Industrial Engineering*, *36*(4), 793–810. doi:10.1016/S0360-8352(99)00166-7

Sarkis, J. (2003). A strategic decision framework for green supply chain management. *Journal of Cleaner Production*, *11*(4), 397–409. doi:10.1016/S0959-6526(02)00062-8

Sarkis, J., Zhu, Q., & Lai, K. H. (2011). An organizational theoretic review of green supply chain management literature. *International Journal of Production Economics*, *130*(1), 1–15. doi:10.1016/j.ijpe.2010.11.010

Srinivas, Y. M. (2014). Initiatives for Green Manufacturing in India. *BVIMR Management Edge, 7*(2).

Seyfettinoğlu, Ü. K. (2016). Analysis of Relationships between Firm Performance and Open Innovation Strategies and Stages in the Turkish Food and Beverage Industry. *New Medit*, (1): 42–54.

Sharma, V., Kumar, R., & Kumar, R. (2017). QUAT-DEM: Quaternion-DEMATEL based neural model for mutual coordination between UAVs. *Information Sciences*, *418-419*, 74–90. doi:10.1016/j.ins.2017.08.005

Shieh, J. I., Wu, H. H., & Huang, K. K. (2010). A DEMATEL method in identifying key success factors of hospital service quality. *Knowledge-Based Systems*, *23*(3), 277–282. doi:10.1016/j.knosys.2010.01.013

Song, W., & Cao, J. (2017). A rough DEMATEL-based approach for evaluating interaction between requirements of product-service system. *Computers & Industrial Engineering*, *110*, 353–363. doi:10.1016/j.cie.2017.06.020

Srivastava, S. K. (2007). Green supply chain management: A state-of-the art literature view. *International Journal of Management Reviews*, *9*(1), 53–80. doi:10.1111/j.1468-2370.2007.00202.x

Su, C. M., Horng, D. J., Tseng, M. L., Chiu, A. S., Wu, K. J., & Chen, H. P. (2016). Improving sustainable supply chain management using a novel hierarchical grey-DEMATEL approach. *Journal of Cleaner Production*, *134*, 469–481. doi:10.1016/j.jclepro.2015.05.080

Sun, S. G., Zhang, W. T., & Ying, L. I. U. (2017). Develop Green Building Materials, Optimize the Living Environment. *International Conference on Environmental Science and Energy Engineering (ICESEE 2017)*.

Supeekit, T., Somboonwiwat, T., & Kritchanchai, D. (2016). DEMATEL-modified ANP to evaluate internal hospital supply chain performance. *Computers & Industrial Engineering*, *102*, 318–330. doi:10.1016/j.cie.2016.07.019

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Tao, F., Bi, L. N., Zuo, Y., & Nee, A. Y. C. (2016). A hybrid group leader algorithm for green material selection with energy consideration in product design. *CIRP Annals-Manufacturing Technology*, *65*(1), 9–12. doi:10.1016/j.cirp.2016.04.086

Tatoglu, E., Bayraktar, E., & Arda, O. A. (2015). Adoption of corporate environmental policies in Turkey. *Journal of Cleaner Production*, *91*, 313–326. doi:10.1016/j.jclepro.2014.12.039

Thierry, M., Salomon, M., Van Nunen, J., & Van Wassenhove, L. (1995). Strategie issues in product recovery management. *California Management Review*, *37*(2), 114–135. doi:10.2307/41165792

Tooranloo, H. S., Azadi, M. H., & Sayyahpoor, A. (2017). Analyzing Factors Affecting Implementation Success of Sustainable Human Resource Management (SHRM) using a Hybrid Approach of FAHP and Type-2 Fuzzy DEMATEL. *Journal of Cleaner Production*.

Tsai, S. B. (2018). Using the DEMATEL model to explore the job satisfaction of research and development professionals in china's photovoltaic cell industry. *Renewable & Sustainable Energy Reviews*, *81*, 62–68. doi:10.1016/j.rser.2017.07.014

Tseng, M. L. (2009). A causal and effect decision making model of service quality expectation using grey-fuzzy DEMATEL approach. *Expert Systems with Applications*, *36*(4), 7738–7748. doi:10.1016/j.eswa.2008.09.011

Uygun, Ö., Kahveci, T. C., Taşkın, H., & Piriştine, B. (2015). Readiness assessment model for institutionalization of SMEs using fuzzy hybrid MCDM techniques. *Computers & Industrial Engineering*, *88*, 217–228. doi:10.1016/j.cie.2015.07.008

Vachon, C. (2007). Green supply chain practices and the selection of environmental technologies. *International Journal of Production Research*, *45*(18/19), 4357–4379. doi:10.1080/00207540701440303

Walker, H., Di Sisto, L., & McBain, D. (2008). Drivers and barriers to environmental supply chain management practices: Lessons from the private and public sectors. *Journal of Purchasing and Supply Management*, *14*(1), 69–85. doi:10.1016/j.pursup.2008.01.007

Wang, Y. F., Chen, S. P., Lee, Y. C., & Tsai, C. T. S. (2013). Developing green management standards for restaurants: An application of green supply chain management. *International Journal of Hospitality Management*, *34*, 263–273. doi:10.1016/j.ijhm.2013.04.001

Wells, P., & Seitz, M. (2005). Business models and closed-loop supply chains: A typology. *Supply Chain Management*, *10*(4), 249–251. doi:10.1108/13598540510612712

Wu, H., & Dunn, S. (1995). Environmentally responsible logistics systems. *International Journal of Physical Distribution & Logistics Management*, *25*(2), 20–38. doi:10.1108/09600039510083925

Wu, H. H., & Chang, S. Y. (2015). A case study of using DEMATEL method to identify critical factors in green supply chain management. *Applied Mathematics and Computation*, *256*, 394–403. doi:10.1016/j.amc.2015.01.041

Zhang, H., Peng, Y., Tian, G., Wang, D., & Xie, P. (2017). Green material selection for sustainability: A hybrid MCDM approach. *PLoS One*, *12*(5), e0177578. doi:10.1371/journal.pone.0177578 PMID:28498864

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Zhu, Q., & Sarkis, J. (2004). Relationships between operational practices and performance among early adopters of green supply chain management practices in Chinese manufacturing enterprises. *J. Ops. Mgmt.*, *22*(3), 265–289. doi:10.1016/j.jom.2004.01.005

Zhu, Q., & Sarkis, J. (2007). The moderating effects of institutional pressures on emergent green supply chain practices and performance. *International Journal of Production Research*, *45*(18/19), 4333–4355. doi:10.1080/00207540701440345

Zhu, W., & He, Y. (2017). Green product design in supply chains under competition. *European Journal of Operational Research*, *258*(1), 165–180. doi:10.1016/j.ejor.2016.08.053

KEY TERMS AND DEFINITIONS

Clean Technology: It means the technology that does not cause any harmful effects to the environment.

Globalization: It is the process in which there is a free movement of goods among different countries.

Green Supply Chain Management: It refers to the consciousness of the companies with respect to the environmental issues.

Recycling: It refers to the process of converting waste to the new objects that can be used again.

Return on Asset (ROA): It is calculated by dividing net profit to total assets. It shows how profitable a company is.

Reverse Logistics: It shows the role of the logistic in reusing, recycling, and reducing waste.

This research was previously published in the Handbook of Research on Supply Chain Management for Sustainable Development edited by Ulas Akkucuk, pages 144-175, copyright year 2018 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 66
Survey of State-of-Art in Green Cloud Computing

Sanjay P. Ahuja
University of North Florida, USA

Karthika Muthiah
University of North Florida, USA

ABSTRACT

Cloud computing is witnessing tremendous growth at one time when climate change and reducing emissions from energy use is gaining attention. With the growth of the cloud, however, comes an increase in demand for energy. There is growing global awareness about reducing greenhouse gas emissions and healthy environments. Green computing in general aims to reduce the consumption of energy and carbon emission and also to recycle and reuse the energy usage in a beneficial and efficient way. Energy consumption is a bottleneck in internet computing technology. Green cloud computing related technology arose as an improvement to cloud computing. Cloud data centers consume inordinate amounts of energy and have significant CO2 emissions as they have a huge network of servers. Furthermore, these data centers are tightly linked to provide high performance services, outsourcing and sharing resources to multiple users through the internet. This paper gives an overview about green cloud computing and its evolution, surveys related work, discusses associated integrated green cloud architecture – Green Cloud Framework, innovations, and technologies, and highlights future work and challenges that need to be addressed to sustain an eco-friendly cloud computing environment that is poised for significant growth.

1. INTRODUCTION

To know what Green Cloud Computing is let's split the words and understand the meaning of each word. The word "Green" implies living friendly to the environment and contributing towards maintaining ecological balance and preserving the planet and its natural resources. The word "Cloud" is used as an analogy for network of servers accessible over the internet that provides a service to its users. So green cloud computing refers to use of computers and relevant resources in an environmentally responsible manner through implementing energy efficient computer systems and their peripherals (Rouse, 2010).

DOI: 10.4018/978-1-5225-7915-1.ch066

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

It is known that global warming emitting greenhouse gases and other toxic gases are harmful to mankind and the environment. Moreover, human activities like burning of coal, natural gas and oil causes emission of more greenhouse gases results in change in climate and average temperature of the atmosphere. On the other hand, IT technology keeps advancing and is extensively used globally due to the tremendous growth of the internet in the past decades. Industries like medical, telecommunication, business, and financial are predominantly dependent on applications that are developed and serviced by information technology systems.

The demand for internet bandwidth has been accelerated by the advent cloud computing technology. Cloud computing is helpful in providing services like software, infrastructure, and platform to its clients in an efficient manner. The cloud computing network provides a shared infrastructure which includes large data centers to store and service the client's data. Energy consumption is the key concern in distributed cloud computing systems. This cloud's cooling system consumes more energy and power and results in major energy costs and high carbon emission.

It makes sense to save energy and recycle or reuse as much as possible for the wellness and preservation of the environment. Lot of research is going on in every field to make the environment pure and healthy. Safety measures have also been taken by many organizations to support eco-friendly environment. Nowadays industries and companies in various fields like science and technology, medical, manufacturing, research etc. have started transforming their innovations and developments towards green technology. Because of the utilization of inordinate amount of energy in cloud computing, it has become a necessity to find a way for reducing energy consumption and promote reusability. Green cloud computing technology has evolved to fill this need.

Green cloud computing aims in reducing energy utilization and promote a sustainable and eco-friendly environment in cloud computing field. This paper discusses how green cloud computing plays a vital role in reducing energy usage and carbon-di-oxide emissions in the cloud data-center setting.

The remaining sections in the paper are organized as follows, Section 2 will discuss about the introduction to cloud computing technology Section 2.1 is about green cloud computing and section 2.2 is its relevant terminologies. Section 3 is about Literature Survey. Section 4 describes about the list of organizations that supports Green Cloud Technology. Sections 5, 6, 7 and 8 will discuss about the study of the latest architecture – Integrated Green Cloud Computing, simulators, and algorithms of green cloud computing technology, benchmarks and the challenges it faces towards sustainability in environment. Lastly, Section 9 will discuss the conclusion and future work that can be done to improve this technology to a greater extent.

2. CLOUD COMPUTING

The ideas and concepts behind cloud computing have existed for many years. It was started in 1950's along with mainframe computing. In the 1970's virtualization concept was created in which one or more operating systems can execute simultaneously in an isolated environment. In the early 1990's, telecommunication companies were offering virtualized private network services to its users. In the late 1990's the term "cloud" signifies the computing space among provider and end user. Later on the cloud providers like salesforce.com, amazon.com, Google gained the major internet marketplace and proved the power of cloud computing to the real world.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

According to United States National Institute of Standards and Technology, Cloud Computing is defined as "A model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction". Cloud computing is used in one's personal as well as business life. It is widely used by major corporations like Amazon, Google, IBM, Sun, Cisco, Oracle etc., Social networking websites, email services, backup services, banking and financial services, health care and governmental agencies all use cloud computing.

Cloud computing is offered as different types of services like Software as a Service is commonly represented as SaaS, where the end user applications run on a set of pooled hardware resources and are accessed over the network; Platform as a Service is commonly represented as PaaS, a set of application components is offered by the service providers are used by developers put together into applications; Infrastructure as a Service is commonly represented as IaaS which subcontract the equipment that comprises of hardware, servers, storage, and networking components to support operations.

Cloud computing systems are characterized by on request self -service computing capabilities, wide network access on different platforms, multi-tenant model to serve multiple customers with hardware and simulated resources that are dynamically allocated and reallocated based on customer request, elasticity to scale up or down the services, and automatically optimized and which control the resource usage through measured service capability. Many IT companies and global brands like Amazon, Facebook, and Google are rapidly transforming their way of work, communication, sharing pictures, watching television, listening music to "cloud" systems in order to benefit the great services cloud offers. The cloud development and investment scale is very significant and it is been estimated that almost a 50-fold growth in digital data by 2020 and almost half a trillion in investment in the future years, all these are evident to generate and nourish our need for abundant access to endless information from our computers, laptops and mobile devices, rapidly (Cook, 2012).

2.1. Green Cloud Computing

The cloud data center consists of thousands of servers to store and manage the rapidly growing data and these consume tremendous amount of electricity equivalent to the electricity consumption of nearly 180,000 homes. For example, the datacenters in Amazon on a 3-year amortization-schedule estimated to be about 53% of the total budget on cost and operation payment of the servers, 42% on energy related costs, approximately 19% through power usage and cooling infrastructure and amortized over a 15 year period estimated to be about 23% on cooling infrastructure (Hamilton, 2009). Thus, we need to increase energy efficiency in cloud data centers to contribute to greater environmental sustainability. With the advent of Green Cloud technology it is possible to achieve better energy efficient and eco-friendly environment.

Green cloud computing is facing lot of challenges these days and research is going on in at various levels to attain energy efficiency and reduce power consumption in cloud computing architecture. The application level (SaaS) is focused on deploying the software on accurate infrastructure to ensure it executed efficiently, less energy consumption and good performance on many platform and hardware. The infrastructure level is focused on planning and resource management to reduce the workload that execute the user applications of active resources. Virtualization technique plays a vital role in this level.

At the datacenter level, many fine practices are proposed to improve efficiency by building energy effective datacenters. Many best practices has been recommended to improve efficiency from electrical to processor level of individual device (Garg and Buyya, 2012). It includes constructing the data center

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

by selecting a smart location, cooling systems to consume only 33.33% of overall energy consumption, power efficient servers and processors to be deployed in the datacenter and to design energy efficient power supply unit. At the monitoring/metering level, to construct a power model to determine the energy consumed by a particular device and to reduce the consumption. Green Grid proposed two metrics called Datacenter Infrastructure Efficiency (DciE) and Power Usage Effectiveness (PUE) (Rawson et al., 2008) to measure efficiency and improve performance of the datacenter's. At the network infrastructure level, the focus is on either node level or infrastructure level to achieve energy efficiency.

2.2. Relevant Terminology

This section lists the common terminology used in cloud or green cloud computing technology.

- **Computer Recycling:** A process in which equipment is broken into smaller pieces to recycle back the computer components easily. Recycling components include leaded glass from the cathode ray tubes, gold, copper, silver, tin ores and wires.
- **Green Computing:** It aims in reducing the usage of hazardous materials in computers, lower the energy consumption, maximize the new computers output, and recycle older computer parts to keep them out from landfills.
- **Electronic Waste:** It consists of discarded computer / electrical equipment. These wastes need to be recycled as they are harmful to environment.
- **Hibernate:** It is a feature of the operating system where the RAM is written to non-volatile storage before system power is turned off. The system can be restored without any break with exactly the programs that was left as before to work. Hibernating and restoring from hibernation is usually faster than normal system shutdown and reboot.

3. RELATED WORK: LITERATURE SURVEY

Saurabh et al in (2012) discuss that to achieve energy efficiency a detailed analysis on cloud related to their power efficiency is required and how these solutions draws a conclusion that directs to enable green cloud computing. Green cloud computing was enabled to provide solution to network contribution via Green Cloud Architecture which considers user's and provider's aspect to make green. In this architecture the greenest cloud provider is selected through a middleware green broker to service user's request. The framework's efficiency is validated using 5 policies including Greedy Minimum Carbon Emission, Minimum and Minimum Carbon Emission, Green Maximum Profit, Maximum Profit Maximum Profit and Minimizing Carbon Emission and Maximizing Profit and proved to be efficient with carbon emission. It is inferred that green policies reduces almost 20% of carbon emission and the usage of energy efficient solutions benefits both users and cloud providers. The paper concludes towards future direction to make green cloud reality with still many technological solutions like designing software at various levels, understanding the existing datacenter's cooling, power designs, energy consumption and resource utilization, design complete resulted in planning and resource provisioning for applications, and emerging technologies do not bring irreversible change and threat to human health society are required.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Qilin et al in (2011) discusses about finding a unifying abstraction in managing the tasks of hardware abstraction, resource allocation and operating system that needs energy awareness being integrated. Three major things approached in green networking are Re-engineering is to design more energy efficient components in network architecture. Dynamic adaptation aims in modulating the capacities of network device resources. The third approach Sleeping/Standby is used to select the idle portions to minimal standby mode and wake it up whenever necessary in the network. The paper concludes that in future many issues like metrics, benchmarking standards, green data and abstraction layers control; redundant devices support and management; virtualization and equipment in networks all requires investigation.

Mazedur et al in (2013) addresses and classifies the energy saving issues and challenges in mobile clouds and computing, reviews the current research techniques and outputs, examines their strengths and weaknesses, and identifies open issues for future research. The energy consumption issue during computation task is addressed by offloading computation to cloud and derive the amount of energy saved. In ad-hoc mobile cloud framework only small portion of task is executed locally and remaining is delegated to nearby mobile which already runs the same task. The cellular data rates are monitored periodically at a chosen interval in order to minimize the significant usage of device energy. Catnap, an energy saving strategy accumulates the small intervals between packets to form large intervals when the device is sent to sleep mode without changing packets actual delivery time. EnaCloud approach uses energy aware heuristic algorithm to generate the application assignment and schemes scheduling in response to workload entry and exit, and alter the events size. The paper concludes that technology only focus on specific issues from one perspective and lacks saving energy with well-defined frameworks and solutions to address diverse green computing issues and needs in mobile clouds. The future research focus is on developing an innovative energy-saving infrastructure based on real-time analysis and intelligent decision-making.

4. ORGANIZATIONS

This section lists some of the organizations that help in regulating green computing in today's worldwide markets.

- **TCO Certification:** A series of accreditations and principles fixed up and maintained by TCO Development. These accreditations refer to monitors and high standards for computer equipment's, mobile phones, furniture's and additional electrical office tools.
- **Climate Savers Computing Initiative:** It comes under non-profit organization (NPO) consisting of customers, businesses, and other maintenance organizations are helpful in refining power efficiency, consuming less energy, and promoting smart technologies in computers.
- **Green Computing Impact Organization (GCIO):** It is a non-profit organization to support end clients and more responsibility towards environment with their products. It provides special services in auditing to help their users.
- **Green Electronics Council:** On the basis of 28-point criteria, different systems and components are evaluated to measure the efficiency of the product and its attributes.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

5. INTEGRATED GREEN CLOUD COMPUTING ARCHITECTURE

The Green Cloud Framework was proposed as an integrated solution with the intention to reduce energy consumption in green clouds. Cloud is made green by considering users and providers aspect. With the help of green broker middleware, the software type cloud service request is submitted by the users. The greenest cloud provider is selected by the middleware broker to service user's request. The services are registered by cloud providers as green offers which need the access time for least carbon emission to a public directory and time being retrieved by green broker.

By using different cloud services and carbon emission directory, the present energy parameters status are received by green brokers (Kawade and Kapse, 2013). The entire data associated to energy efficiency is maintained in Carbon Emission Directory which also includes Power Usage Effectiveness (PUE), network cost, cooling efficiency for datacenters, and emission rate of carbon in electricity. The carbon discharge value is calculated for all cloud providers and the service with the least value is selected by Green Broker and buys it as a representative of users.

To make the requested service "Green" the complete energy utilization and efficiency of each cloud provider that depends on carbon emission directory and green providers components are kept track by Green Cloud Framework. In the cloud providers aspect each cloud layer should be conscious about "green" and in user's aspect serving a user is a crucial role where the cloud services are selected and monitored on the basis of Quality of Service (QoS) requirements by Green Broker to ensure minimum carbon emission.

It becomes essential to ideal and amount the efficiency of energy design, operation and software deployment on behalf of SaaS service level providers. While serving users, only the least figure of copies of user private data should be retained by energy proficient storage. At the PaaS platform service level the developed applications should confirm wide energy efficiency in system by addition of energy profiling tools like JouleSort, a scale to measure vital energy to do external sort. The IaaS infrastructure service level providers offers both infrastructure and other support services and plays an important part in accomplishment of green architecture. They design various green offers and incentives to users using the service throughout the off-peak hours of energy efficiency.

6. STUDY ON GREEN CLOUD SIMULATORS

These simulators were developed in recent years to make cloud data centers energy efficient. This study discusses the features of different energy efficient green cloud simulators available namely, GreenCloud, iCanCloud, CloudSim and Cloud Reports.

The *GreenCloud Simulator* is an extension to packet-level network simulator Ns2 and offers a finely tuned energy consumption model by the elements like server, switches and links of the data center. The user demands need to be satisfied by transforming the received power to computing work. Server element uses varied job scheduling mechanisms extending from simplest round-robin to advanced Dynamic Voltage and Frequency Scaling and DNS supported, preset processing power limit and memory or storage resources size to implement single core nodes. The execution of workload is performed by delivering the load to one of the computing servers through interconnection fabric in an appropriate way using switches and links elements of data center. Each workload object execution requires the computational and communicational components for its successful completion. The comparison study done on differ-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

ent data center architecture based on setup composed of 1536 computing nodes employed energy-aware "green" scheduling policy for the incoming workloads arrived in exponentially distributed time intervals (Kliazovich et al., 2010). The policy aimed at grouping the workload together on a least possible set of computing servers allowing idle servers to be put into sleep. The dynamic shutdown showed effective result on both servers and switches energy efficiency.

iCanCloud is a new simulator with features such as elasticity, performance and scalability of cloud infrastructures. It is made based on the following design principles: target to conduct large experiments from literature, offers stretchy and wholly modifiable universal hypervisor for incorporating any cloud brokering rule, creation of instance type replica's as delivered by cloud setup, and lastly, it has a user-friendly GUI for organizing and initiating simulations (Nunez et al., 2012).

CloudSim is a popular simulator for cloud parameters, free and open source software based on Java code library. It provides the features like, an autonomous platform for service brokers, provisioning policies and model large-scale clouds; support and maintenance for simulation of computing environments and network connections; ability for simulation of combined cloud environment and experimentation studies linked to Cloud-Bursts and spontaneous application scaling (Calheiros et al., 2010).

CloudReports, a realistic tool to simulate scattered computing settings created using Cloud Computing pattern which uses CloudSim's simulation engine and offers easy access of graphical user interface, providing report information and design of extension plugin (Gupta, 2013).

7. STUDY ON GREEN CLOUD ALGORITHMS

This section lists some of the algorithm studied related with green cloud computing.

- *Green Genetic Algorithm* is a search heuristic based on genetic operations used for generating solutions to optimization and search problems. Two algorithms Critical Path Genetic Algorithm to minimize total execution time and Task Duplication Genetic Algorithm to deal with load balance satisfaction and to overcome communication overhead was developed. The Improved Genetic Algorithm was developed to make use of the computing resources to complete the tasks in shorter time period and reduced costs. It includes chromosome encoding and decoding, production of the initial population, fitness function, and genetic operations: selection, crossover and mutation (Nirubah and John, 2014).
- *Improved Clonal Selection Algorithm (ICSA)* will regulate the complete distribution of resources. As a pre-process, relationships are mapped into binary codes as a set of initial population X (0) and every individual i.e., antibody represent a binary series of characters of bits among tasks and resources. The length of the bits is used to get solution for the problem. The resource allocation process in ICSA evaluates the attraction of each antibody and the one with higher attraction is taken for subsequent generation. The selected antibodies are multiplied and replicated in the current population and then executed to mutation operation which produces a mutant individual. By this way, the worst antibodies are replaced best antibodies from the clonal library (Shu et al., 2014).
- *Green Scheduling Algorithm* used neural network predictor to address the shortage of energy problem and global climate change. It uses four different running modes namely, optimal, conventional, prediction and prediction plus 20% additional servers mode to predict the future load demand.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Six new algorithms, namely Shortest Task First for Computer with Minimum Energy and Random Computer, Longest Task First for Computer with Minimum Energy and Random Computer, Random Task for Computer with Minimum Energy and Random Computer are developed to reduce the pollution and lower energy consumption.

Two traditional heuristic task scheduling algorithms - Shortest and Longest Task First for Computer with Minimal Energy First with Maximum Speeds and two new green task scheduling algorithms – Shortest and Longest Task First for Computer with Minimum Energy First with Speed Adjustment are evolved to minimize energy consumption in multi-task scheduling problem. Six energy-efficient task scheduling algorithms with continuous speeds, discrete speeds and hybrid algorithms are developed to conserve maximum energy (Nirubah and John, 2014).

- *Green Algorithm* is an effective way used for short and long terms to consolidate the tasks to manage clouds. In short term, the volume flux is handled by decreasing the live resources count and inordinate to a power saving mode or switching off systematically and in long term, cloud providers create an improved model to facilitate power and resources to lower the burden due to excess of provisioning. The two energy conscious algorithms used in power management are Maximum Utilization, and Energy and Task Consolidation (Yamini, 2012).

8. BENCHMARKS

This section lists the benchmarks used in green cloud computing that are helpful to make the cloud performance easy.

Perfkit is a living benchmark framework intended to develop through cloud technology variations and measures the latest workloads and makes knowledgeable decisions that matches infrastructure needs. New design tools, patterns and providers arise to keep it up-to-date (Google Cloud Platform Performance Team, 2015).

Grid'5000 similar to a benchmark is a large-scale, versatile test bed used to perform research experiments focusing on parallel and distributed computing which includes Cloud, High-Performance Computing (HPC), and Big Data (Grid'5000).

9. CONCLUSION AND FUTURE WORK

Cloud Computing has made tremendous impact to how business and companies leverage on computing technology. Green Computing has been evolving and makes amends on improving technology. There have been innovations, changes in architecture, simulators and other energy-efficient algorithms that are trying to help computing environment friendly. Green Cloud is one such, where it makes cloud computing friendly to our ecosystem.

The future of Green cloud is still evolving, with more work towards green computing and efficient algorithms. Green cloud is not a distant reach, new techniques will come out which is not only energy efficient but also efficient carbon emission usage. Cloud providers should reduce the demand of electricity in clouds and shift to using renewable energy sources for servicing.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

REFERENCES

Calheiros, R.N., Ranjan, R., Beloglazov, A., De Rose, C.A.F., & Buyya, R. (2010). CloudSim: a toolkit for modeling and simulation of cloud computing environments and evaluation of resource provisioning algorithms. doi:10.1002pe.995

Cook, G. (2012, April). How clean is your cloud? *Greenpeace International*.

Garg, S.K., & Buyya, R. (2012). Green Cloud computing and Environmental Sustainability. In Harnessing Green IT: Principles and Practices (pp. 315-340). UK: Wiley Press.

Google Cloud Platform Performance Team. (2015, February 11). New Open Source tools for measuring Cloud Performance. Retrieved from http://googlecloudplatform.blogspot.com/2015/02/new-open-source-tools-for-measuring-cloud-performance.html

Grid5000. (n. d.). Retrieved from https://www.grid5000.fr

Gupta, P. (2013). Cloud Report Simulator. *Cloudsim-setup*. Retrieved from http://cloudsim-setup.blogspot.com/2013/01/cloud-reportcloudsimseulator.html

Hamilton, J. (2009) Cooperative expendable micro-slice servers (CEMS): low cost, low power servers for internet-scale services. *Proceedings of CIDR'09*, California, USA.

Kawade, U., & Kapse, S. (2013, April 19-20). Green Computing: An Integrated Approach to Cloud Computing Architecture. *Proceedings of National Conference on Emerging Trends: Innovations and Challenges in IT*.

Kliazovich, D., Bouvry, P., & Khan, S.U. (2012). GreenCloud: a packet-level simulator of energy-aware cloud computing data centers. Springer Science + Business Media. doi:10.100711227-010-0504-1

Li, Q., & Zhou, M. (2011). The Survey and Future Evolution of Green Computing. *Proceedings of the 2011 IEEE/ACM International Conference on Green Computing and Communications*. doi:10.1109/GreenCom.2011.47

Nirubah, J., & John, R.R. (2014). A Survey of the Impact of Task Scheduling Algorithms on Energy-Efficiency in Cloud Computing. *International Journal of Engineering Research and Technology*, *3*(1).

Nunez, A., Vazquez-Poletti, J.L., Caminero, A.C., Castane, G.G., Carretero, J., & Llorente, I.M. (2012). iCanCloud: A Flexible and Scalable Cloud Infrastructure Simulator. Springer Science + Business Media. doi:10.100710723-012-9208-5

Rahman, M., Gao, J. & Tsai, W.-T. (2013). Energy Saving Mobile Cloud Computing. *Proceedings of the* 2013 *IEEE International Conference on Cloud Engineering*. DOI:.37.10.1109/IC2E.2013

Rawson, A., Pfleuger, J., & Cader, T. (2008). *Green Grid Data Center Power Efficiency Metrics*. Consortium Green Grid.

Rouse, M. (2010, May). Green Computing definition. *Techtarget.com*. Retrieved from http://searchdatacenter.techtarget.com/definition/green-computing

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Shu, W., Wang, W., & Wang, Y. (2014). A novel energy-efficient resource allocation algorithm based on immune clonal optimization for green cloud computing. *EURASIP Journal on Wireless Communications and Networking*, *64*. Retrieved from http://jwcn.eurasipjournals .com/content/2014/1/64

Yamini, R. (2012). Power Management in Cloud Computing using Green Algorithm. *Proceedings of the International Conference on Advances in Engineering, Science and Management*.

This research was previously published in the International Journal of Green Computing (IJGC), 7(1); edited by Vicente Gonzalez-Prida, pages 25-36, copyright year 2016 by IGI Publishing (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 67
Looking Good and Thinking Green:
Can Green Personal Care Products Be Promoted?

Gauri Joshi
Symbiosis Centre for Management and Human Resource Development (SCMHRD), India

Gurudas Nulkar
Symbiosis Centre for Management and Human Resource Development (SCMHRD), India

ABSTRACT

The purpose of this paper is to determine the extent of environmental concern among consumers while purchasing personal care products. This paper also examines the role of consumer's willingness to pay for environmentally friendly products while making green purchase. It also tests if willingness to pay can be predicted based on certain product attributes. An exploratory factor analysis was carried out to develop the conceptual framework and based on which a questionnaire was designed. Primary data was collected from 300 respondents, women working in Information technology sector between the age group 25-45. The results show that there is high amount of environmental awareness among the consumers. However due to lack of proper and reliable information exchange between the manufacturers and the consumers this awareness does not materialize in green purchase behavior. Consumer's willingness to pay extra for ecolabeled product is dependent on the product reliability and appeal. Hence ecolabeled products stand a chance to be selected if they are appealing and reliable.

1. INTRODUCTION

The personal care products category (PCP) in India is rapidly growing. Over the last a few years, it has witnessed a 12 percent growth (Walkers, 2013). Products which once targeted higher income consumers are increasingly accessible to lower economic segments. C.K. Prahlad's call for serving the bottom of the pyramid has spawned several innovations; a notable one is the single serve sachet, which helped

DOI: 10.4018/978-1-5225-7915-1.ch067

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

companies reach out to the poor and create an environmental menace with the lack of proper disposal of the sachets (Nulkar, 2016). The PCP market includes large multinational and domestic players who have since, widened their product ranges to accommodate new market segments. In the euphoria of rapidly growing markets and increasing competitive intensity, the environmental impacts of PCP cannot be ignored. Like other products, they impact the environment in the entire life cycle consuming resources, creating waste and emissions during production, distribution and consumption and increasing the carbon and water footprints. Even as regulation and competitive pressures drive companies to improve their performance within their premises, overuse of resources and waste generated in consumption is not controlled and urban waste is turning out to be one of India's biggest problems. Moreover, consumers are often unaware of environmental impacts of the products they buy (Kennedy, Beckley, McFarlane, & Nadeau, 2009) which makes them overlook the environmental costs of their purchases. In this situation, it is imperative to promote green behavior in consumers of PCP category.

Product labels have been considered useful in this quest. Labels are used to convey specific attributes of the product that may be overlooked by consumers (Koos, 2011). Similarly, they can display environmental information about the product. This is increasingly seen in durables, especially those which consume energy during use. Environmental certifications and marking systems have evolved in many countries, which can be placed on product labels. Unfortunately, Indian industry lacks sophisticated labeling norms and has a weak enforcement regime. Unscrupulous sellers can get away with deceitful information. In 1991 the Ministry of Environment and Forests (MoEF) introduced 'Ecomark' scheme of labeling for environment-friendly products, however, this does not have a wide industry acceptance.

The authors conducted an exploratory study to examine factors which can influence green purchase behavior in consumers during purchase of personal care products. The role of ecolabels in this category was also studied. This paper presents the results of the study conducted on 300 women consumers and 35 retailers of PCP in Pune, India. This research is intended to assist in development of a more comprehensive study on PCP and ecolabeling. In the paper the term ecolabel is used to denote the information displayed on products about environmental impacts in their life cycle. The word 'green' is used to denote the environmental considerations.

2. LITERATURE REVIEW

Growing awareness of environmental problems and increasing media coverage have prompted many firms to take up greener practices. Studies show increasing consumer awareness and concern of the environmental impacts of the products they buy, and this manifests in growing purchases of environmentally friendly products across markets (AMF do Paco. & Raposo, 2009). Consumer's environmental concern is not easily translated into pro-environmental behaviour, so individuals holding strong beliefs that their environmental conscious behaviour will result in positive outcome are more likely to engage themselves in such behaviour in support of their concern for the environment (Sharma & Bansal, 2013).

Akwa (2009) suggests that women are significant actors in natural resource management and major contributors to environment rehabilitation and conservation. Studies also show that women are generally more willing to pay a premium for a green-product (Blend & Van Ravenswaay, 1999) (Loureiro & Lotade, 2005), (Loureiro M., 2003), (Loureiro, Mittelhammer, & McCluskey, 2002), (Brécard, Hlaimi B., Lucas S., Salladarré F., & Y., 2009). However, Lee (2011) argued that the environmental awareness of consumers affects environmental friendly behavior. To differentiate green products from others, it

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

is then important to communicate environmental information of the product to consumers. Moreover, terminology is not clearly defined and "recyclable", "eco-friendly", "environmentally safe" could mean different things to different manufacturers (Borin, Cerf, & Krishnan, 2011).

Studies have examined awareness, attitude, cultural background and situational factors to explain green purchase behavior in consumers. Bray et al (2011) note that despite environmental concerns and positive attitude of consumers towards sustainability and green products, market share of green products remains at about 3% of the entire market. Green purchase behavior forms a complex form of ethical decision-making behavior (Joshi & Rahman, 2015). Individual values and concerns for health, safety and pleasure specifically affected green food purchase behavior (Cerjak, Mesic, Kopic, Kovacic, & Markovina, 2010). Tsarkiridou et al (2008) found habit to be an important obstacle to green purchasing, which makes it difficult to change behavior. Another challenge is posed by the lack of trust consumers have on green claims and confusion among green characteristics (Joshi & Rahman, 2015).

Nelson (1978) suggests that an environmentally conscious consumer may be held back if she lacks sufficient knowledge on intended purchase and environmental labels are gaining importance as a tool for identification of green products (D'Souza, Taghian, & and Lamb, 2006).

Our concepts about price shape an expectation, which then biases our experience and our purchasing behaviour (Plassmann, 2008).

The increased concern of consumers towards the environment is reflected by their willingness to pay relatively higher prices for products that have been produced in an environmentally friendly manner. This increased willingness to pay provides a positive incentive for producers to choose techniques that minimize the adverse effects on the environment and improve the quality of final products (A. K. Basu., N. H. Chau., & U. Grote., 2003) In the Indian context there are few studies published on understanding the female consumer's willingness to pay for eco-labeled personal care products. The present study uses the Product Reliability which in this paper is an aggregate of Government certification, fixed vendor and Superior quality of product and Label Appeal which is an aggregate of the label design and the advertisement of the labeled product as predicting variables to predict the willingness to pay for an ecolabeled product.

Eco labels include claims like 'recyclable', 'eco-friendly', and 'recycled content' so as to catch attention of consumers that are looking for ways in which they could reduce adverse impacts to environment through purchasing decisions (Sinha, 2014). Ecolabels convey more than just functional properties of products. Scholl (2006) suggests that the symbolic values of a product can be more decisive, and ecolabels play an important role in this. Ecolabels can hold a variety of information and the quality of an ecolabel depends on the standards it selects (CSI, 2010). Moisander (2007) discusses the role of ecolabels in reducing controversial and dubious ecological information and how they could simplify decision making for consumers (Thøgersen, Jørgensen, & Sandager, 2012). Several studies have been undertaken on ecolabels (Gallastegui, 2002) (D'Souza, Taghian, & Lamb, 2006). Many researchers agree that ecolabels can influence consumers to take an informed purchase decision (Sherman, 2012) and are considered important to improve consumer's trust in a firm's environmental claims (Thøgersen, 2002) (Commission of the European Communities, 2007).

One category of ecolabel literature talks on relevance to buyers and sellers while another discusses third party eco-certifications and its market implications. An accepted definition of ecolabel is by Global ecolabeling network (GEN) - 'A label which identifies overall environmental preference of a product (i.e. good or service) within a product category based on life cycle considerations'. Rex (2007) considers it a tool for consumers to facilitate decision making during choice of environmentally friendly products.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Horne (2009) discusses the role of appropriate label information in sustainable purchasing. The large number of symbols and marking add to consumer's difficulty in assessing the comparable advantages of different products. Additionally, labels could be incomplete in terms of comprehensive environmental disclosure. Even as the social cost of purchase is not a high priority for many consumers, they could be persuaded to make an environmentally better choice through ecolabels.

However, some studies show a lack of trust among consumers on the information provided while some may not understand environmental information on the ecolabels. This leads to confusion or even negative reactions towards ecolabels (Hamilton & Zimmerman, 2006). Few studies show evidence of a variety and sheer number of eco-certifications and labels leading to consumer confusion (Leire, 2005). Moreover, it is often difficult to identify with accuracy the true attributes of product environmental impacts, the credibility of the ecolabeling process is important to facilitate consumer choices of green products (Mason, 2006). Some of the early generations of ecolabeled products were associated with lower quality products and some consumers might still associate ecolabels with lower quality products and be reluctant to purchase them (Gallastegui, 2002) (Peattie & Crane, 2005). Teisl (2008) suggests that the success of an ecolabel depends on its ability to present the information in such a way so that the consumer absorbs it. One study suggests that consumer's growing preference to ecolabeled products could give sellers a competitive advantage and an incentive to develop more environmentally friendly products (Grankvist, Dahlstrand, & Biel, 2004).

Third party eco-certifications, often given by non-producing organizations, have been studied in many countries. They suggest that there is growing acceptance of such certifications since they offer an independent validation of the producers' claims (Ibanez & Grolleau, 2008) (Cason & Gangadharan, 2002). In India Eco-Mark was launched in 1991. However, this has not met expected success (Mehta, 2007). Unlike category specific labels, the Eco-mark can be used for wide range of product categories from paper, pulp to leather to detergents to personal care products like soaps. Food and personal care items are low-involvement products which entails minimal effort and consideration before a purchase decision. Hence we need to check for the success of the ecolabeling scheme for such products; especially considering that the personal care products business is nearly $950 billion market and expected to treble by 2020.

3. MATERIALS AND METHODS

We first examined empirical research from various countries, to identify factors affecting green behavior among consumers. This was followed by exploratory interviews with consumers and retailers of PCP in Pune. Based on this, a conceptual model was developed which proposed factors affecting green purchase behavior and their relationship. A detailed questionnaire was developed with a web based survey application. This was administered online and in paper and pen format to over 450 respondents living in Pashan, Bavdhan, Aundh and Hinjewadi suburbs of Pune city. Respondents were working women between ages 20 to 45 and employed in the information technology sector in Pune. Sampling methods employed were simple random using internet lists, convenient samples and snowballing. 300 valid responses were analyzed. For selection of retailers, random and convenience sampling methods were used. In-depth interviews were conducted with 35 retailers. This comprised of chemists, vanity store owners and grocery store owners but did not include organized retailers like D-Mart, Big Bazar and others.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

3.1. Objectives, Conceptual Framework and Hypotheses

Although many studies on consumers' green purchase intentions in the PCP category are published from developed countries, very few from India were available. Most Indian research focuses on organic food or healthcare products. This study was developed with two primary objectives: (i) to examine factors which affect the green purchase behavior of consumers in personal care products and (ii) to study the role of ecolabels on consumers' purchase behavior. Urban working women are important target segments for PCP. Based on previous studies, we identified factors and studied them within Indian working women. Additionally, the environmental awareness, attitudes and behavior of respondents helped understand the environmental considerations in purchase of PCP.

3.2. Conceptual Framework

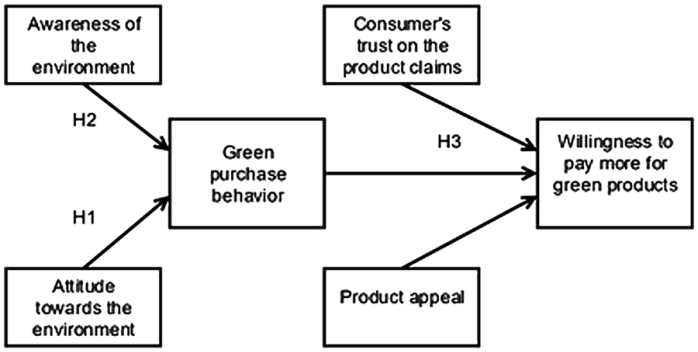
The conceptual framework (Figure 1) depicts the research variables and proposes relationships between them.

Corresponding to the objectives we propose the following hypotheses:

H1: Green purchase behavior is dependent on the consumer's attitude towards the environment.
H2: Green purchase behavior is dependent on the consumer's environmental awareness.
H3: Consumer's trust on the product and its appeal will result in a higher willingness to pay more for green products.

The questionnaire opened with relevant demographic questions and questions on leisure activities, shopping frequency and preferences. The construct '*Attitude towards environment'* was operationalized by classifying attitudes based on responses to questions on personal care products and the environment, recycling and on willingness to pay for environmentally friendly products. The respondent's '*Awareness of environmental issues'* was measured through questions on ecolabels, environmental terms and respondents' understanding of the impact of personal care products on the environment. One set of questions pertained to the extent of information sought during the purchase, her awareness and perceptions of ecolabeling and factors which might influence respondents to choose eco-labeled PCP.

Figure 1. Conceptual framework



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

4. RESULTS AND DISCUSSIONS

The research focused on the personal care product category. A list of the sub-categories is shown in Table 1. The demographic profile of the respondents is shown in Table 2.

The responses were clubbed into the two age groups - Age group 1 for respondents from 20 to 35 and Age group 2 for those over 35 years. 79.7% of the respondents fell in Age group 1 and 20% in Age group 2. 64% of all respondents earn up to INR 50,000 per month, which indicates that they are in early stages of their careers. To group the respondents according to their activities and interests, we conducted an exploratory factor analysis (EFA). The reliability test on this set of questions yielded Cronbach's alpha of 0.706. The EFA came up with four groups which were named as Multiactive, Self-engaged, Relaxed, TV addicts.

The respondents' 'Awareness of environmental issues' was measured through a set of questions and the responses were given marks. The total marks were termed as the Awareness Score. Due to a high variance in this score, three groups were made representing three levels of environmental awareness – high, medium and low. The number of respondents in each Awareness level is shown in Table 3.

Table 1. List of personal care product categories in this study

Soaps
Hair care
Skin care
Oral care
Baby and child care
Men's grooming
Cosmetics

Table 2. Demographic profile of respondents

Sr. No.	Characteristic	Category	Frequency	Percent
1	Age	20 to 35 years	239	79.7
		Over 35 years	60	20
2	Monthly income	Upto 50,000	191	63.7
		50 to 100,000	55	18.3
		100,000 and above	37	12.3

Table 3. Level of environmental awareness among respondents

Level of Environmental Awareness	Number of Respondents	Percent of Respondents
Low	73	24.3
Medium	53	17.7
High	174	58.0
Total	300	100.0

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Considering the educational and other demographic similarities in the respondents, the high incidence of environmental awareness was expected.

In the same manner, the Attitude Score was computed from the set of questions measuring the respondents' attitude. The scores were clubbed into negative, indifferent and positive Attitude Type. The frequencies are shown in Table 4.

The majority of respondents (63%) demonstrated an indifferent attitude, which is surprising, since 58% had high environmental awareness. Our review of other studies suggested that this could be due to a low trust that consumers have on environmental information, certifications and on the lack of accepted definitions of green products.

To test if the Attitude and Awareness levels are independent of each other a Fisher Exact Chi Square test was conducted. The test showed a significant dependence of the two variables (p=0.006). Table 5 shows the test results.

74.4% of the respondents with a positive attitude had a high awareness. This suggests a need to improve consumer awareness and one way to do this is displaying environmental information on the product label. Such information is found on some product categories in India, however, not in the PCP category. There is also a need to communicate the benefits of purchasing ecolabeled products through various mediums of communication.

4.1. Green Behavior

We asked the respondents their shopping preferences in sub-categories. The sub-categories included deodorants, sunscreen lotions, moisturizer and body wash, hair care products, colour cosmetics, oral care products and baby products. From the responses the 'Green Behavior Score' was computed for the respondent. These scores ranged from -17 to +20. Based on their z values the scores were clubbed into three 'Shades of Green Behavior' - Brown, Grey and Green (Table 6). A 'brown' consumer would have neither sought nor purchased ecolabeled PCP in any of the categories'; a 'grey' consumer may have

Table 4. Respondents' attitude towards the environment

Attitude Type	Number of Respondents	Percent of Respondents
Negative	68	22.7
Indifferent	189	63
Positive	43	14.3
Total	300	100.0

Table 5. Correlation between the level of environmental awareness and attitude of respondents

		Level of environmental Awareness			
		Low	Medium	High	Total
Attitude	Negative	33.8%	23.5%	42.6%	100%
	Indifferent	21.7%	18.5%	59.8%	100%
	Positive	20.9%	4.7%	74.4%	100%
		24.3%	17.7%	58%	100%

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 6. Shades of green behaviours among respondents

Shade of Green Behavior	Brown	Grey	Green	Total
Number of respondents	44	89	167	300
Percent of respondents	14.7%	29.7%	55.7%	100%

sometime bought one or more of the ecolabeled PCP category products and a 'green' would have bought and searched for ecolabeled products.

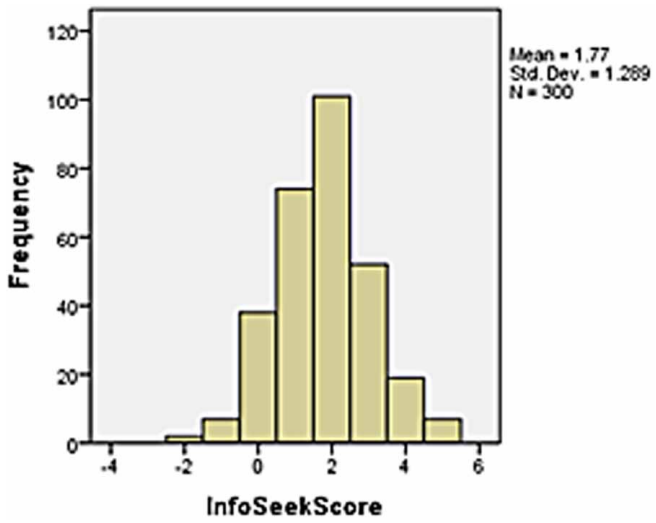
In our study, a large number of consumers demonstrated green behavior (55.7%). Considering the earlier finding, it is possible that consumers may have inadvertently chosen greener products. This suggests that at least some environment considerations in the PCP can improve the value of the product in some way which is important to consumers. For example, consumers perceive herbal products as more health friendly. This finding can be an important reason for companies improve their environmental performance and to educate consumers on those aspects of their products.

4.2. Do Consumers Seek Environmental Information During Purchase of PCP?

To answer this, we asked questions about the respondent's search for information in the purchase process. The questions checked how often respondents read the label information and what information they read. The responses were scored into an InfoSeek Score. The scores ranged from -2 to 6 (see Figure 2).

The skew of the histogram indicates that consumers seek environmental information during these purchases. This was supported by responses from retailers who said that consumers generally read product labels during purchase. This finding places importance on the role of labels in conveying the information sought as well as emphasizes that retailers should have knowledgeable and sales persons at the counters who can help consumers interpret the ecolabels. This will increase the chances of sale of ecolabeled products (Pandey & Khare, 2015).

Figure 2. Scores



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

4.3. Is the Green Purchase Behavior Dependent on the Information Sought by Consumer in the Buying Process?

To understand this, we carried out a parametric ANOVA to see if the mean InfoSeek Score was different in the three groups of Shade of Green behavior. The ANOVA showed a highly significant difference in the mean scores in Brown, Grey and Green behavior groups. This suggests that consumers who exhibit a green behavior have a higher tendency to seek information on the product. This could explain the increase in the market share of organic personal care products category in India, which mention 'organic' on their labels. Product information, in addition to manufacturer's information and product usage form a part of Secondary benefit which women seek to satisfy while making purchase decision related to personal care products (Sundari & Murugan, 2011).

4.4. What Drives Consumers' Willingness to Pay a Premium for Ecolabeled PCP?

To understand consumer's willingness to pay extra for an eco-labeled product, we conducted a factor analysis by grouping items from Q.23. The questions comprised of options influencing the purchase of ecolabeled personal care products. The factor analysis yielded 5 factors which were grouped under two sub headings of 'Product Reliability' and 'Product Appeal'. Three variables - buying from a known vendor, presence of independent certifications on labels and the quality of the product being bought were grouped under 'Product Reliability'. The other two variables - well designed label and advertisement of ecolabeled products, were grouped under 'Product appeal'. A regression equation was formed with 'Willingness to pay extra' as the dependent variable and 'Product reliability' and 'Product appeal' as independent variables. The relation between 'Product reliability' and 'Willingness to pay' is significant with a B value of 0.166. Similarly, the relation between 'Product appeal' and 'Willingness to pay' is also significant with a B value 0.146. The regression equation explains an overall variance of 26% (Table 7). This suggests that there are other factors apart from 'Product reliability' and 'Product appeal' which influence the willingness to pay extra for eco-labeled products and worth studying further. This supports the third hypothesis made in the conceptual framework - *Consumer's trust on the product and its appeal will result in a higher willingness to pay more for green products.*

A further analysis on the responses on 'Willingness to Pay' more for ecolabeled PCP yields four categories of respondents - not willing to pay more, unsure if they would pay more, willing to pay up

Table 7. Regression between Prodrel and ProdAppeal

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	.867	.266		3.261	.001	.344	1.390
	Q24_Prodrel	.166	.022	.395	7.717	.000	.124	.209
	Q25_ProdAppeal	.146	.028	.268	5.235	.000	.091	.201

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

to 10% and willing to pay over 10% for eco-labeled PCP (Table 8 and 9). The results showed a high percent of respondents (58%) were willing to pay up to 10% more. On the other hand, just 11.3% were unwilling to pay anything more for eco-labeled PCP. This makes an argument in favor of improving product ecolabeling.

4.5. Testing the Hypotheses

In the conceptual framework we proposed the first hypothesis as - *Green purchase behavior is defendant on the consumer's attitude towards the environment.* To test this, we performed an ANOVA on the Attitude scores by factoring the Shade of Green behavior. The test showed a highly significant difference between the mean attitude scores between each shade of green. A post-hoc test showed no significant difference in the mean scores of grey and brown, but a highly significant difference between green and brown and green and grey. The test accepts the hypothesis.

The second hypothesis proposed is - *Green purchase behavior is dependent on the consumer's environmental awareness.*

To test this, we conducted the non-parametric ANOVA (Kruskal Wallis) between the Awareness scores of the respondents and the Shade of Green behavior. The test showed a significant difference in the mean Awareness scores between the three Shades of Green. The post-hoc Mann Whitney test was carried out on each pair, yielding the following results:

1. Between the Brown and Grey Shades of Green Behavior, there is no difference in the mean awareness scores;
2. Between the Brown and Green highly there is a significant difference in the mean awareness scores;
3. Between the Grey and Green there is a highly significant difference in the mean awareness scores.

Table 8. Willingness to pay more for green products

	Number of Respondents	Percent
Not willing to pay more	34	11.4
Not sure	74	24.8
Willing to pay up to 10% more	173	58.1
Willing to pay up to 20% more	17	5.7
Total	298	100.0

Table 9. Summary statistics for predictor variables

Variable Name	Description	Scaled Values	Mean	Std Deviation
Product Reliability	If a PCP is selected from the same vendor with Govt validated label and is of superior quality	(1,5)	9.05	3.00
Product Appeal	If a PCP is based on label attractiveness and Advertising	(1,5)	6.25	2.03

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

These relations suggest the possibility of improving green behavior by conveying more information to buyers. The information conveyed needs to be made directly relevant to the kind of product the consumer is intending to purchase. This could be trickier since no manufacturer would like to highlight the synthetic substances used in their products. A stronger policy regulation needs to be in place to control the malpractices.

4.6. Qualitative Responses

In addition to the questionnaire data, qualitative data was also collected from female respondents working in Information technology sector and the chemists and retailers stocking personal care products.

The female respondents were questioned on their personal background, the mode of transportation used by them to commute to the place of work, the manner in which they carried food to their workplace, their usage of disposables in the routine life and their inclination towards organic food and on the personal care product they used.

It was observed that out of a group of 35 female respondents, 60% preferred to travel by company transport, 20% preferred purchasing organic vegetables and fruits and a majority of them (70%) preferred using disposable items while hosting family functions. This suggests that on the one hand the respondents are demonstrating pro-environmentally behavior, they probably compensate its impact by indulging in non-ecofriendly practices like using disposable items. This also indicates the changing lifestyle of urban working women where convenience is preferred over functionality. Most of them preferred the branded personal care products (57%) while 31% preferred to use either home-made remedies or herbal products from well-known brands like Patanjali, Lotus Herbal and Himalaya. This indicates the increased exposure of working women to branded personal care products. In addition, it also emphasizes the trend of consumer's increasing consciousness about their looks. This further suggests that if marketed properly with the right communication strategies, ecolabeled products can get a foothold into the current market.

We also interviewed chemists, retailers and vanity store owners who stocked PCP. This was done to understand their awareness of eco labeled products. Out of 21 chemists interviewed, 80% were unaware of eco labeled products. This finding is quiet surprising as chemists are generally qualified individuals with a degree in pharmacy science. Though they stocked most of the personal care products, they did not recommend a product unless asked by the customer. The recommendations were not on eco-friendliness of a product. Since retail product margins are strong drivers to push product sales for retailers, conventional products may be paying retailers more than ecolabeled products. This could be altered by incentivizing pharmacists to increase the sale of ecolabeled personal care products.

5. CONCLUSION

The 2014 Greendex survey has shown that the top scoring consumers of this survey belong to the developing countries like India and China. Our research corroborates these findings as they show a high percent of Indian consumers displaying green behavior, possibly inadvertently, in the purchase of PCP. Moreover, PCP buyers showed a high awareness of environmental impact of their purchase. A large number of respondents are willing to pay extra to purchase ecolabeled personal care products. This aligns to consumers' correlation of price and quality, where a higher price corresponds to higher quality (Solomon M. R., 2006). The willingness to pay more suggests that PCP consumers perceive a similar relation

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

between price and quality. Correlations between awareness, attitude and green behavior are similar to findings from other countries and support the results of studies in other countries.

PCP consumers seeking green products consciously searched for environment related information on the product labels. This is a key consumer characteristic for marketers. This is a positive change as it will encourage producers, manufacturers and the Government agents involved to increase the standard of environmental products or services (Gallastegui, 2002). Unfortunately, our research does not support the findings from developed economies that there is a growing incidence of ecolabeling. We did not find any significant labeling in the PCP category in the Indian market. However, the findings from our research significantly favor ecolabeling and their ability to convey environmental information which can help marketers realize better prices. This can be looked upon as an opportunity to increase awareness through better labeling schemes and thus increasing the demand for environmentally friendly personal care products. We suggest that some existing ecolabels can be simplified to better communicate with non-buyers of ecolabeled products, especially since Tversky & Kahnemann (1981) study shows that negative information receives greater attention in consumers.

Some studies suggest that retailers have a prominent role in promoting green products and influencing consumers (Grunert, 2011). However, our study showed low awareness among various retailers and lack of interest in promoting green products. Most of retailers promoted products based on the margins they received and their popularity in the market. The retailers themselves were not highly educated to understand the gravity of the environmental issues. Moreover, there is confusion between herbal and ecolabeled products. Marketers need to consider this while launching green products. Product training and visual merchandise needs to be developed to improve retailer-consumer communication. Additionally, product labels can convey health benefits. Stricter law on product labeling especially for personal care products have to be enforced in order to avoid 'green washing' by PCP companies.

5.1. Limitations

The limitations of this research paper are it has considered only women working in Information technology sector and not any working women. The sample size of 300 is relatively small and may not represent the population of PCP buyers. In addition to this it has not considered the exact interpretation of an ecolabeled personal care product from these women. This was meant to be an exploratory study to further develop an in depth research with a larger sample.

REFERENCES

Akwa, L. (2009). Women involvement in environmental protection. *Journal of Sustainable development in Africa*, 2009, 173-191.

Basu, A. K., Chau, N. H., & Grote, U. (2003). Eco-Labeling and stages of development. *Review of Development Economics*, *7*(2), 228–247. doi:10.1111/1467-9361.00188

Blend, J. R., & Van Ravenswaay, E. O. (1999). Measuring Consumer Demand For Ecolabeled Apples. *American Journal of Agricultural Economics*, *81*(5), 1072–1077. doi:10.2307/1244086

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Borin, N., Cerf, D., & Krishnan, R. (2011). Consumer effects of environmental impact in product labeling. *Journal of Consumer Marketing*, *28*(1), 76–86. doi:10.1108/07363761111101976

Bray, J., Johns, N., & Kilburn, D. (2011). An exploratory study into the factors impeding ethical consumption. *Journal of Business Ethics*, *98*(4), 597–608. doi:10.100710551-010-0640-9

Brécard, D., Hlaimi, B., Lucas, S., & Salladarré, F. (2009). Determinants of demand for green products: An application to eco-label demand for fish in Europe. *Ecological Economics*, *69*(1), 115–125. doi:10.1016/j.ecolecon.2009.07.017

EN Bureau. (2015, June 24). India's organic skincare market to cross Rs 1,000 crore in next five years. *The Financial Express*, Mumbai, Maharashtra, India.

Cason, T., & Gangadharan, L. (2002). Environmental labeling and incomplete consumer information in laboratory markets. *Journal of Environmental Economics and Management*, *43*(1), 113–114. doi:10.1006/jeem.2000.1170

Cerjak, M., Mesic, Z., Kopic, M., Kovacic, D., & Markovina, J. (2010). What motivates consumers to buy organic food; Comparison of Croatia, Bosnia, Herzegovina and Slovenia. *Journal of Food Products Marketing*, *16*(3), 278–292. doi:10.1080/10454446.2010.484745

Commission of the European Communities. (2007). Communication from the Commission to the Council and the European Parliament: Progress Report on the European Union Sustainable Development Strategy 2007 (Accompanying Document). Brussels.

CSI. (2010). *An overview of ecolabels and sustainability certifications in the global market place. An overview of Eco labels and Sustainability certifications in the global marketplace (Interim Report)*. Durham, North Carolina, The United States of America: Duke University.

D'Souza, C., Taghian, M., & Lamb, P. (2006). An empirical study on the influence of environmental labels on consumers. Corporate communications. *International Journal (Toronto, Ont.)*, 2006, 162–173.

D'Souza, C., Taghian, M., & Lamb, P. (2006). An empirical study on the influence of environmental labels on consumers. *Corporate Communications: An International Journal*, 2006, 162-173.

AMF do Paco., & Raposo, M. (2009). Identifying the green consumer: A segmentation study. *Journal for Targeting, Measurement and Analysis for Marketing*, 17(1).

do Paco, A. R. (2009). Identifying the green consumer: A segmentation study. Journal of Targeting. *Measurement and Analysis for Marketing*, *17*(1), 17–25. doi:10.1057/jt.2008.28

Gallastegui, G. (2002). The use of eco-labels: A review of literature. *European Environment*, *12*(6), 316–331. doi:10.1002/eet.304

Gallastegui, G. (2002). The use of eco-labels: A review of the literature. *European Environment*.

Grankvist, G., Dahlstrand, U., & Biel, A. (2004). The impact of environmental labelling on consumer preference: Negative vs. Positive labels. *Journal of Consumer Policy*, *27*(2), 213–230. doi:10.1023/B:COPO.0000028167.54739.94

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Grunert, K. (2011). Sustainability in the Food Sector: A Consumer Behaviour perspective. *International Journal of Food System Dynamics*, 2(3), 207-218.

Hamilton, S., & Zimmerman, D. (2006). Environmental regulations, illicit behaviour, and equilibrium fraud. *Journal of Environmental Economics and Management*, 52(3), 627–644. doi:10.1016/j.jeem.2006.05.002

Horne, R. (2009). Limits to labels: The role of eco-labels in the assessment of product sustainability and routes to sustainable consumption. *International Journal of Consumer Studies*, *33*(2), 175–182. doi:10.1111/j.1470-6431.2009.00752.x

Ibanez, L., & Grolleau, G. (2008). Can ecolabeling schemes preserve the environment? *Environmental and Resource Economics*, *40*(2), 233–249. doi:10.100710640-007-9150-3

Joshi, Y., & Rahman, Z. (2015). Factors affecting green purchase behaviour and future research directions. *International Strategic Management Review*, *3*(1-2), 128–143. doi:10.1016/j.ism.2015.04.001

Kennedy, E., Beckley, T., McFarlane, B., & Nadeau, S. (2009). Why We Don't "Walk the Talk": Understanding the Environmental Values/Behavior Gap in Canada. *Human Ecology Review*, 16(2), 151–160.

Koos, S. (2011). Varieties of environmental labelling, market structures and sustainable consumption across Europe: A comparative analysis of organizational and market supply determinants of environmental-labelled goods. *Journal of Consumer Policy*, 34, 127-151.

Lee, K. (2011). The green purchase behavior of Hong Kong young consumers: The role of peer influence, local environmental involvement, and concrete environmental knowledge. *Journal of International Consumer Marketing*, *23*(1), 21–44. doi:10.1080/08961530.2011.524575

Leire, C., & Thidell, Å. (2005). Product-related environmental information to guide consumer purchases—A review and analysis of research on perceptions, understanding and use among Nordic. *Journal of Cleaner Production*, *13*(10-11), 1061–1070. doi:10.1016/j.jclepro.2004.12.004

Loureiro, M. (2003). Rethinking new wines: Implications of local and environmentally friendly labels. *Food Policy*, *28*(5-6), 547–560. doi:10.1016/j.foodpol.2003.10.004

Loureiro, M., McCluskey, J. J., & Mittelhammer, R. C. (2002). Will Consumers Pay a Premium for Eco-labeled Apples? *The Journal of Consumer Affairs*, *36*(2), 203–219. doi:10.1111/j.1745-6606.2002.tb00430.x

Loureiro, & Lotade. (2005). Do fair trade and eco-labels in coffee wake up the consumer conscience? *Ecological Economics*, 53(1), 129-138.

Mason, C. F. (2006). An economic model of ecolabeling. *Environmental Modeling and Assessment*, *11*(2), 131–143. doi:10.100710666-005-9035-1

Mehta, P. S. (2007). Why was India's Ecomark scheme unsuccessful? Jaipur: Jaipur Printers Private ltd.

Moisander, J. (2007). Motivational complexity of green consumerism. *International Journal of Consumer Studies*, *31*(4), 404–409. doi:10.1111/j.1470-6431.2007.00586.x

Nelson, P. (1978). Information and consumer behaviour. *Journal of Political Economy*, 78(2), 311–329.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Nulkar, G. (2016). The environmental costs of serving the bottom of the pyramid. *Sustainability: The journal of record*, 9(1), 31-38.

Pandey, S., & Khare, A. (2015). Mediating role of opinion seeking in explaining the relationship between antecedents and organic food purchase intentions. *Journal of Indian business research*, 7(4), 321-337.

Peattie, K., & Crane, A. (2005). Green marketing: legend, myth, farce or prophesy? *Qualitative Market Research: An International Journal*, 8(4), 357-370.

Rex, E., & Baumann, H. (2007). Beyond ecolabels: What green marketing can learn from conventional marketing. *Journal of Cleaner Production*, *15*(6), 567–576. doi:10.1016/j.jclepro.2006.05.013

Scholl, G. (2006). Product Service Systems. *Proceedings for Workshop of SCORE! Network*. Wuppertal. 10.9774/GLEAF.978-1-907643-36-1_15

Sharma, K., & Bansal, M. (2013). Environmental consciousness, its antecedents and behavioural outcomes. *Journal of Indian Business Research*, *5*(3), 198–214. doi:10.1108/JIBR-10-2012-0080

Sinha, R. (2014). Exploring the relationship between ecolabel and green buying behaviour with reference to Mumbai city. In I. Samantha (Ed.), *Strategic marketing in fragile economic conditions* (pp. 1–300). Hershey: IGI Global. doi:10.4018/978-1-4666-6232-2.ch006

Solomon, M. R. (2006). *Consumer Behavior*. London: Pearson.

Sundari, R., & Murugan, M. (2011). Brand Loyalty's Influence on Women's Buying with Special Reference to Personal Care Products. *International Journal of Commerce*, *IT and Management*, *1*(2), 56–62.

Teisl, M., Rubin, J., & Noblet, C. L. (2008). Non-dirty dancing? Interactions between eco-labels and consumers. *Journal of Economic Psychology*, *29*(2), 140–159. doi:10.1016/j.joep.2007.04.002

Thøgersen, J. (2002). Promoting green consumer behavior with eco-labels. In T. Dietz & P. Stern (Eds.), *New Tools for Environmental Protection: Education, Information, and Voluntary Measures* (pp. 83–104). Washington, DC: National Academy Press.

Thøgersen, J., Jørgensen, A. K., & Sandager, S. (2012). Consumer decision making regarding a "green" everyday product. *Journal of Psychology & Marketing*, 29(4), 187-197.

Tsakiridou, E., Boutsouki, C., Zotos, Y., & Mattas, K. (2008). Attitudes and behaviour towards organic products; an exploratory study. *International Journal of Retail & Distribution Management*, *36*(2), 158–175. doi:10.1108/09590550810853093

Tversky, A., & Kahnemann, D. (1981). The Framing of decisions and the psychology of choice. *Science*, *211*(4481), 453–458. doi:10.1126cience.7455683 PMID:7455683

Walkers, R. (2013, May 13). The state of the industry. GCI.

This research was previously published in the International Journal of Asian Business and Information Management (IJABIM), 7(4); edited by Patricia Ordóñez de Pablos, pages 49-62, copyright year 2016 by IGI Publishing (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Section 6
Managerial Impact

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 68
Psychological Factors Influencing the Managers' Intention to Adopt Green IS: A Review-Based Comprehensive Framework and Ranking the Factors

Mohammad Dalvi Esfahani
Universiti Teknologi Malaysia, Malaysia

Mehrbakhsh Nilashi
Universiti Teknologi Malaysia, Malaysia

Azizah Abdul Rahman
Universiti Teknologi Malaysia, Malaysia

Amir Hossein Ghapanchi
Griffith University, Australia

Nor Hidayati Zakaria
Universiti Teknologi Malaysia, Malaysia

ABSTRACT

This paper proposes a comprehensive framework of the individual factors that influence organizational decision-makers to adopt Green information systems (IS), based on a review of psychological theories and empirical studies on Green IS and technology adoption. The objectives of this paper are, firstly, to explain that the adoption of Green IS by managers is directly influenced by their intention, which is assumed to be influenced by their attitude towards Green IS, subjective norms, perceived behavioral control and personal norms. In the framework, attitude towards Green IS is influenced by managers' positive and negative affect in response to Green IS. The findings of this study show that subjective norms are reflected from three sources containing primary, secondary and work referents. Perceived behavioral control includes self-efficacy, monetary cost–benefit assessment and the ethical climate of the organization. Personal norms are influenced by awareness of consequences, ascription of responsibilities and

DOI: 10.4018/978-1-5225-7915-1.ch068

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

personal values including self-transcendence and self-enhancement. Secondly, the paper aims to assess the importance of the individual factors that influence the organizational decision-makers to adopt Green IS. Accordingly, the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) is applied to rank the importance of the factors incorporated in the proposed framework. The data for this study is collected by conducting an online survey through a structured questionnaire-based instrument comprising 5-point Likert-type scales. The findings of this study contribute to the Green IS literature by improving the decision-making process in IS adoption for the purpose of environmental sustainability enhancement. It is hoped that the proposed model would help to clarify the relative importance of the psychological and socio-demographic factors influencing the adoption of Green IS by organizational decision-makers.

INTRODUCTION

Due to the fragile balance of the future of our ecosystem and society, sustainability issues are paramount and corporations, governments and cross-national bodies are turning their attention to the question of "how we can make the world a better place" (Malhotra et al., 2013). Sustainability is a complex term which encompasses issues related to the environment, economy and society. Simply, sustainability refers to conservation deployment and the responsible use of resources. According to the United Nations Report of the World Commission on Environment and Development (the Brundtland Report), sustainable development is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Commission, 1987). Recently, the focus of environmental concerns has changed from the local scale to the global scale, and has become the top concern of organizations, governments, non-governmental organizations and consumers (Dedrick, 2010; Kuo and Dick, 2010). As policies regarding environmental sustainability have been developed, and rules and legislation have been established, it was natural that organizations would focus more on their sustainable practices (Bansal, 2005; Zeleny, 2010).

Environmental sustainability has gained significant interest among researchers from different disciplines such as management (as evidenced in special issues of the Academy of Management Review in 1995 and Academy of Management Journal in 2000), and in other disciplines through some specialized journals such as Journal of Environmental Management, Journal of Industrial Ecology and Journal of Social Issues. The role which can be played by information technology (IT)[1] and information systems (IS)[2] in such endeavors has been neglected by researchers with few exceptions (see Pavlou and Fygenson, 2006 for a summary). The impact of IT and IS on the environment was considered in the special issue of Management Information Systems Quarterly (MISQ) in 2010/2011 on IS and environmental sustainability. Following this special issue, researchers focused on identifying the relationship between IT/IS and the environment, with this relationship found to be a complex one because of the two order effects of IT on the environment (Elliot, 2011; Malhotra et al., 2013). The first order refers to the negative impact of IT production, use and disposal on the environment. This perspective considers IT as part of the problem (Dedrick, 2010; Molla and Abareshi, 2012). Making IT product, use and disposal more environmentally friendly and greener is referred as Green IT (Dedrick, 2010; Molla, 2013; Molla and Abareshi, 2012; Ryoo and Koo, 2013). The second order effect refers to the positive impact of IT

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

on the environment which considers IT as part of the solution. Utilizing IT to make business processes and activities greener is known as IT for Green or Green IS (Dedrick, 2010; Molla, 2013; Sarkis et al., 2013; Watson et al., 2010).

Green IT and Green IS are still in their infancy and have just begun to be understood and implemented by organizations (Grant and Marshburn, 2014). The majority of Green IT and Green IS studies are focused on the introduction of the research agenda (e.g., Elliot, 2011; Esfahani et al., 2015b; Jenkin et al., 2011; Melville, 2010; Watson et al., 2010), and theoretically and empirically explaining the drivers and consequences of adopting organizational Green IT and Green IS initiatives (e.g., Bose and Luo, 2011; Chen et al., 2011; Molla and Abareshi, 2012). Despite the importance of organizational Green motivations, actions and factors that influence the adoption of these initiatives, they only tell part of the story (Molla et al., 2014). These studies have expanded our knowledge regarding the macro level-factors influencing the adoption of Green IS (Esfahani et al., 2015a; Esfahani et al., 2015b). For environmental sustainability and climate change issues which are complex problems, besides the organizational factors, there is a need to identify and understand the individual drivers and actions (Hasan and Dwyer, 2010) of managers and other decision-makers within the corporation who have the power to impact the direction and degree of environmental initiatives (Al-Khatib et al., 1995; Molla et al., 2014; Shafer, 2008; Trevino, 1986). The focus of the present study is on Green IS.

The pursuit of environmental sustainability in an organization should be the responsibility of everyone regardless of their position because of its complexity (Molla et al., 2014), while the urgency of the issues and the capacity for taking action would vary significantly. The adoption and implementation of organizational Green initiatives is not solely driven by commercial imperatives (Hemingway and Maclagan, 2004), but could also be associated with the environmental beliefs and attitudes of managers. Knowledge regarding the environmental beliefs of managers and their actions towards environmental sustainability, together with the factors which contribute to their beliefs and action formation, could be utilized to define the strategies that encourage individuals and groups to engage more in Green behaviors, and to facilitate the implementation of organizational Green IS initiatives and strategies (Molla et al., 2014).

Furthermore, organizational researchers like Starik and Rands (1995) proposed that "there is much to be gained by studying what guides managers' and other employees' sustainability-oriented decisions and behaviors" (as cited in Flannery and May, 2000). We also believe that in order to understand what organizations must do to become ecologically sustainable (e.g. Green IS adoption), it is crucial that we understand the decision intention of managers as they encounter the environmentally sensitive dilemmas.

Although some studies have shed light on the psychological factors in the adoption of Green IS, they have been limited to a set of psychological factors and did not embrace an encyclopedic set of key factors influencing the adoption of Green IS. As Trevino (1986) postulated, most managers "will look outside themselves for cues about what is right (appropriate) behavior and what is wrong (inappropriate) behavior". Understanding what key psychological factors influence the adoption of Green IS initiatives would interest managers as they intend to promote environmentally and ethically sound decision-making. Furthermore, as stated by Collins (1989), "ethical issues are often complex because in many instances, the trade-off is not between generating a harm or benefit, but between degrees of harms or benefits to company and/or stakeholder"; thus, the combination of psychological factors would be necessary to help and prepare decision-makers to make such difficult decisions.

To the best of the authors' knowledge, no such comprehensive framework for the adoption of Green IS has yet been proposed. The purpose of this paper is to develop a framework for the adoption of Green IS

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

initiatives by organizations to improve the social and/or environmental conditions. Thus, in comparison with the research efforts found in the literature, our work has a number of differences. In this research:

- A comprehensive set of psychological factors influencing the managers' intention to adopt Green IS has been integrated;
- The goal-frame of morality is included in the model, as it has been neglected in the Green IS-related literature;
- Following the upper echelons theory stating the importance of individual characteristics in the ethical decision-making process, the influences of socio-demographic factors of managers including age, gender and education level have been considered;
- Since Green IS is a new concept, measuring the actual behavior of managers regarding the adoption of Green IS is difficult. Hence, in this research, the impacts of identified factors on the adoption behavior are mediated through intention, which is the most significant predictor of actual behavior;
- The influence of identified factors in the proposed framework on the adoption behavior has been ranked based on their importance from the experts' perspective utilizing the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS).

We first elaborate the concepts of sustainability, ecological sustainability and Green IS. Next, based on goal-framing theory we discuss the motives and their underlying psychological frameworks that influence behavior in favor or against the adoption of Green IS. Subsequently, we clarify the factors that indirectly impact the decision-making process of managers to adopt Green IS initiatives. Then, the comprehensive framework, constituting the psychological factors that directly and indirectly influence the managers' decision to adopt Green IS, is presented. The applied methodology and the data collection strategy are discussed. Finally, the conclusions and contributions of the study are presented in the last section.

SUSTAINABILITY, ECOLOGICAL SUSTAINABILITY, AND GREEN IS

In this section, the terms "sustainability", "ecological sustainability" and "Green IS" are conceptualized.

Sustainability

Sustainability is a complex and partially developed concept (Mulvihill and Milan, 2007). The term was popularized in the Brundtland Report which defined it as "development that meets the needs of the present world, without compromising the ability of future generations to meet their own needs" (Commission, 1987). Traditionally, the single bottom-line measurement of success for organizations is the generation of profit, known as the creation of value for stakeholders (Friedman and Allen, 1970). Economic sustainability, which is the sustainable generation of profit, is pursued by many corporations, particularly the large ones. The opportunities for improving market share, profitability and competitiveness have enticed organizations to solely focus on their economic sustainability. However, only short-term success can be achieved through this single-minded economic sustainability. In order to achieve long-term success, organizations need to satisfy economic, social and ecological sustainability simultaneously (Dyllick and Hockerts, 2002). The ultimate goal of organizations is constituted by satisfying the three interdependent

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

dimensions of the "triple-bottom line" (Elkington, 1997), namely, economic sustainability, social sustainability and ecological sustainability.

Ecological Sustainability

Ecological sustainability refers to "the ability of one or more entities, either individually or collectively, to exist and thrive (either unchanged or in evolved forms) for lengthy timeframes, in such a manner that the existence and flourishing of other collectivities of entities is permitted at related levels and in related systems" (Starik and Rands, 1995). Natural resources have been long taken for granted and their preservation and sustainability are unlikely to be high on organizational agendas. Due to the lack of serious foreseeable economic impact in the future, societies and the natural environment have been ignored in organizational decision-making processes (Chen et al., 2008). All human activities such as agriculture, forestry and manufacturing rely on the natural environment (Starik and Rands, 1995). Hence, ecological sustainability should have the higher priority in organizational decision-making than economic sustainable development (Starik and Rands, 1995). The natural environment should be added to the list of organizational assets to ensure the long-term viability of the firm (Hart, 1995).

Green IS

Due to the compelling problem of ecological deterioration, the relationship between IS and environmental sustainability has attracted growing attention (Elliot, 2011; Melville, 2010; Watson et al., 2010). Related to environmental sustainability, IS applications abound for the purpose of good citizenship or to alleviate the detrimental effects of value chain activities. As stated by Malhotra et al. (2013), an example of these environmentally responsible IS applications is a large technology company's launch of an IS application to raise awareness regarding the climate and energy use and to drive engagement. Another example, provided by Musbah (2010), is related to a logistics company that gathered and analyzed route information on trucks, and was successful in increasing safety, lowering emissions and cutting maintenance. This IS application complemented the company's software package to recommend the most sustainable routes to drivers to deliver their packages, resulting in the reduction of gas usage by three million gallons and CO2 emission by 32,000 metric tons (Malhotra et al., 2013). Strategically, the deployment of IS applications for environmental sustainability allows organizations to proactively transform their business processes to benefit the society economically and ecologically.

Melville (2010) defined IS for environmental sustainability as "IS-enabled organizational practices and processes that improve environmental and economic performance" which is referred to as "Green IS". Green IS refers "to the development and use of information systems to support or enable environmental sustainability initiatives and, thus, tends to have an indirect and positive impact" (Jenkin et al., 2011). Overall, Green IS refers to strategically investing, deploying and using IS to mitigate the detrimental impacts of organizational activities on the natural environment.

GOAL-FRAMING THEORY

In psychology and sociology it is assumed that people have different views on a given situation, and these views define how people behave in that situation. So, among other things, the behavior of an individual

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

in a given situation depends on the "definition of the situation" (Lindenberg and Steg, 2007). The goal "frame", which is the way of processing information by people in a given situation and acting upon it, has been identified as the main determinant of how people look to the given situation (Lindenberg and Steg, 2007). By changing the goal, the perception of people regarding the given situation will also change. The perceptions of individuals based on the goal-frame, and their behaviors, are the basics of goal-framing theory which has emerged from different sources but is strongly influenced by research in cognitive social psychology on the influence of goal-frames on cognitive processes (Lindenberg, 2001; Lindenberg and Steg, 2007). Based on the study by Lindenberg and Steg (2007), the central idea of this theory is that "goals govern or frame what people attend to, what knowledge and attitudes become cognitively most accessible, how people evaluate various aspects of the situation, and what alternatives are being considered".

Lindenberg and Steg (2007) identified three main goals which are also highly related to environmental behavior. These goals are the hedonic goal "to feel better right now", the gain goal "to guard and improve one's resources" and the normative goal "to act appropriately". When a gain goal is activated, the choice of an individual is based on giving weights to factors such as the costs, benefits and risks of different options, and the individual will select an option with the highest gain against the lowest costs or risks. When a normative goal is activated, the choice of the individual from different options is based on moral evaluation, which is what is supposed to be the best in that situation. When a hedonic goal is activated, the choice of the individual is based on what feels better. When it comes to technologies related to environmental sustainability, individuals can base their adoption on: 1) the accumulation of costs, benefits and risks, 2) moral evaluation, depending on the extent to which the technology has a positive or negative effect on the environment or society, and 3) feelings, whether positive or negative, such as feelings of satisfaction, joy fear, or anger (Huijts et al., 2012).

Based on Lindenberg and Steg (2007), these three goal-frames coincide with popular theories and models in environmental psychology, which typically focus on one motivation only. The three goal-frames together with their coinciding theories are elaborated in following sections.

Gain-Goal Frame and Theory of Planned Behavior

When the focal goal-frame is gain, individuals are sensitive to changes to their personal property and resources. The time horizon of this goal-frame is medium- or long-term and the criterion for the realization of this goal-frame is the improvement of or prevention from a decrease in one's property and resources (Lindenberg, 2001; Lindenberg and Steg, 2007). In this goal-frame, individuals are sensitive regarding incentive information such as benefits, costs and risks especially in terms of scarce resources such as money, time and status (Lindenberg and Steg, 2007).

Among the social psychology theories of behaviors, the theory of planned behavior (TPB) (Ajzen, 1991; Ajzen and Madden, 1986) utilizes a rational-choice framework and self-interest deliberation to explain pro-environmental behavior and is likely to be particularly relevant when gain goals are focal (Lindenberg and Steg, 2007; López-Mosquera and Sánchez, 2012; Steg et al., 2014). TPB is a well-researched model that has been proven to predict behavior across a variety of contexts and settings (Pavlou and Fygenson, 2006),, and as a general model is used to explain most human behaviors (Ajzen, 1991). In TPB, behavioral intention depends on three factors: (1) attitudes, defined as "learned predisposition to respond in a consistently favorable or unfavorable manner with respect to a given object" (Fishbein and Ajzen, 1975), (2) subjective norms, which refer to individuals' perceived social pressures to perform or

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

not to perform a specific behavior, and (3) perceived behavioral control, which refers to the individuals' perceived ease or difficulty in performing a particular behavior.

Green IS Attitude

Attitude refers to the degree to which an individual assesses a behavior as favorable or unfavorable (Fishbein and Ajzen, 1975). According to Gholami et al. (2013), attitude is an affective characteristic of an organization's decision-makers which measures the extent to which they are aware of and interested in Green IS. Organizations' decision-makers (i.e. senior managers) play an important role in conveying the strategic importance of Green IS across the organization and in making resource allocations (Gholami et al., 2013). . In particular, the positive attitude of organizations' decision-makers is necessary for Green IS to be adopted successfully (Butler, 2011; Gholami et al., 2013). Empirical studies have proven that attitude is a strong predictor of intention to adopt IT (Hsu and Chiu, 2004; Taylor and Todd, 1995) and Green IS use (Kranz and Picot, 2011, 2012; Rivis et al., 2009).

Subjective Norms

The behaviors of humans do not happen in a vacuum environment, but are embedded within a social context, so they are susceptible to interactions with the social environment (Kranz and Picot, 2011, 2012). Several theories in different disciplines such as social psychology (e.g., Fulk et al., 1987), behavioral research (e.g., Fishbein and Ajzen, 1975), and innovation diffusion (e.g., Venkatesh et al., 2003) highlight the impact of social influence. In studies related to technology adoption, however, social influence has only the subordinate role because of its uncertain psychometric properties (Davis et al., 1989) and contradicting results (e.g., Pavlou and Fygenson, 2006; Venkatesh and Morris, 2000). Based on TPB, most of these studies measured the social influence factor by a single item. Armitage and Conner (2001) suggest that the poor performance of subjective norms in different studies is because of its single-item scale measurement; they believe a multi-item scale measurement would be more reliable. Following empirical studies (e.g., Brown and Venkatesh, 2005; Venkatesh et al., 2003) influential others are grouped into primary sources, secondary sources, and workplace referents. The influence of primary sources is "the extent to which members of social network influence one another's behavior" (in this case, family and friends), the influence of secondary sources is "the extent to which information from TV, newspaper, and other secondary sources influence behavior", and the influence of workplace referents is "the extent to which coworkers influence behavior" (Venkatesh and Morris, 2000; Venkatesh et al., 2003).

Perceived Behavioral Control

Ajzen differentiated between internal and external perceived behavioral controls, and defined internal control factors as "individual dispositional factors and include the amount of information a person has, along with the person's skills, abilities, emotions, and compulsions concerning a specific behavior" (Ajzen, 1988). External control factors are situational issues outside the individual. Ajzen and Madden (1986) asserted that "these factors determine the extent to which circumstances facilitate or interfere with the performance of the behavior". Following the empirical studies (e.g., Flannery and May, 2000; Papagiannakis and Lioukas, 2012), we distinguish between the internal control factor of self-efficacy and the two external control factors of monetary cost-benefit assessment and ethical climate of the organiza-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

tion. Self-efficacy (i.e. the belief or conviction that one has the capability to perform a specific behavior (Bandura, 1997)) is a prominent construct in social psychology. As Bandura (1997) stated, self-efficacy refers to a person's expectancy about whether he/she can perform the specific behavior successfully. She argued that self-efficacy influence individuals' decisions and choices, because they engage and put more efforts in tasks that they believe they can successfully perform. The adoption and diffusion of environmental initiatives highly depend on the budget allocation and process prioritization of the corporation (Phillips and e Costa, 2007) and the associated cost-benefit assessment (Weber, 2008). As suggested by Papagiannakis and Lioukas (2012), when the assessment is purely based on monetary issues, "it does not embrace the philosophy of environmental proactiveness". While the costs can be measured easily, the benefits such as customer attraction or the improved image of the corporation cannot be measured without additional information. While the acquisition of such information is often considered too costly, the misestimation of the overall assessment (King and Lenox, 2002) may lead managers to invest in costly environmental practices. The importance of studying organizational decision-makers and their context is established in the literature (Trevino, 1986) and (Tetlock, 1985), because "both individuals and small groups of individuals are constrained by the norms, procedures, and resources of the institutions in which they live and work" (Tetlock, 1985). As proposed by Wimbush and Shepard (1994), the factor which mostly causes individuals to behave unethically is the instrumental climate. In an ethical climate based on the instrumental dimension, "organizational members look out for their own self-interest, first and foremost, to the exclusion of the interest of others who may be affected (even adversely) by their decisions" (Wimbush and Shepard, 1994).

TPB has been applied in various studies to investigate the environmental behavior and intention of individuals both within and outside organizations (e.g., Bernardi, 1994; Bernath and Roschewitz, 2008; De Groot and Steg, 2007; Flannery and May, 2000). Most importantly, this theory has been applied as a bridge between the managers' characteristics and the organizations' environmental behaviors (e.g., Flannery and May, 1994; Flannery and May, 2000; Papagiannakis and Lioukas, 2012; Sharma and Sharma, 2011). From the empirical studies (e.g., Flannery and May, 2000; Papagiannakis and Lioukas, 2012), it can be thus concluded that attitudes towards Green IS, subjective norms and self-efficacy positively influence the managers' intention to adopt Green IS initiatives, while the monetary cost–benefit assessment and ethical climate (instrumental) of the organization negatively impact their intention to adopt Green IS initiatives. A summary of the TPB adapted for the context of Green IS adoption is depicted in Figure 1.

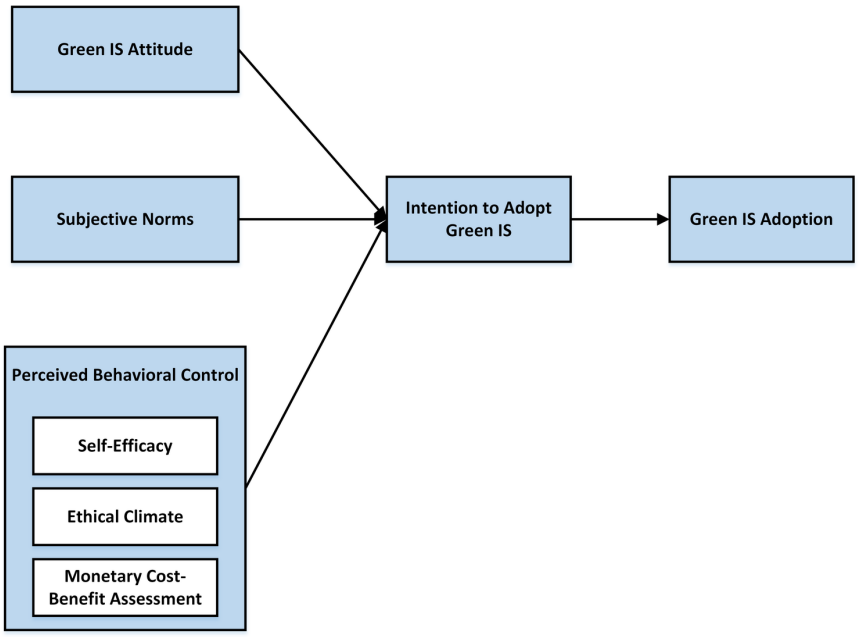
Normative Goal-Frame and Value-Belief-Norm Theory

Following the activation of the normative goal-frame, all related sub-goals linked to appropriateness are also activated. This goal-frame makes individuals sensitive regarding what they think that they should do. This makes the aspects of the situation normative in that the individual is sensitive both to what he or she "should" do according to self or others, and sensitive to observing what other people are doing (Lindenberg, 2001; Lindenberg and Steg, 2007). In the environmental context, the normative goal-frame means acting pro-environmentally without considering costs or benefits (Lindenberg and Steg, 2007) and this goal-frame is stronger when people are aware of environmental problems.

Normative goals are the key factors of Schwartz's norm activation theory (Schwartz, 1977) which explains how moral motivations impact on behavior. The central idea of this theory is that, by activation of personally moral norms, the pro-social behaviors are influenced. There are two pre-conditions for the

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 1. Theory of planned behavior adapted to Green IS adoption



activation of personal norms: 1) awareness of consequences (i.e. "the individual must be aware that her action has consequences for the welfare of others"), and 2) ascription of responsibility (i.e. "the individual must feel a personal responsibility to undertake that action") (Schwartz, 1968, 1977). Schwartz (1977) explains that, in an action situation, norms are constructed based on a set of values related to the taken action. In the literature on the application of norm activation theory in pro-environmental action, altruism (or concerns toward other human beings) is considered as a value orientation that is relevant for norm construction in the context of environmental behavior. However, Stern (1999) argues that besides the personal norms based on altruistic values towards other human beings, norms based on self-interest and altruism towards non-human species are also guiding the individual's pro-environmental behavior. The idea of guiding pro-environmental action through these three value orientations further resulted in the development of the value–belief–norm (VBN) theory by Stern (1999). The VBN theory postulates that the relationship between values and actual behaviors is affected by more factors than the specific environmental attitudes. These factors are: (i) fundamental values, (ii) behavior-specific beliefs, and (iii) personal moral norms that guide the individual's actions. Within VBN theory, various individually held values have been identified that affect individuals' beliefs and norms and consequently their actual behavior (Jansson et al., 2010). The values most related to activating individuals' pro-environmental beliefs and norms and thus influencing their Green behaviors have been found to be altruistic, biospheric, egoistic (De Groot and Steg, 2008; Hansla et al., 2008; Stern, 1999), and hedonic values (Steg et al., 2014; Steg et al., 2012). Altruistic and biospheric values (also known as self-transcendence) have generally been found to have a positive relation with environmental beliefs and norms and subsequently with pro-environmental behaviors, while egoistic and hedonic values (also known as self-enhancement) have been found to have negative influences on pro-environmental behaviors (De Groot and Steg, 2007, 2008; Nordlund and Garvill, 2003; Steg et al., 2014).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

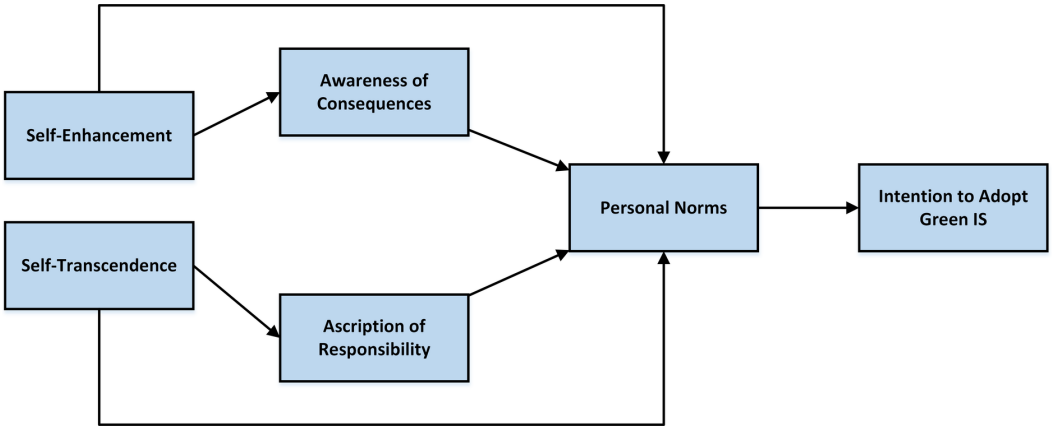
In conjunction with VBN theory, different types of beliefs have been found to influence individuals to behave pro-environmentally. Following norm activation theory (Schwartz, 1977) and further VBN (Stern, 2000), it can thus be concluded that if organizational decision-makers are aware of the environmental consequences (the first pre-condition for the activation of personal norms) of their organizational activities, whether general or specific, and ascribe responsibility (AR – the second pre-condition for the activation of personal norms) to themselves to take preventive actions, their pro-environmental norms will be developed with a high potential to impact their actual behavior (Bamberg and Schmidt, 2003; Stern, 2000), in which there would be the adoption of Green IS. While attitudes reflect cognitive beliefs about the behavior in question, perceived behavioral control reflects beliefs about the degree of determination, and social norms reflect the beliefs of important others, personal norms provide the moral "coloring" of the decision-making process. However, the integration stage is the intention which is generated immediately before the behavioral decision is made (Klöckner and Blöbaum, 2010). It has also already been shown that a personal norm towards taking action is the most important predictor of intention to act pro-socially and pro-environmentally (Huijts et al., 2013); likewise, the study by De Groot and Steg (2010) regarding the adoption of nuclear energy technologies showed that the intention is strongly influenced by personal norms. Managers' awareness of consequences and ascription of responsibility influence their intention to adopt Green IS via their personal norms (see Figure 2).

Hedonic Goal-Frame and Theories on Affect

Based on Lindenberg and Steg (2007), when the hedonic goal-frame is activated, it eventually improves the feeling of an individual in a specific situation (e.g. avoiding efforts, avoiding negative thoughts, seeking direct pleasure or improving self-esteem). The time horizon of this goal-frame is short, and the improvement in the individual's feelings is its goal realization. Individuals who are in the hedonic goal-frame are sensitive to what makes their feelings, mood and pleasure better or worse (Lindenberg and Steg, 2007) . In this goal-frame, individuals are sensitive to factors such as mood, energy level (tired or energetic) and social atmosphere, with these factors playing the central role in theories on affect.

Vallerand et al. (1992) asserted that people who act pro-environmentally because it makes them pleased and satisfied are more likely to engage in pro-environmental behaviors, compared to the situation

Figure 2. Value-belief-norm theory adapted to Green IS adoption



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

where they act morally or follow pro-environmental norms especially when the behavior is relatively difficult. In the studies by Nilsson and Küller (2000) and Steg (2005) it was found that individuals who were emotionally attached to car-use for commuting drove more frequently than the individuals who were not emotionally attached to their cars and were more predicted by affect than instrumental motives. Emotional reactions to environmental problems also appear to be related to pro-environmental behaviors (Lindenberg and Steg, 2007). For example, as Grob (1995) postulated, the more intense the reaction of individuals to environmental degradation emotionally, the more they will engage in pro-environmental behaviors. In addition, it has been found that emotional affinity is positively related to conservation behavior (Kals and Maes, 2002).

Different studies (e.g., Bechara et al., 1994; Bechara et al., 1997) suggest that decision-making without affect is at "best impractical" and at "worst impossible". According to Djamasbi et al. (2009), affect "guides rationality by helping individuals to focus on a manageable subset of possibilities that look right or feel right". People who are in their positive affective state access more positive thoughts in their memory and hence tend to focus more on favorable and positive aspects of the situation, while on the other hand, people who are in the negative affective state are focusing more on the unfavorable aspects of the situation and tend to be more critical towards the situation (Djamasbi et al., 2009).

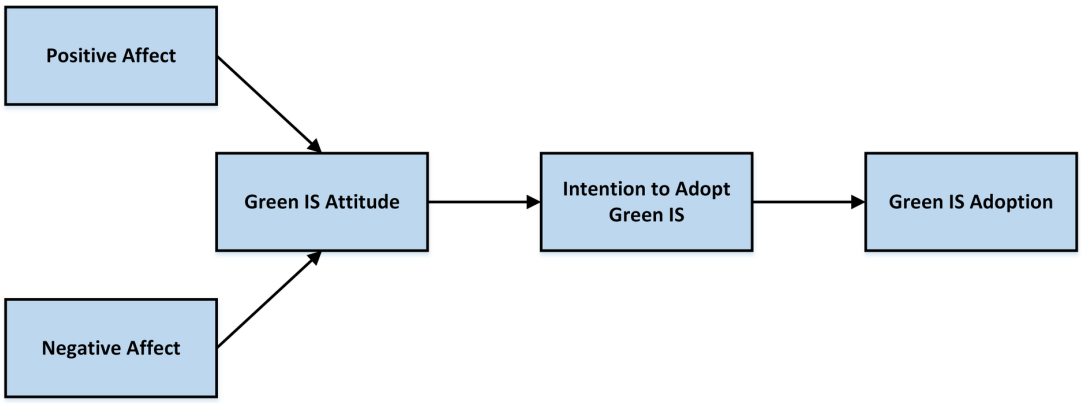
Various studies have investigated whether affective responses positively influence attitude and behavior (Loewenstein and Lerner, 2003) ; for example, studies related to risk perception (Taylor-Gooby and Zinn, 2006) and marketing (Erevelles, 1998). Following Ajzen (2001), affect can directly influence attitude; or following TPB (Ajzen, 1991), affect can indirectly influence intention. This suggests that attitude is both rooted in perceived costs, benefits and risks (cognitions) and affect (Ajzen, 2001) in which attitude is defined as "an evaluative integration of cognitions and affect experienced in relation to an object" (Crano and Prislin, 2006). In empirical studies (e.g., Cropanzano et al., 2003; Midden and Huijts, 2009; Peters and Slovic, 1996) it has been shown that positive affect (such as pride, happiness or satisfaction) and negative affect (such as fear, worries or anger) are related to each other but are distinct factors while both factors independently predict attitude. In studies related to the acceptance and adoption of energy technologies (e.g., Midden and Huijts, 2009; Montijn-Dorgelo and Midden, 2008; Peters and Slovic, 2007), affect has been found to influence evaluation of the technologies. Regarding the adoption of Green IS, it is then likely that senior managers in a positive mood will focus more on the helpful and beneficial aspects of Green IS, while those who are in a negative mood will focus more on those aspects of Green IS that are not favorable (Djamasbi et al., 2009) . Hence, we propose that positive and negative affect influence the attitudes of managers towards Green IS and indirectly their intention (see Figure 3).

THE INFLUENCE OF DEMOGRAPHIC FACTORS

In the IS literature it has been proved that socio-demographic variables such as age, gender, education level and working experience are critical in understanding how individuals make decisions regarding the adoption of technologies (Venkatesh et al., 2003). In the business ethics literature, the importance of these variables on individuals' ethical decision-making has been proven (Craft, 2013; Ford and Richardson, 1994; Lehnert et al., 2014; Loewenstein and Lerner, 2003; O'Fallon and Butterfield, 2005). In the literature, it has been identified that people who behave more ethically and are more ecologically responsible are female (Abeliotis et al., 2010; Cagle and Baucus, 2006), older (Brouthers et al., 2008; Eweje and Brunton, 2010; Krambia-Kapardis and Zopiatis, 2008), and well-educated (do Paço et al.,

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 3. Integration of affect and attitude influencing intention to adopt Green IS



2009). Thus, we surmise that the managers' demography such as age, gender and education level can influence their decision-making process to adopt Green IS.

Age

The potential relationship between age and ethical decision-making has been investigated by many researchers in the business ethics literature (Cagle and Baucus, 2006). Mixed results have been reported regarding the influence of age on ethical decision-making. Some state that age is positively correlated with ethical decision-making (Nill et al., 2004), while others found an insignificant relationship between age and ethical decision-making (Marta et al., 2004). In the cognitive development approach adopted by Rest and Barnett (1986), they asserted that people are less likely to behave unethically as they gain an understanding of their position in society. In the empirical studies regarding ethical behaviors it is reported that older people tend to behave more ethically than younger ones (Brouthers et al., 2008; Eweje and Brunton, 2010; Krambia-Kapardis and Zopiatis, 2008).

A number of researchers have investigated the relationship between age and environmental sustainability commitment. Some scholars have reported a significant correlation between age and environmentalism (Jain and Kaur, 2006; Tilikidou, 2007). For example, Jain and Kaur (2006) reported that frugality and a conservative lifestyle were associated with older age. Tilikidou (2007) reported that people aged 55–60 tended to engage in more pro-environmental purchasing behaviors, while individuals aged 25–35 showed strong but unstable concern. Abeliotis et al. (2010) suggested that there is a positive link between individuals' age and pro-environmental behavior, finding that as age increases, the engagement in pro-environmental activities like "reduce, reuse, recycle" also increases. In the field of Green IT, Molla et al. (2014) reported a significant correlation between age and pro-environmental IT practices, and they found that young IT professionals tended to practice IT pro-environmentally.

Gender

A factor which is heavily researched in empirical studies on ethical decision-making is gender (Ford and Richardson, 1994; Lehnert et al., 2014; Loe et al., 2000; O'Fallon and Butterfield, 2005). The gender

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

social theory (Gilligan, 1982) argues that males and females have different ethical behaviors because of differences in their socialization. It asserts that females tend to maintain relationships and emphasize the needs of others, while males engage in socialization according to fairness and equity. Furthermore, the ethical studies within the IS literature report that males are more likely to engage in ethical behaviors than females (Gattiker and Kelley, 1999; Kreie and Cronan, 1998; Loch and Conger, 1996; Solomon and O'Brien, 1990), while Moores and Chang (2006) reported that there were no difference between males and females regarding ethical behaviors.

Likewise, in the environmental psychology literature, mixed results are reported about the relationship between gender and pro-environmental behaviors. For example, Schultz et al. (1995) reported that gender does not predict attitude towards the environment. Further, it has been reported that there is no difference between males and females regarding committed environmentalism (Jain and Kaur, 2006), or the opinions regarding the seriousness of climate change or engaging in "reduce, reuse, recycle" activities (Abeliotis et al., 2010). However, some researchers have reported a significant difference in pro-environmental behaviors because of gender difference. For example, Iyer and Kashyap (2007) reported that females have "more favorable attitudes towards the environment and recycling and were more likely to engage in environmentally friendly and recycling behaviors" than males. Further, Ngo et al. (2009) reported that females pay more attention to greenhouse gas reduction activities than males, with women found to be more likely than men "to characterize global climate change as the most important environmental issue" (Abeliotis et al., 2010). Regarding pro-environmental IT practices and Green IT behaviors, Molla et al. (2014) reported the better behavior of males than females; however, in their model, there were no differences in the path coefficient between males and females.

Education Level

The correlation between ethical decision-making and the educational level of individuals has been studied in the literature related to business ethics. The results regarding the influence of education level on ethical decision-making are mixed, with some scholars reporting the significant influence of educational level while others arguing the insignificant impact of educational level on the ethical decision-making process (Musbah, 2010).

In the literature related to environmental psychology, a large number of studies have investigated the influence of education on environmental consciousness. However, the results that are reported are inconclusive. Although some studies have reported a negative correlation between education level and pro-environmental behaviors, most scholars have reported a significant positive relationship between the individuals' education level and their pro-environmental behaviors (do Paço et al., 2009; Rowlands et al., 2003; Tilikidou, 2007). Regarding pro-environmental IT practices and Green IT behaviors, Molla et al. (2014) reported that the IT professionals with undergraduate-level education or below tended more towards the pro-environmental practice of IT.

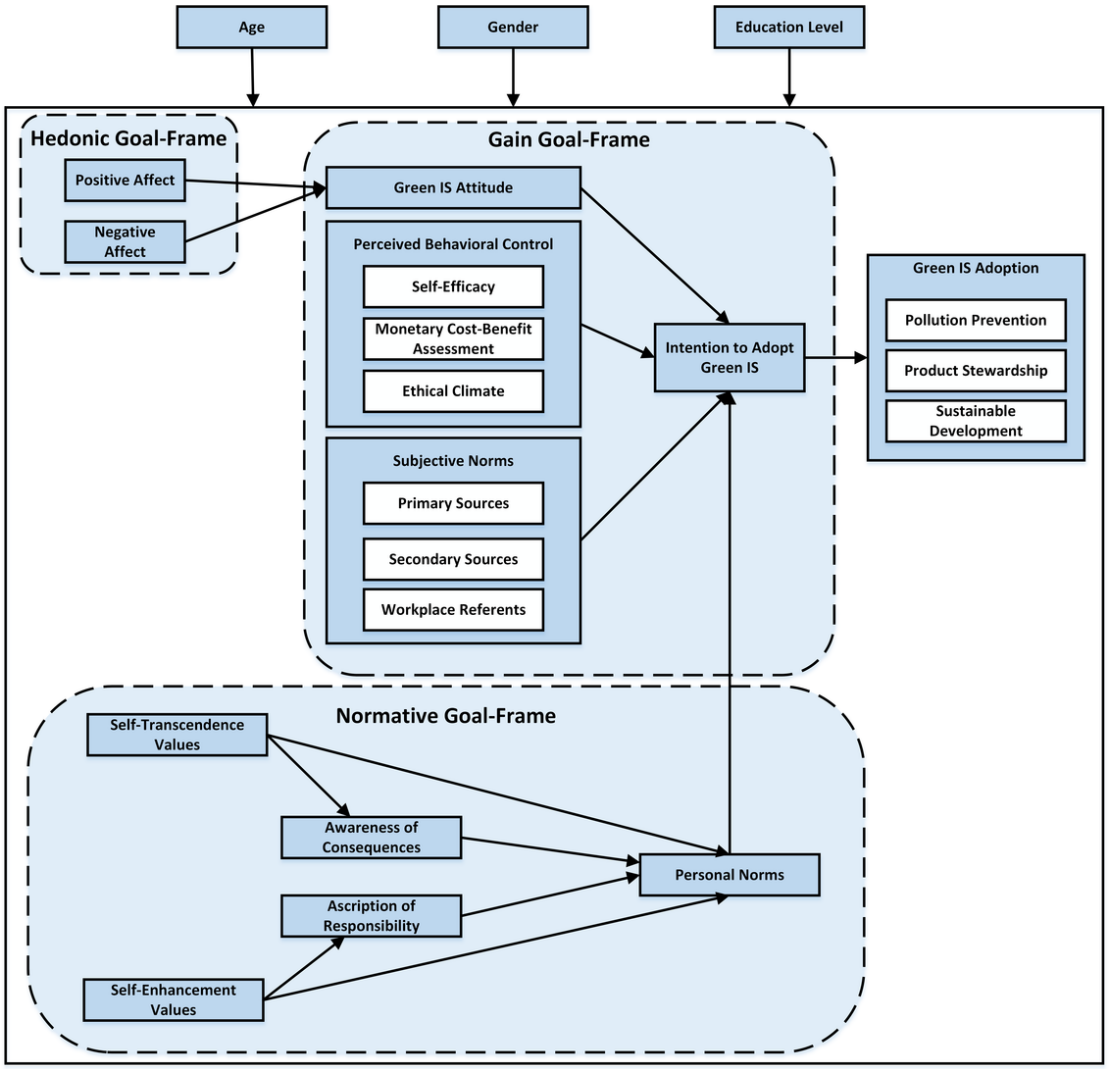
Following the above discussion on the influence of age, gender and education level on the adoption of Green IS, we suggest that these factors impact the whole decision-making process of managers towards the adoption of Green IS rather than specific factors or relationships.

There are various information technologies that enable an organization to practice Green IS including collaborative technologies such as telepresence and video-conferencing, carbon emission management systems and energy informatics systems. Green IS organizations also implement policies on the organi-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

zation's use of IS for managing their emissions, energy and other assets (Gholami et al., 2013). Based on Chen et al. (2011) and Gholami et al. (2013), the adoption of Green IS by an organization can be assessed through the extent to which IS is embedded in its pollution prevention (i.e. "reducing overall emissions, waste and hazardous materials"), product stewardship (i.e. "enhancing the environmental friendliness of upstream and downstream supply chain management"), and sustainable development (i.e. "transforming business operations"). Hence, we suggest that the goal-framing of firms' managers together with their demographic characteristics influence the adoption of Green IS for the purposes of pollution prevention, product stewardship and sustainable development (see Figure 4).

Figure 4. The integrated framework of psychological factors influencing the organizational Green IS adoption



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

THE COMPREHENSIVE GREEN IS ADOPTION FRAMEWORK

Based on the psychological theories and the empirical studies on Green IS and IT adoption discussed above, we propose the comprehensive Green IS adoption framework as depicted in Figure 4.

METHODOLOGY

TOPSIS Method

TOPSIS was first developed by Yoon (1980) and is one of the well-known classical multiple criteria decision-making (MCDM) methods (Jajimoggala et al., 2010). Several objectives are achieved by MCDM, in which it provides a structured approach to determine the overall preferences among alternatives (Agha et al., 2014; Jajimoggala et al., 2011). TOPSIS can be used with both normal numbers and fuzzy numbers. It has been widely used in dealing with MCDM problems (Yazdani and Graeml, 2014). It makes full use of attribute information, provides a cardinal ranking of alternatives, and does not require attribute preferences to be independent. To apply this technique, attribute values must be numeric, monotonically increasing or decreasing, and have commensurable units. The procedure of the TOPSIS method consists of the following steps (Hwang and Yoon, 1981):

Given a set of alternatives, $A = \{A_i \mid i = 1,...,n\}$ and a set of criteria, $C = \{C_j \mid j = 1,...,m\}$ where:

$$X = \{\tilde{x}_{ij} \mid i = 1,...,n; j = 1,...,m\}$$

denotes the set of ratings and $\tilde{W} = \{\tilde{w}_j \mid j = 1,...,m\}$ is the set of weights. The first step of TOPSIS is to calculate normalized ratings by:

$$\tilde{r}_{ij}(\boldsymbol{x}) = \frac{\tilde{x}_{ij}}{\sqrt{\sum_{i=1}^{n} \tilde{x}_{ij}^2}},\ i = 1,\cdots,n;\ j = 1,\cdots,m \tag{1}$$

and then to calculate the weighted normalized ratings by:

$$\tilde{v}_{ij}(x) = \tilde{w}_j \tilde{r}_{ij}(x),\ i = 1,\cdots,n;\ j = 1,\cdots,m \tag{2}$$

Next the positive ideal point (PIS) and the negative ideal point (NIS) are derived as:

$$PIS = \tilde{A}^+$$
$$= \{\tilde{v}_1^+(x), \tilde{v}_2^+(x), \cdots, \tilde{v}_j^+(x), \cdots, \tilde{v}_m^+(x)\}$$

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

$$= \{(\max_i \tilde{v}_{ij}(x) \mid j \in J_1),$$
$$(\min_i \tilde{v}_{ij}(x) \mid j \in J_2) \mid i = 1,\cdots,n\}$$

$$NIS = \tilde{A}^-$$
$$= \{\tilde{v}_1^-(x), \tilde{v}_2^-(x), \cdots, \tilde{v}_j^-(x), \cdots, \tilde{v}_m^-(x)\}$$

$$= \{(\min_i \tilde{v}_{ij}(x) \mid j \in J_1),$$
$$(\max_i \tilde{v}_{ij}(x) \mid j \in J_2) \mid i = 1,\cdots,n\} \tag{3}$$

where J_1 *and* J_2 are the benefit and the cost attributes, respectively. Similar to the crisp situation, the following step is to calculate the separation from the PIS and the NIS between the alternatives. The separation values can also be measured using the Euclidean distance given as:

$$\tilde{S}_i^+ = \sqrt{\sum_{j=1}^{m} [\tilde{v}_{ij}(x) - \tilde{v}_j^+(x)]^2}, i = 1,\cdots,n \tag{4}$$

$$\tilde{S}_i^- = \sqrt{\sum_{j=1}^{m} [\tilde{v}_{ij}(x) - \tilde{v}_j^-(x)]^2}, i = 1,\cdots,n \tag{5}$$

$$\max\{\tilde{v}_{ij}(x)\} - \tilde{v}_j^+(x)$$
$$= \min\{\tilde{v}_{ij}(x)\} - \tilde{v}_j^-(x) = 0 \tag{6}$$

Next, the similarities to the PIS is given as:

$$C_i^* = D(S_i^-) \Big/ [D(S_i^+) + D(S_i^-)], \ i = 1,\cdots,n \tag{7}$$

where:

$$C_i^* \in [0,1] \ \forall i = 1,\cdots,n \tag{8}$$

Finally, the preferred orders are ranked according to C_i^* in descending order to choose the best alternatives.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Calculation of the Entropy Weight Vector

Information entropy is an uncertainty measure in information theory. Using the entropy method, objective weights are calculated.

Objective weights of the objective ratios can be determined by Shannon's entropy concept (Shannon, 2001). In this research, the concept of entropy is applied to determine the criteria weight. According to Shi-fei and Zhong-zhi (2005) and Zeleny and Cochrane (1982), entropy is a term in information theory, also known as the average amount of information. The criteria weights are calculated by the entropy method. According to the degree of index dispersion, the weight of all indicators is calculated by information entropy. The entropy method is highly reliable and can be easily adopted in information measurement (Zou et al., 2005).

Formally, the entropy method begins with a normalization process using the values of matrix $N = (n_{ij})_{n\times m}$ (n alternatives and m indicators) by the following specific formulation (Hwang and Yoon, 1981):

$$n_{ij} = r_{ij} / \sum_{i=1}^{n} r_{ij} \tag{9}$$

The following equation calculates entropy measure of every index:

$$\begin{aligned} E_j &= -K\sum_{i=1}^{n}\left[n_{ij}\ln(n_{ij})\right] \forall_j = 1,2,...m \\ K &= \frac{1}{\ln(n)} \end{aligned} \tag{10}$$

The degree of divergence dj of the intrinsic information for each criterion C (j= 1, 2, …, n) may be calculated as:

$$d_j = 1 - E_j \tag{11}$$

The value d_j represents the inherent contrast intensity of cj. The higher the dj, the more important the criterion cj is for the problem. The objective weight for each criterion can be obtained. Accordingly, the normalized weights of indexes can be calculated as:

$$W_j = \frac{d_j}{\sum_{k=1}^{m} d_k} \tag{12}$$

Since E_j is less than or equal to one, the entropy weights are therefore always positive.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 1. Profile of survey respondents

Gender	%	Age	%	Academic Rank	%	Number of Publications	%
Male	73	< 25	0	PhD (ongoing)	9	1-3	26
Female	27	25 – 34	17	Lecturer	13	3-5	22
		35 – 44	24	Senior lecturer	18	5-10	50
		44 – 55	26	Associate Professor	55	> 10	2
		55 – 65	23	Professor	5		
		> 65	10				

Data Collection and Analysis

The data for this study was collected by conducting an online survey through a structured questionnaire-based instrument comprising a 5-point Likert-type scale. The respondents were asked to indicate the importance (from 1 'not at all important' to 5 'very important') of each factor in influencing the behavior of managers to adopt Green IS.

This research instrument was addressed only to experts in the field of IS and preferably those with knowledge of Green IS. To that aim, using the Association for Information Systems database, which is the basket of IS-related journals and conference proceedings, we extracted the list of scholars who had published papers in the scope of incorporating IS and environmental sustainability issues (including Green IT and Green IS). The list contained the details of 113 scholars meeting the desired attributes.

Invitation to participate in the survey, together with an explanation about the research and a web link to the online survey questionnaire, was sent to all the listed scholars through an email. We followed up on the initial invitation with four reminders. After two weeks, 50 scholars had completed the survey. Respondents had a variety of positions in the field of IS. Almost 91 percent of respondents held a lecturing position in their affiliated institution and IS department. The majority of respondents were male (73 percent), held Associate Professor title (55 percent), were within the age of 34–65 (73 percent), and had 5 to 10 publications in the field of Green IT or Green IS (50 percent). A summary of the demographic background and profile of the respondents is provided in Table 1.

After data collection, we applied the TOPSIS technique to rank the factors in each group which influence Green IS adoption. Using the entropy method, objective weights were calculated and finally the ranks of all 15 Green IS adoption factors were calculated. Accordingly, the positive ideal and negative ideal (using Equation 3) and the final ranks (using Equation 7) are presented in Table 2 and Table 3, respectively. The calculated entropy measures of every index using Equations (10)–(12) are presented in matrix W (see Box 1).

Table 2. Positive ideal and negative ideal

Max V_{i1}	**Max V_{i2}**	**Max V_{i3}**	**Max V_{i4}**	**Max V_{i5}**
0.3429	0.529	3.559	8.529	8.411
Min V_{i1}	**Min V_{i2}**	**Min V_{i3}**	**Min V_{i4}**	**Min V_{i5}**
0.0345	0.181	0.193	1.212	3.186

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 3. The final ranks of all 15 factors for green IS adoption

Factor	$D(S_i^-) / [D(S_i^+) + D(S_i^-)]$	Rank of Factor
Secondary Sources	0.451	15
Negative Affect	0.455	14
Primary Sources	0.463	13
Ethical Climate	0.472	12
Work Referents	0.508	11
Self-Enhancement	0.552	10
Positive Affect	0.561	9
Self-Efficacy	0.561	8
Ascription of Responsibility	0.582	7
Self-Transcendence	0.595	6
Awareness of Consequences	0.612	5
Monetary Cost-Benefit Assessment	0.665	4
Attitude	0.676	3
Personal Norm	0.721	2
Intention	0.741	1

[1] IT: devices which store, process and transmit information

[2] IS: cooperating set of people, processes and information technologies to support individual, organizational and societal goals

Box 1. Calculated entropy measures

$$w_1 = 0.048,\ w_2 = 0.185, w_3 = 0.221, w_4 = 0.379 \text{ and } w_5 = 0.165 \Rightarrow W = \begin{bmatrix} 0.0048 & 0 & 0 & 0 & 0 \\ 0 & 0.185 & 0 & 0 & 0 \\ 0 & 0 & 0.221 & 0 & 0 \\ 0 & 0 & 0 & 0.379 & 0 \\ 0 & 0 & 0 & 0 & 0.165 \end{bmatrix}$$

According to the ranking presented in Table 2, the first five ranks (using a threshold value greater than 0.6) belong to awareness of consequences (0.612), monetary cost–benefit assessment (0.665), attitude (0.676), personal norm (0.721) and intention (0.741).

DISCUSSION

IT has made significant impact on our lives (Amrollahi et al., 2013, Ghapanchi and Aurum, 2012, Zarei and Ghapanchi, 2008, Ghapanchi et al., 2012b, Ghapanchi et al., 2011, (Ghanbarzadeh et al., 2014, Najaftorkaman et al., 2014, Ghapanchi and Aurum, 2011). Many studies to date have been directed on various effects of IT in a wide variety of fields (Merati et al., 2012, Ghapanchi, 2013, Khosravi et al.,

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

2012, Ghapanchi and Aurum, 2011b, Amrollahi et al., 2014, Ghapanchi et al., 2014, Rezvani et al., 2012, Ghapanchi et al., 2010, Ghapanchi et al., 2012a). Several of such studies have reported positive impact of technology on various aspects of businesses (e.g. Zarei et al., 2013; Atlikhan et al., 2013; Purarjomandlangrudi et al., 2014; Talaei-Khoei et al., 2014; Vichitvanichphong et al., 2013; Ghapanchi et al., 2008; Ghapanchi et al., 2013; Ghapanchi, 2015).

By developing the comprehensive framework comprising the factors that influence the adoption of Green IS and by analyzing the model utilizing the TOPSIS technique and the data collected from 50 experts in the field of IS, some findings of previous studies on the importance of factors in adopting organizational eco-innovations and pro-environmental IT practices were confirmed. The results of the TOPSIS analysis revealed that the intention to adopt Green IS gained the first rank among the other factors regarding the importance of its influence on adoption behavior (0.741). This is in line with the theory of reasoned action (Fishbein and Ajzen, 1975) which postulates that the immediate predictor of actual behavior is the behavioral intention. Furthermore, behavior has been hypothesized as a function of a willingness to perform a behavior, which is intention. In the technology adoption in the literature, it is already asserted that the intention to act is a better predictor of the actual behavior than just merely evaluating the technology (Ajzen, 1991; Armitage and Conner, 2001). Huijts et al. (2013) asserted that by studying the intention, policy-makers can benefit from the early knowledge of how individuals will respond prior to the actual observable behavior.

Another important variable, sitting in the second place in the ranking list, is the personal norm. The ranking of this factor (with the value of 0.721) reflects the fact that individuals with the feeling of a moral obligation to engage in pro-environmental behaviors have a greater intention to practice Green IS initiatives. This supports the findings from previous studies that the most important predictor of intention and behavior to act pro-socially and pro-environmentally is the individual's personal norm (Andersson et al., 2005; Huijts et al., 2013; Jansson, 2011; Jansson et al., 2010; Jansson et al., 2011; Stern, 2000).

The third important factor in the list is the managers' attitude toward Green IS (0.676). Attitude, referring to the degree to which an individual assesses a behavior as favorable or unfavorable (Fishbein and Ajzen, 1975), plays a significant role in individuals' decisions to engage in a specific behavior. In a study on the factors that influence the senior managers' decision to adopt Green IS, Gholami et al. (2013) reported that the possibility of adopting Green IS initiatives among the managers with a positive attitude towards Green IS was higher than among the ones with less positive or even negative attitudes. The significant impact of attitude on the decision-making process of individuals to adopt IT (Hsu and Chiu, 2004; Taylor and Todd, 1995) and practice pro-environmental behaviors (Papagiannakis and Lioukas, 2012) has already been reported in the literature, and the findings of this study echo the results obtained by previous scholars.

The decisions of managers to adopt innovations for their firms are mostly based on rational choices, which are the trade-offs amidst costs, benefits and the risks of diffusing new technology and applying it to the business processes of the organizational activities. The fourth important factor on the list from the point of view of the experts and based on the results retrieved from the TOPSIS analysis is the assessment of cost and benefit (with the weight of 0.665). Economic motivations and outcomes are often the focus of the strategic decision-making literature (Flannery and May, 2000; Ilinitch and Wicks, 1996). However, in environmental proactiveness studies it has been reported that monetary cost–benefit assessment negatively influences the behavior of managers. It means that, the more that managers base their cost–benefit assessment on monetary criteria, the less they will integrate environmental initiatives

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

in their business processes (Bansal and Roth, 2000; Flannery and May, 2000). These findings indicate the importance of financial costs and benefits on the decision-making process of managers and further suggest that organizational researchers should examine the role played by monetary cost–benefit assessment in ethical and environmental decision-making.

Based on the TOPSIS analysis, the fifth important factor influencing the decision-making process of managers towards the adoption of Green IS is their awareness regarding the detrimental effects of their behavior on the natural environment. Various studies have investigated the impact of awareness of consequences on engaging in pro-environmental behaviors. Jansson et al. (2011) reported that the intention of individuals to adopt eco-innovations can be largely explained by their awareness of consequences. Furthermore, Gholami et al. (2013) asserted that the managers who attach a high degree of importance to the immediate consequences of behavior to the environment are more likely to integrate Green IS initiatives into their business processes. Hence, the results of this study reflect and support the results reported by other scholars from various disciplines.

Abovementioned are the first five important factors that influence managers to adopt Green IS based on the data retrieved from the experts and analyzed by the TOPSIS technique with the threshold of 0.6. Besides these five factors, the other factors including self-transcendence, ascription of responsibility, self-efficacy, positive affect, self-enhancement and work referents were placed within the ranking values of 0.5 and 0.6. The last four items, which are ethical climate, primary source, negative affect and secondary source, had the ranking values of 0.4 to 0.5. The dichotomizing of factors based on their ranking values helps organizational researchers to prioritize their focus in studying factors that influence the decision-making process of managers to practice Green IS initiatives in the business processes. In summary, it is believed that the intention of managers to adopt Green IS, their personal moral obligation to engage in pro-environmental behaviors, their attitude towards Green IS, financial considerations, and awareness of detrimental consequences of their behaviors are the key factors in influencing their behavior to integrate environmental practices in their organizations. Other factors regardless of their lower importance rankings should not be overlooked by researchers.

CONCLUSION

In this paper, we proposed a comprehensive framework to understand the factors that influence the firms' decision-makers to adopt Green IS initiatives. To conclude the proposed model, the literature was reviewed from various disciplines and fields including IS, environmental psychology and social psychology. The dependent variable in the model is the intention to adopt Green IS which is the most significant predictor of actual behavior. The model comprehends the psychological factors related to: (1) evaluating the Green IS initiatives themselves, (2) taking action in favor or against Green IS, and (3) morality influencing the intention to adopt Green IS.

The framework assumes that the managers' intention to adopt Green IS initiatives is based on the three relevant goal-frames (see goal-framing theory), which are the gain, moral and hedonic goal-frames. Gain motives are perfectly reflected in TPB, while the moral motives are assumed in VBN theory. These two theories are integrated in the proposed framework. In the model, hedonic goals are modeled as the predictors of attitude which are assumed in a large body of studies on affect.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The variables that directly or indirectly predict the managers' intention to adopt Green IS have been identified as: positive affect, negative affect, attitude, perceived behavioral control (including self-efficacy, monetary cost–benefit assessment and ethical climate), subjective norms (including primary sources, secondary sources, and work referents), self-transcendence values, self-enhancement values, awareness of consequences, ascription of responsibilities, personal norms, age, gender and education level. The casual paths between the factors in the model were all based on the reviewed empirical studies in the corresponding literature. The variables of age, gender and education level were assumed to influence several factors and relationships, and were, hence, depicted to impact the whole proposed model.

The influence of each factor on the adoption behavior has been analyzed based on their level of importance. To do so, the data was collected from the IS experts and scholars through a 5-point Likert scale online questionnaire. To analyze the data, we applied TOPSIS, which is a multi-criteria decision analysis method for ranking the factors based on their importance in influencing the behavior. Results from the TOPSIS analysis supported the previous studies in the literature and reflected the experts' insights into the most important factors impacting the decision-making process of managers regarding Green IS adoption. From the perspective of the experts, intention, personal norm, attitude, monetary cost–benefit assessment and awareness of consequences were the five most important constructs influencing the behavior of managers. This study aimed to provide insights organizational researchers investigating the factors impacting the behavior of decision-makers to practice pro-environmental initiatives in corporations. Furthermore, corporations aiming at enhancing environmental sustainability would achieve better outcomes if they screen candidates for environmental management positions on the basis of their pro-environmental behavior. As Trevino (1986) postulated that "most managers will look outside themselves for cues about what is right (appropriate) behavior and what is wrong (inappropriate) behavior", the findings of this study would interest managers as they are intended to promote environmentally and ethically sound decision-making. As stated by Collins (1989), "ethical issues are often complex because in many instances, the trade-off is not between generating a harm or benefit, but between degrees of harms or benefits to company and/or stakeholder"; thus, the combination of ethics, ecological educations and explicit behavioral guidelines would be necessary to help and prepare decision-makers to make such difficult decisions. Finally, by integrating the individual factors and issues into organizational ethics and environmental behavior models, researchers may begin to understand the process of judgments and decision-making of our society's most influential decision-makers – the individuals who through their daily decisions within organizations contribute to the sustainability of the natural environment.

The framework is specifically proposed for Green IS adoption; however, it also can be used to study the adoption of Green IT, which focuses on mitigating the detrimental effects of IT on the environment. We limited the model to psychological and socio-demographic factors. Other factors may influence managers to adopt Green IS in their firms such as mimetic pressures, coercive pressures and normative pressures. These factors may influence the intention of managers to adopt Green IS through the variables in the model rather than directly. We hope the proposed model would help to clarify the relative importance of the psychological and socio-demographic factors influencing the adoption of Green IS by organizational decision-makers.

The casual order of the relationships between factors in the model has been investigated in the literature and has been the subject of debate in various empirical studies. The proposed framework (as illustrated in Figure 4) is based on the relationships dominantly investigated and suggested in the literature. For future studies, an appropriate research design would be needed to elucidate or strengthen the causality

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

of relationships, such as empirical and longitudinal studies. Furthermore, the variables in the framework are investigated in relation to Green IS as general technology acceptance or pro-environmental behavior. Hence, it would be worthwhile to use the framework to study specific Green IS initiatives as the technological aspects vary among different initiatives.

ACKNOWLEDGMENT

The authors would like to thank the anonymous reviewers for their helpful and constructive comments that greatly contributed to improving the final version of the paper. They would also like to thank the Editors for their generous comments and support during the review process.

REFERENCES

Abeliotis, K., Koniari, C., & Sardianou, E. (2010). The profile of the green consumer in Greece. *International Journal of Consumer Studies*, *34*(2), 153–160. doi:10.1111/j.1470-6431.2009.00833.x

Agha, M. S., Alnahhal, M. J., Agha, S. R., & Alafeefy, A. S. (2014). Industrial Sectors Eligibility for Rehabilitation Programs: An Integrated AHP – TODIM Approach. [IJSDS]. *International Journal of Strategic Decision Sciences*, *5*(1), 95–110. doi:10.4018/ijsds.2014010106

Ajzen, I. (1988). Attitudes, personality, and behavior. Ajzen, Icek and Martin Fishbein:"The Prediction of Behavior from Attitudinal and Normative Variables. *Journal of Experimental Social Psychology*, (6): 483.

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179–211. doi:10.1016/0749-5978(91)90020-T

Ajzen, I. (2001). Nature and operation of attitudes. *Annual Review of Psychology*, *52*(1), 27–58. doi:10.1146/annurev.psych.52.1.27 PMID:11148298

Ajzen, I., & Madden, T. J. (1986). Prediction of goal-directed behavior: Attitudes, intentions, and perceived behavioral control. *Journal of Experimental Social Psychology*, *22*(5), 453–474. doi:10.1016/0022-1031(86)90045-4

Al-Khatib, J. A., Dobie, K., & Vitell, S. J. (1995). Consumer ethics in developing countries: An empirical investigation. *Journal of Euromarketing*, *4*(2), 87–109. doi:10.1300/J037v04n02_06

Amrollahi, A., Ghapanchi, A.H., & Talaei-Khoei, A. (2013). A Systematic Literature Review on Strategic Information Systems Planning: Insights from the Past Decade. *Pacific Asia Journal of Association for Information Systems*, *5*(2), 39–66.

Amrollahi, A., Ghapanchi, A.H., & Talaei-Khoei, A. (2014). Three Decades of Research on Strategic Information System Plan Development, Communications of the Association for Information Systems, Vol. 34. *Article*, *84*, 1439–1467.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Andersson, L., Shivarajan, S., & Blau, G. (2005). Enacting ecological sustainability in the MNC: A test of an adapted value-belief-norm framework. *Journal of Business Ethics*, *59*(3), 295–305. doi:10.100710551-005-3440-x

Armitage, C. J., & Conner, M. (2001). Efficacy of the theory of planned behaviour: A meta-analytic review. *The British Journal of Social Psychology*, *40*(4), 471–499. doi:10.1348/014466601164939 PMID:11795063

Atlikhan, A., Albadvi, A., & Ghapanchi, A. (2013). A Conceptual Model for Proactive-Interactive Customer Complaint Management Systems. *International Journal of Business Information Systems*, *13*(4), 490–503. doi:10.1504/IJBIS.2013.055303

Bamberg, S., & Schmidt, P. (2003). Incentives, morality, or habit? Predicting students' car use for university routes with the models of Ajzen, Schwartz, and Triandis. *Environment and Behavior*, *35*(2), 264–285. doi:10.1177/0013916502250134

Bandura, A. (1997). *Self-Efficacy: The Exercise of Control*. Worth Publishers.

Bansal, P. (2005). Evolving sustainably: A longitudinal study of corporate sustainable development. *Strategic Management Journal*, *26*(3), 197–218. doi:10.1002mj.441

Bansal, P., & Roth, K. (2000). Why Companies Go Green: A Model of Ecological Responsiveness. *Academy of Management Journal*, *43*(4), 717–736. doi:10.2307/1556363

Bechara, A., Damasio, A. R., Damasio, H., & Anderson, S. W. (1994). Insensitivity to future consequences following damage to human prefrontal cortex. *Cognition*, *50*(1), 7–15. doi:10.1016/0010-0277(94)90018-3 PMID:8039375

Bechara, A., Damasio, H., Tranel, D., & Damasio, A. R. (1997). Deciding advantageously before knowing the advantageous strategy. *Science*, *275*(5304), 1293–1295. doi:10.1126cience.275.5304.1293 PMID:9036851

Bernardi, R. A. (1994). Fraud Detection-The Effect of Client Integrity and Competence and Auditor Cognitive-Style. *Auditing-A Journal of Practice & Theory*, *13*, 68–84.

Bernath, K., & Roschewitz, A. (2008). Recreational benefits of urban forests: Explaining visitors' willingness to pay in the context of the theory of planned behavior. *Journal of Environmental Management*, *89*(3), 155–166. doi:10.1016/j.jenvman.2007.01.059 PMID:17720294

Bose, R., & Luo, X. (2011). Integrative framework for assessing firms' potential to undertake Green IT initiatives via virtualization - A theoretical perspective. *The Journal of Strategic Information Systems*, *20*(1), 38–54. doi:10.1016/j.jsis.2011.01.003

Brouthers, L. E., Lascu, D.-N., & Werner, S. (2008). Competitive irrationality in transitional economies: Are communist managers less irrational? *Journal of Business Ethics*, *83*(3), 397–408. doi:10.100710551-007-9627-6

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Brown, S. A., & Venkatesh, V. (2005). Model of adoption of technology in households: A baseline model test and extension incorporating household life cycle. *Management Information Systems Quarterly*, 399–426.

Butler, T. (2011). Compliance with institutional imperatives on environmental sustainability: Building theory on the role of Green IS. *The Journal of Strategic Information Systems*, *20*(1), 6–26. doi:10.1016/j.jsis.2010.09.006

Cagle, J. A., & Baucus, M. S. (2006). Case studies of ethics scandals: Effects on ethical perceptions of finance students. *Journal of Business Ethics*, *64*(3), 213–229. doi:10.100710551-005-8503-5

Chen, A. J., Boudreau, M.-C., & Watson, R. T. (2008). Information systems and ecological sustainability. *Journal of Systems and Information Technology*, *10*(3), 186–201. doi:10.1108/13287260810916907

Chen, A. J., Watson, R. T., Boudreau, M.-C., & Karahanna, E. (2011). An Institutional Perspective on the Adoption of Green IS & IT. *Australasian Journal of Information Systems*, *17*(1), 23–45.

Collins, D. (1989). Organizational harm, legal condemnation and stakeholder retaliation: A typology, research agenda and application. *Journal of Business Ethics*, *8*(1), 1–13. doi:10.1007/BF00382011

Commission, B. (1987). *World Commission on Environment and Development, Our Common Future*. Oxford University Press.

Craft, J. L. (2013). A review of the empirical ethical decision-making literature: 2004–2011. *Journal of Business Ethics*, *117*(2), 221–259. doi:10.100710551-012-1518-9

Crano, W. D., & Prislin, R. (2006). Attitudes and persuasion. *Annual Review of Psychology*, *57*(1), 345–374. doi:10.1146/annurev.psych.57.102904.190034 PMID:16318599

Cropanzano, R., Weiss, H. M., Hale, J. M., & Reb, J. (2003). The structure of affect: Reconsidering the relationship between negative and positive affectivity. *Journal of Management*, *29*(6), 831–857. doi:10.1016/S0149-2063(03)00081-3

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science*, *35*(8), 982–1003. doi:10.1287/mnsc.35.8.982

De Groot, J., & Steg, L. (2007). General beliefs and the theory of planned behavior: The role of environmental concerns in the TPB. *Journal of Applied Social Psychology*, *37*(8), 1817–1836. doi:10.1111/j.1559-1816.2007.00239.x

De Groot, J., & Steg, L. (2008). Value Orientations to Explain Beliefs Related to Environmental Significant Behavior How to Measure Egoistic, Altruistic, and Biospheric Value Orientations. *Environment and Behavior*, *40*(3), 330–354. doi:10.1177/0013916506297831

De Groot, J., & Steg, L. (2010). Morality and nuclear energy: Perceptions of risks and benefits, personal norms, and willingness to take action related to nuclear energy. *Risk Analysis*, *30*(9), 1363–1373. doi:10.1111/j.1539-6924.2010.01419.x PMID:20412516

Dedrick, J. (2010). Green IS: Concepts and Issues for Information Systems Research. *Communications of the Association for Information Systems*, *27*(11), 174–184.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Djamasbi, S., Fruhling, A. L., & Loiacono, E. (2009). The influence of affect, attitude and usefulness in the acceptance of telemedicine systems. [JITTA]. *Journal of Information Technology Theory and Application*, *10*(1).

do Paço, A. M. F., Raposo, M. L. B., & Leal Filho, W. (2009). Identifying the green consumer: A segmentation study. Journal of Targeting. *Measurement and Analysis for Marketing*, *17*(1), 17–25. doi:10.1057/jt.2008.28

Dyllick, T., & Hockerts, K. (2002). Beyond the business case for corporate sustainability. *Business Strategy and the Environment*, *11*(2), 130–141. doi:10.1002/bse.323

Elkington, J. (1997). Cannibals with forks. The triple bottom line of 21st century.

Elliot, S. (2011). Transdisciplinary perspectives on environmental sustainability: A resource base and framework for IT-enabled business transformation. *Management Information Systems Quarterly*, *35*(1), 197–236.

Erevelles, S. (1998). The role of affect in marketing. *Journal of Business Research*, *42*(3), 199–215. doi:10.1016/S0148-2963(97)00118-5

Esfahani, M. D., Rahman, A. A., & Zakaria, N. H. (2015a). Green IT/IS Adoption as Corporate Ecological Responsiveness: An Academic Literature Review. *Journal of Soft Computing and Decision Support Systems*, *2*(1), 35–43.

Esfahani, M. D., Rahman, A. A., & Zakaria, N. H. (2015b). The Status Quo and the Prospect of Green IT and Green IS: A Systematic Literature Review. *Journal of Soft Computing and Decision Support Systems*, *2*(1), 18–34.

Eweje, G., & Brunton, M. (2010). Ethical perceptions of business students in a New Zealand university: Do gender, age and work experience matter? *Business Ethics (Oxford, England)*, *19*(1), 95–111. doi:10.1111/j.1467-8608.2009.01581.x

Fishbein, M., & Ajzen, I. (1975). *Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research*. Reading, MA: Addison-Wesley.

Flannery, B. L., & May, D. R. (1994). Prominent factors influencing environmental activities: Application of the environmental leadership model (ELM). *The Leadership Quarterly*, *5*(3), 201–221. doi:10.1016/1048-9843(94)90012-4

Flannery, B. L., & May, D. R. (2000). Environmental ethical decision making in the US metal-finishing industry. *Academy of Management Journal*, *43*(4), 642–662. doi:10.2307/1556359

Ford, R. C., & Richardson, W. D. (1994). Ethical decision making: A review of the empirical literature. *Journal of Business Ethics*, *13*(3), 205–221. doi:10.1007/BF02074820

Friedman, M., & Allen, G. C. (1970). The counter-revolution in monetary theory: first Wincott memorial lecture, delivered at the Senate House, University of London, 16 September, 1970: Wincott Foundation.

Fulk, J., Steinfield, C. W., Schmitz, J., & Power, J. G. (1987). A social information processing model of media use in organizations. *Communication Research*, *14*(5), 529–552. doi:10.1177/009365087014005005

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Gattiker, U. E., & Kelley, H. (1999). Morality and computers: Attitudes and differences in moral judgments. *Information Systems Research*, *10*(3), 233–254. doi:10.1287/isre.10.3.233

Ghanbarzadeh, R., Ghapanchi, A. H., Blumenstein, M. & Talaei-Khoei, A. (2014). A Decade of Research on the Use of Three-Dimensional Virtual Worlds in Health Care: A Systematic Literature Review. *Journal of Medical Internet Research*, 16.

Ghapanchi, A.H., Aurum, A., & Low, G. (2011). Creating a Measurement Taxonomy for the Success of Open Source Software Projects. *First Monday*, *16*(8).

Ghapanchi, A.H., Aurum, A., & Daneshgar, F. (2012a). The Impact of Process Effectiveness on User Interest in Contributing to the Project, Journal of software, Vol. 7, No. 1, pp. 212-219.

Ghapanchi, A. H. (2015). Predicting Software Future Sustainability: A Longitudinal Perspective, Information Systems, Vol. 49, pp- 40-51

Ghapanchi, A. H., & Aurum, A.Ghapanchi. (2011a). Antecedents to IT personnel's intentions to leave: A systematic literature review. *Journal of Systems and Software*, *84*(2), 238–249. doi:10.1016/j.jss.2010.09.022

Ghapanchi, A. H., & Aurum, A.Ghapanchi. (2011b). The Impact of Project License and Operating System on the Effectiveness of the Defect-Fixing Process in Open Source Software Projects. *International Journal of Business Information Systems*, *8*(4), 413–424. doi:10.1504/IJBIS.2011.042398

Ghapanchi, A. H., & Aurum, A.Ghapanchi. (2012). Competency rallying in electronic markets: Implications for open source project success. *Electronic Markets*, *22*(2), 117–127. doi:10.100712525-012-0088-0

Ghapanchi, A. H.Ghapanchi. (2013). Rallying competencies in virtual communities: A study of core processes and user interest in open source software projects. *Information and Organization*, *23*(2), 129–148. doi:10.1016/j.infoandorg.2013.03.001

Ghapanchi, A. H., Ghapanchi, A. R., Talaei-Khoei, A., & Abedin, B. (2013). A Systematic Review on Information Technology Personnel's Turnover. *Lecture Notes on Software Engineering*, *1*(1), 98–101. doi:10.7763/LNSE.2013.V1.22

Ghapanchi, A. H., Jafarzadeh, M. H., & Khakbaz, M. H. (2008). Fuzzy-DEA approach to ERP system analysis and selection. *International Journal of Information Systems and Change Management.*, *3*(2), 157–170. doi:10.1504/IJISCM.2008.020693

Ghapanchi, A. H., Tavana, M., Khakbaz, M. H., & Low, G.Ghapanchi. (2012b). A Methodology for Selecting Portfolios of IS/IT Projects with Interactions and Under Uncertainty. *International Journal of Project Management*, *30*(7), 791–803. doi:10.1016/j.ijproman.2012.01.012

Ghapanchi, A. H., Wohlin, C., & Aurum, A.Ghapanchi. (2014). Resources Contributing to Gaining Competitive Advantage for Open Source Software Projects: An Application of Resource-Based Theory. *International Journal of Project Management*, *32*(1), 139–152. doi:10.1016/j.ijproman.2013.03.002

Gholami, R., Sulaiman, A. B., Ramayah, T., & Molla, A. (2013). Senior managers' perception on green information systems (IS) adoption and environmental performance: Results from a field survey. *Information & Management*, *50*(7), 431–438. doi:10.1016/j.im.2013.01.004

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Gilligan, C. (1982). *In a different voice*. Harvard University Press.

Grant, N., & Marshburn, D. (2014). Understanding the Enablers and Inhibitors of Decision to Implement Green Information Systems: A Theoretical Triangulation Approach Paper presented at the Twentieth Americas Conference on Information Systems, Savannah.

Grob, A. (1995). A structural model of environmental attitudes and behaviour. *Journal of Environmental Psychology*, *15*(3), 209–220. doi:10.1016/0272-4944(95)90004-7

Hansla, A., Gamble, A., Juliusson, A., & Gärling, T. (2008). The relationships between awareness of consequences, environmental concern, and value orientations. *Journal of Environmental Psychology*, *28*(1), 1–9. doi:10.1016/j.jenvp.2007.08.004

Hart, S. L. (1995). A Natural-Resource-Based View of the Firm. *Academy of Management Review*, *20*(4), 986–1014. doi:10.2307/258963

Hasan, H. M., & Dwyer, C. (2010). Was the Copenhagen Summit doomed from the start? Some insights from Green IS research.

Hemingway, C. A., & Maclagan, P. W. (2004). Managers' personal values as drivers of corporate social responsibility. *Journal of Business Ethics*, *50*(1), 33–44. doi:10.1023/B:BUSI.0000020964.80208.c9

Hsu, M.-H., & Chiu, C.-M. (2004). Predicting electronic service continuance with a decomposed theory of planned behaviour. *Behaviour & Information Technology*, *23*(5), 359–373. doi:10.1080/01449290410001669969

Huijts, N., De Groot, J., Molin, E., & Van Wee, B. (2013). Intention to act towards a local hydrogen refueling facility: Moral considerations versus self-interest. *Transportation Research Part A, Policy and Practice*, *48*, 63–74. doi:10.1016/j.tra.2012.10.006

Huijts, N., Molin, E., & Steg, L. (2012). Psychological factors influencing sustainable energy technology acceptance: A review-based comprehensive framework. *Renewable & Sustainable Energy Reviews*, *16*(1), 525–531. doi:10.1016/j.rser.2011.08.018

Hwang, C. L., & Yoon, K. P. (1981). *Multiple Attribute Decision Making: Methods and Applications*. New York: Springer. Verlag. doi:10.1007/978-3-642-48318-9

Ilinitch, A., & Wicks, A. (1996). Integrating Strategic Decision making & Business Ethics: A Cognitive Approach. Academy of Management Proceedings, 1996(1), 352-356. doi:10.5465/ambpp.1996.4980923

Iyer, E. S., & Kashyap, R. K. (2007). Consumer recycling: Role of incentives, information, and social class. *Journal of Consumer Behaviour*, *6*(1), 32–47. doi:10.1002/cb.206

Jain, S. K., & Kaur, G. (2006). Role of socio-demographics in segmenting and profiling green consumers: An exploratory study of consumers in India. *Journal of International Consumer Marketing*, *18*(3), 107–146. doi:10.1300/J046v18n03_06

Jajimoggala, S., Rao, V. V. S. K., & Beela, S. (2010). A Hybrid Multiple Criteria Decision Making Technique for Prioritizing Equipments. [IJSDS]. *International Journal of Strategic Decision Sciences*, *1*(4), 56–75. doi:10.4018/jsds.2010100104

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Jajimoggala, S., Rao, V. V. S. K., & Satyanarayana, B. (2011). Maintenance Strategy Evaluation Using ANP and Goal Programming. [IJSDS]. *International Journal of Strategic Decision Sciences*, *2*(2), 56–77. doi:10.4018/jsds.2011040104

Jansson, J. (2011). Consumer eco-innovation adoption: Assessing attitudinal factors and perceived product characteristics. *Business Strategy and the Environment*, *20*(3), 192–210. doi:10.1002/bse.690

Jansson, J., Marell, A., & Nordlund, A. (2010). Green consumer behavior: Determinants of curtailment and eco-innovation adoption. *Journal of Consumer Marketing*, *27*(4), 358–370. doi:10.1108/07363761011052396

Jansson, J., Marell, A., & Nordlund, A. (2011). Exploring consumer adoption of a high involvement eco-innovation using value-belief-norm theory. *Journal of Consumer Behaviour*, *10*(1), 51–60. doi:10.1002/cb.346

Jenkin, T. A., Webster, J., & McShane, L. (2011). An agenda for 'Green' information technology and systems research. *Information and Organization*, *21*(1), 17–40. doi:10.1016/j.infoandorg.2010.09.003

Kals, E., & Maes, J. (2002). *Sustainable development and emotions Psychology of sustainable development* (pp. 97–122). Springer. doi:10.1007/978-1-4615-0995-0_6

King, A., & Lenox, M. (2002). Exploring the locus of profitable pollution reduction. *Management Science*, *48*(2), 289–299. doi:10.1287/mnsc.48.2.289.258

Klöckner, C. A., & Blöbaum, A. (2010). A comprehensive action determination model: Toward a broader understanding of ecological behaviour using the example of travel mode choice. *Journal of Environmental Psychology*, *30*(4), 574–586. doi:10.1016/j.jenvp.2010.03.001

Krambia-Kapardis, M., & Zopiatis, A. (2008). Uncharted territory: Investigating individual business ethics in Cyprus. *Business Ethics (Oxford, England)*, *17*(2), 138–148. doi:10.1111/j.1467-8608.2008.00527.x

Kranz, J., & Picot, A. (2011). Why Are Consumers Going Green? The Role of Environmental Concerns in Private Green-Is Adoption. Paper presented at the ECIS 2011 Proceedings.

Kranz, J., & Picot, A. (2012). Is It Money Or The Environment? An Empirical Analysis of Factors Influencing Consumers' Intention to Adopt the Smart Metering Technology Paper presented at the Proceedings of the Eighteenth Americas Conference on Information Systems, Seattle, Washington.

Kreie, J., & Cronan, T. P. (1998). How men and women view ethics. *Communications of the ACM*, *41*(9), 70–76. doi:10.1145/285070.285084

Kuo, B., & Dick, G. (2010). The greening of organisational IT: What makes a difference? *Australasian Journal of Information Systems*, *16*(2), 81–92.

Lehnert, K., Park, Y.-h., & Singh, N. (2014). Research Note and Review of the Empirical Ethical Decision-Making Literature: Boundary Conditions and Extensions. Journal of Business Ethics, 1-25.

Lindenberg, S. (2001). Intrinsic motivation in a new light. *Kyklos*, *54*(2-3), 317–342. doi:10.1111/j.0023-5962.2001.00156.x

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Lindenberg, S., & Steg, L. (2007). Normative, gain and hedonic goal frames guiding environmental behavior. *The Journal of Social Issues*, *63*(1), 117–137. doi:10.1111/j.1540-4560.2007.00499.x

Loch, K. D., & Conger, S. (1996). Evaluating ethical decision making and computer use. *Communications of the ACM*, *39*(7), 74–83. doi:10.1145/233977.233999

Loe, T. W., Ferrell, L., & Mansfield, P. (2000). A review of empirical studies assessing ethical decision making in business. *Journal of Business Ethics*, *25*(3), 185–204. doi:10.1023/A:1006083612239

Loewenstein, G., & Lerner, J. S. (2003). The role of affect in decision making. Handbook of affective science, 619(642), 3.

López-Mosquera, N., & Sánchez, M. (2012). Theory of Planned Behavior and the Value-Belief-Norm Theory explaining willingness to pay for a suburban park. *Journal of Environmental Management*, *113*(0), 251–262. doi:10.1016/j.jenvman.2012.08.029 PMID:23041517

Malhotra, A., Melville, N. P., & Watson, R. T. (2013). Spurring Impactful Research on Information Systems for Environmental Sustainability. *Management Information Systems Quarterly*, *37*(4), 1265–1274.

Marta, J. K. M., Singhapakdi, A., Attia, A., & Vitell, S. J. (2004). Some important factors underlying ethical decisions of Middle-Eastern marketers. *International Marketing Review*, *21*(1), 53–67. doi:10.1108/02651330410522916

Melville, N. P. (2010). Information systems innovation for environmental sustainability. *Management Information Systems Quarterly*, *34*(1), 1–21.

Midden, C. J., & Huijts, N. (2009). The role of trust in the affective evaluation of novel risks: The case of CO2 storage. *Risk Analysis*, *29*(5), 743–751. doi:10.1111/j.1539-6924.2009.01201.x PMID:19228343

Molla, A. (2013). Identifying IT sustainability performance drivers: Instrument development and validation. *Information Systems Frontiers*, 1–19. doi:10.100710796-013-9415-z

Molla, A., & Abareshi, A. (2012). Organizational Green Motivations for Information Technology: Empirical Study. *Journal of Computer Information Systems*, *52*(3), 92–102.

Molla, A., Abareshi, A., & Cooper, V. (2014). Green IT beliefs and pro-environmental IT practices among IT professionals. *Information Technology & People*, *27*(2), 2–2. doi:10.1108/ITP-10-2012-0109

Montijn-Dorgelo, F. N., & Midden, C. J. (2008). The role of negative associations and trust in risk perception of new hydrogen systems. *Journal of Risk Research*, *11*(5), 659–671. doi:10.1080/13669870801967218

Moores, T. T., & Chang, J. C.-J. (2006). Ethical decision making in software piracy: Initial development and test of a four-component model. *Management Information Systems Quarterly*, 167–180.

Mulvihill, P. R., & Milan, M. J. (2007). Subtle world: Beyond sustainability, beyond information. *Futures*, *39*(6), 657–668. doi:10.1016/j.futures.2006.11.006

Musbah, A. Y. S. (2010). *The Role of Individual Variables, Organizational Variables, and Moral Intensity Dimensions in Accountants' Ethical Decision Making: A Study of Management Accounting in Libya. (Doctor of Philosophy)*. The University of Huddersfield.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Najaftorkaman, M., Ghapanchi, A. H., Talaei-Khoei, A. & Ray, P. 2014. A taxonomy of antecedents to user adoption of health information systems: A synthesis of thirty years of research. Journal of the Association for Information Science and Technology.

Ngo, A. T., West, G. E., & Calkins, P. H. (2009). Determinants of environmentally responsible behaviours for greenhouse gas reduction. *International Journal of Consumer Studies*, *33*(2), 151–161. doi:10.1111/j.1470-6431.2009.00763.x

Nill, A., Schibrowsky, J. A., & Peltier, J. W. (2004). The impact of competitive pressure on students' ethical decision-making in a global setting. *Marketing Education Review*, *14*(1), 61–73.

Nilsson, M., & Küller, R. (2000). Travel behaviour and environmental concern. *Transportation Research Part D, Transport and Environment*, *5*(3), 211–234. doi:10.1016/S1361-9209(99)00034-6

Nordlund, A. M., & Garvill, J. (2003). Effects of values, problem awareness, and personal norm on willingness to reduce personal car use. *Journal of Environmental Psychology*, *23*(4), 339–347. doi:10.1016/S0272-4944(03)00037-9

O'Fallon, M. J., & Butterfield, K. D. (2005). A review of the empirical ethical decision-making literature: 1996–2003. *Journal of Business Ethics*, *59*(4), 375–413. doi:10.100710551-005-2929-7

Papagiannakis, G., & Lioukas, S. (2012). Values, attitudes and perceptions of managers as predictors of corporate environmental responsiveness. *Journal of Environmental Management*, *100*, 41–51. doi:10.1016/j.jenvman.2012.01.023 PMID:22361109

Pavlou, P. A., & Fygenson, M. (2006). Understanding and predicting electronic commerce adoption: An extension of the theory of planned behavior. *Management Information Systems Quarterly*, 115–143.

Peters, E., & Slovic, P. (1996). The role of affect and worldviews as orienting dispositions in the perception and acceptance of nuclear Power1. *Journal of Applied Social Psychology*, *26*(16), 1427–1453. doi:10.1111/j.1559-1816.1996.tb00079.x

Peters, E., & Slovic, P. (2007). Affective asynchrony and the measurement of the affective attitude component. *Cognition and Emotion*, *21*(2), 300–329. doi:10.1080/02699930600911440

Phillips, L. D., & Costa, C. A. B. (2007). Transparent prioritisation, budgeting and resource allocation with multi-criteria decision analysis and decision conferencing. *Annals of Operations Research*, *154*(1), 51–68. doi:10.100710479-007-0183-3

Purarjomandlangrudi, A., Ghapanchi, A. H., & Esmalifalak, A. (2014). A Data Mining Approach for Fault Diagnosis: An Application of Anomaly Detection Algorithm. *Measurement*, *55*, 343–352. doi:10.1016/j.measurement.2014.05.029

Rest, J. R., & Barnett, R. (1986). Moral development: Advances in research and theory: Praeger New York.

Rivis, A., Sheeran, P., & Armitage, C. J. (2009). Expanding the Affective and Normative Components of the Theory of Planned Behavior: A Meta-Analysis of Anticipated Affect and Moral Norms. *Journal of Applied Social Psychology*, *39*(12), 2985–3019. doi:10.1111/j.1559-1816.2009.00558.x

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Rowlands, I. H., Scott, D., & Parker, P. (2003). Consumers and green electricity: Profiling potential purchasers. *Business Strategy and the Environment*, *12*(1), 36–48. doi:10.1002/bse.346

Ryoo, S., & Koo, C. (2013). Green practices-IS alignment and environmental performance: The mediating effects of coordination. *Information Systems Frontiers*, 1–16. doi:10.100710796-013-9422-0

Sarkis, J., Koo, C., & Watson, R. (2013). Green information systems & technologies – this generation and beyond: Introduction to the special issue. *Information Systems Frontiers*, 1–10. doi:10.100710796-013-9454-5

Schultz, P., Oskamp, S., & Mainieri, T. (1995). Who recycles and when? A review of personal and situational factors. *Journal of Environmental Psychology*, *15*(2), 105–121. doi:10.1016/0272-4944(95)90019-5

Schwartz, S. H. (1968). Words, deeds and the perception of consequences and responsibility in action situations. *Journal of Personality and Social Psychology*, *10*(3), 232–242. doi:10.1037/h0026569

Schwartz, S. H. (1977). Normative Influences on Altruism. *Advances in Experimental Social Psychology*, *10*, 221–279.

Shafer, W. E. (2008). Ethical climate in Chinese CPA firms. *Accounting, Organizations and Society*, *33*(7), 825–835. doi:10.1016/j.aos.2007.08.002

Shannon, C. E. (2001). A mathematical theory of communication. *Mobile Computing and Communications Review*, *5*(1), 3–55. doi:10.1145/584091.584093

Sharma, P., & Sharma, S. (2011). Drivers of proactive environmental strategy in family firms. *Business Ethics Quarterly*, *21*(2), 309–334. doi:10.5840/beq201121218

Shi-fei, D., & Zhong-zhi, S. (2005). Studies on incidence pattern recognition based on information entropy. *Journal of Information Science*, *31*(6), 497–502. doi:10.1177/0165551505057012

Solomon, S. L., & O'Brien, J. (1990). The effect of demographic factors on attitudes toward software piracy. *Journal of Computer Information Systems*, *30*(3), 40–46.

Starik, M., & Rands, G. P. (1995). Weaving an integrated web: Multilevel and multisystem perspectives of ecologically sustainable organizations. *Academy of Management Review*, *20*(4), 908–935.

Steg, L. (2005). Car use: Lust and must. Instrumental, symbolic and affective motives for car use. *Transportation Research Part A, Policy and Practice*, *39*(2), 147–162. doi:10.1016/j.tra.2004.07.001

Steg, L., Bolderdijk, J. W., Keizer, K., & Perlaviciute, G. (2014). An Integrated Framework for Encouraging Pro-Environmental Behaviour: The Role of Values, Situational Factors and Goals. *Journal of Environmental Psychology*, *38*, 104–115. doi:10.1016/j.jenvp.2014.01.002

Steg, L., Perlaviciute, G., Van der Werff, E., & Lurvink, J. (2012). The significance of hedonic values for environmentally relevant attitudes, preferences, and actions. *Environment and Behavior*, 0013916512454730.

Stern, P. C. (1999). Information, incentives, and proenvironmental consumer behavior. *Journal of Consumer Policy*, *22*(4), 461–478. doi:10.1023/A:1006211709570

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Stern, P. C. (2000). New environmental theories: Toward a coherent theory of environmentally significant behavior. *The Journal of Social Issues*, *56*(3), 407–424. doi:10.1111/0022-4537.00175

Talaei-Khoei, A., Vichitvanichphong, S., Solvoll, T., Ray, P., and Ghapanchi, A.H. (2014). A Methodology to Develop Awareness in Agents using Policies, Journal of Computer and System Sciences, Vol. 80, pp, 1323-1338

Taylor, S., & Todd, P. A. (1995). Understanding information technology usage: A test of competing models. *Information Systems Research*, *6*(2), 144–176. doi:10.1287/isre.6.2.144

Taylor-Gooby, P., & Zinn, J. O. (2006). Current directions in risk research: New developments in psychology and sociology. *Risk Analysis*, *26*(2), 397–411. doi:10.1111/j.1539-6924.2006.00746.x PMID:16573629

Tetlock, P. E. (1985). Accountability: The neglected social context of judgment and choice. *Research in Organizational Behavior*, *7*(1), 297–332.

Tilikidou, I. (2007). The effects of knowledge and attitudes upon Greeks' pro-environmental purchasing behaviour. *Corporate Social Responsibility and Environmental Management*, *14*(3), 121–134. doi:10.1002/csr.123

Trevino, L. K. (1986). Ethical decision making in organizations: A person-situation interactionist model. *Academy of Management Review*, *11*(3), 601–617.

Vallerand, R. J., Deshaies, P., Cuerrier, J.-P., Pelletier, L. G., & Mongeau, C. (1992). Ajzen and Fishbein's theory of reasoned action as applied to moral behavior: A confirmatory analysis. *Journal of Personality and Social Psychology*, *62*(1), 98–109. doi:10.1037/0022-3514.62.1.98

Venkatesh, V., & Morris, M. G. (2000). Why don't men ever stop to ask for directions? Gender, social influence, and their role in technology acceptance and usage behavior. *Management Information Systems Quarterly*, *24*(1), 115–139. doi:10.2307/3250981

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *Management Information Systems Quarterly*, 425–478.

Vichitvanichphong, S., Talaei-Khoei, A., Kerr, D., & Ghapanchi, A. H. (2013) Analysis of Research in Adoption of Assistive Technologies for Aged Care, *Australasian Conference on Information Systems (ACIS)*, Melbourne, Australia

Watson, R. T., Boudreau, M.-C., & Chen, A. J. (2010). Information systems and environmentally sustainable development: Energy informatics and new directions for the is community. *Management Information Systems Quarterly*, *34*(1), 23–38.

Weber, M. (2008). The business case for corporate social responsibility: A company-level measurement approach for CSR. *European Management Journal*, *26*(4), 247–261. doi:10.1016/j.emj.2008.01.006

Wimbush, J. C., & Shepard, J. M. (1994). Toward an understanding of ethical climate: Its relationship to ethical behavior and supervisory influence. *Journal of Business Ethics*, *13*(8), 637–647. doi:10.1007/BF00871811

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Yazdani, M., & Graeml, F. R. (2014). VIKOR and its Applications: A State-of-the-Art Survey. [IJSDS]. *International Journal of Strategic Decision Sciences*, *5*(2), 56–83. doi:10.4018/ijsds.2014040105

Yoon, K. (1980). *Systems selection by multiple attribute decision making. (PhD)*. Kansas State University.

Zarei, B., Azizian, S., & Ghapanchi, A. (2013). Road freight information systems: A soft system methodology approach. *International Journal of Logistics Systems and Management*, *14*(2), 161–178. doi:10.1504/IJLSM.2013.051337

Zarei, B., & Ghapanchi, A.Zarei. (2008). Guidelines for government-to-government initiative architecture in developing countries. *International Journal of Information Management*, *28*(4), 277–284. doi:10.1016/j.ijinfomgt.2008.02.008

Zarei, B., Merati, E., & Ghapanchi, A.Merati. (2010). Project Process Re-engineering (PPR): A BPR Method for Projects. *International Journal of Information Systems and Change Management.*, *4*(4), 299–313. doi:10.1504/IJISCM.2010.036914

Zeleny, M. (2010). Strategy as Action: From Porter to Anti-Porter. [IJSDS]. *International Journal of Strategic Decision Sciences*, *1*(1), 1–22. doi:10.4018/jsds.2010103001

Zeleny, M., & Cochrane, J. L. (1982). *Multiple criteria decision making* (Vol. 25). McGraw-Hill New York.

Zou, Z., Sun, J., & Ren, G. (2005). Study and application on the entropy method for determination of weight of evaluating indicators in fuzzy synthetic evaluation for water quality assessment. *Acta Scientiae Circumstantiae*, *25*(4), 552–556.

This research was previously published in the International Journal of Strategic Decision Sciences (IJSDS), 6(2); edited by Madjid Tavana, pages 28-56, copyright year 2015 by IGI Publishing (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 69
Meaning of Green for 3PL Companies

Pervin Ersoy
Yaşar University, Turkey

ABSTRACT

In today's competitive environment managing green, becoming environmentally friendly and sustainable has become main topic for all industries and companies. Therefore, in this chapter it will be addressed how green logistics solutions and practices can help companies to increase their performance with specific practices, cases and results from Turkey's 3PL service providers' side. This chapter will discuss why being green is important for 3PL companies and the benefits of being green from the business and environment side with current data and real life examples. The main purpose of this chapter is to shed light on green performance indicators and to identify benefits of being green for 3PL companies in Turkey.

INTRODUCTION

The growth of economy and globalization have increased the usage of energy and other sources. In a rapidly changing and developing world, environmental and social issues have become more important for managing businesses and industries (Luthra, et al., 2011). Green sustainability and corporate responsibility have started to play an important role in companies and managers' strategic decisions and plans (Lee, 2009) in recent years.

In the parallel of these developments and usage environmental issues, carbon emissions, solid waste disposals, and environmental pollution have become main topic for all industries.

Greening the supply chain is a new topic for many industries for managing their logistics activities in 21th century (Zhu et al., 2008a). Thus, companies try to find new tools or ways for being first innovator in the market.

As known the firm's activities directly threaten the environment with carbon dioxide and carbon monoxide emission through the transportation, production or packaging activities. Managing environmental problems effectively has become strategic and vital issues for many companies in recent years (Diabat and Govindan, 2011). Environmental concerns which has directly impact on company's supply

DOI: 10.4018/978-1-5225-7915-1.ch069

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

chain activities and performance have widely started to implement company's business processes (Zhu, et. al., 2016). It has been an enhancing interest on reducing wastes and company's disposals during the corporate activities (Melnyk et al., 2003).

Companies have started to deal with these increasing environmental changes (Gil-Saura et al., 2009) with green solutions. Therefore, green has become current year's trend for economic, social and environmental sustainability (as shown in Figure 1).

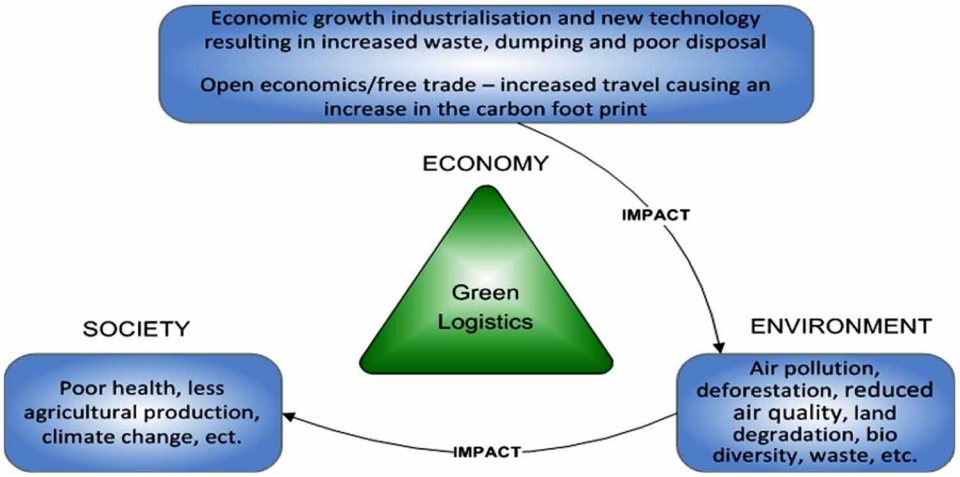
Developed and developing countries have started to adapt environmental solutions to their policies (Mathiyazhagan et al., 2015), likewise all countries have begun to adapt environmentally friendly formulas to their policies to reduce the impact of pollutions, hazardous gases or chemicals, solid wastes, etc. In today's changing and developing world has increased the importance of green and protecting environment.

As seen in Figure 2, scientists and decision makers emphasize that developing countries are facing with intensive carbon dioxide emissions. Although today most developing countries contribute only minor shares to global greenhouse gas (GHG) emissions compared to the OECD and major emerging economies (OECD Report, 2012), like Turkey. Therefore, greening, green thinking, going green and green solutions have become important issues for all members, companies and also countries.

Greening means putting environmental values into each step of the processes. Essentially it can be said that being green means being environmentally friendly in each phases of processes. Companies are increasingly becoming responsible of environmental concerns and environmental issues with increased importance of being green. Therefore, environmental issues have become popular concerning factor in the last decades for the supply chain activities. Due to the increasing recognition towards green issues, firms have started to adapt green supply chain strategies to their business policies. Kurien and Qureshi (2012) emphasized that; "Green Supply Chain Management (GSCM) has become an important strategy for companies to gain profit and market advantages by reducing the environmental risks and improving efficiency".

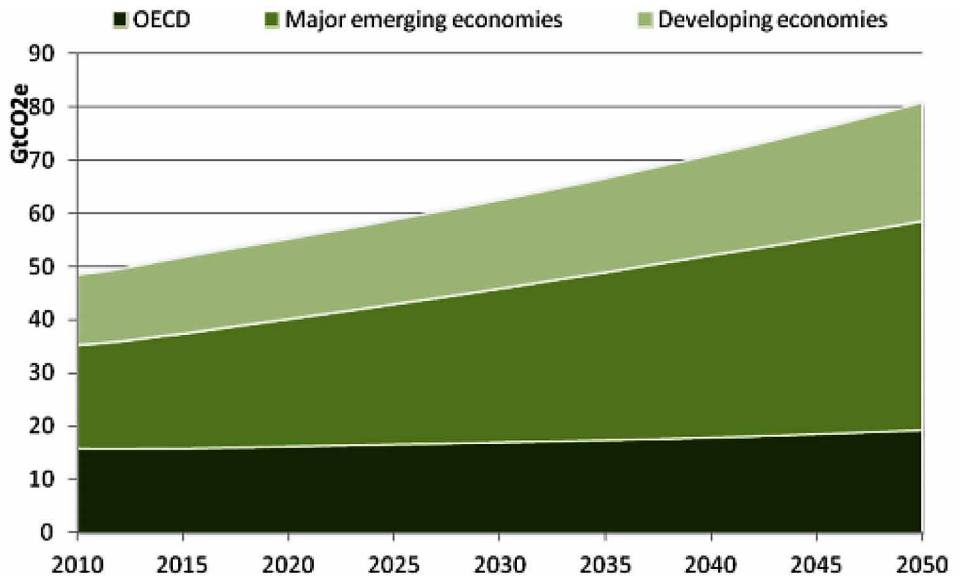
Today many researchers and managers interested in green business, green environment, green logistics and also green supply chain management (GSCM) not only for corporate social responsibility but also gaining sustainable competitive advantage and strengthening company's corporate image. Thus, green

Figure 1. Components of green logistics



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 2. Business as usual GHG emissions 2010-2050
Note: *$GtCO_2e$ = Gige tonnes of CO_2 equivalent*
Source: *OECD, https://www.oecd.org/dac/environment-development/50559116.pdf*



policies and being environmentally friendly have become key issues for many types and sizes of companies in the world. There are many theories in the literature that support these ideas. The main theories are Resourced Based View, Resourced Based Theory, Natural Resource Based View, Complexity Theory and Social Network Theory. Resourced Based View (RBV) theory implies that using environmental tools for managing company's activities can help companies to gain competitive advantages (Barney, 1991; Zhu et. al., 2005). Wernerfelt (1984) emphasized that Resourced Based View is a useful tool for investigating effects of green practices on supply chain performance. Natural Resource Based View (NRBV) highlights, using natural sources for managing company's process can help companies to increase their efficiency, environmental operational and financial performance (Zhu and Sarkis, 2004, Zhu et al., 2005). In the Complexity Theory, being responsive and sensitive to the environmental problems with adapting these solutions firm's system is important (Crozier and Thoenig, 1976). Social Network Theory is a suitable theory for helping and understanding sustainable developments (Connelly, 2011).

GREENING THE SUPPLY CHAINS

The cross-disciplinary field of green supply chain management has been growing in the recent years both in the academia and industry field (Sarkis, et al., 2011). The increasing importance of environmental issues have increased integrating green solutions into supply chain activities. In the traditional supply chain, the flow of materials and information is recti lineal and from one to another. In addition, the responsibility of the being green or environmentally friendly belongs to only limited partner or partners (Emmett & Sood, 2010). However, in the green supply chain the responsibility of protecting green and being environmentally friendly belongs to all members of the chain (Emmett and Sood, 2010). The vital

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

role of green supply chain management is to reduce company's bad environmental impact and increase company's financial performance with sustainability (Chin et al., 2015).

Green Supply Chain (GSC) can be described as the integration of green solution for each step of supply chain processes from raw material to consumer or end product. Although the traditional supply chain only focuses on the process and delivery, green supply chain concentrates on environment, environmental solutions and quality of living conditions during the process and delivery. Adding green component to the supply chain refers to integration of supply chain and environment (Srivastava, 2007). Green Supply Chain Management is the integration of green thinking into all supply chain processes (Chin, et al., 2015). Green supply Chain Management (GSCM) is an improvement tool for process and products development with environmental regulations and requirements (Hsu & Hu, 2008).

The main purpose of green supply chain management is to reduce traditional supply chain's environmental risks and impacts (Guo and Tsai, 2015). The purpose of being green is to minimize the negative impact of firms and their supply chains on the natural environment (Mollenkopf et al., 2010). Green supply chain practices represent the environmentally friendly image of products, process, systems and technologies (Vachon and Klassen, 2006).

This process ranges from green product design to product returns (reverse logistics activities) (Perotti et al., 2012). There are many different green supply chain definitions in the literature, the most commonly used definition was made by Srivastava (2007) as:

Integrating environmental thinking into supply chain management, including product design, material sourcing and selection, manufacturing processes, delivery of the final product to the consumers as well as end-of-life management of the product after its useful life.

Green supply chain means using green solutions in each step of the supply chain. Green supply chain management includes whole processes from product design to recycling. These processes include green design, green materials, manufacturing, green purchasing, green production, environmental performance evaluation and reverse logistics (Zhu and Sarkis, 2004; Hervani et al., 2005; Srivastava, 2007).

The ingredients of green supply chain can be listed as follows: green supply, green transportation, green purchasing and procurement, green distribution, green manufacturing, green warehousing, and green building, green packaging-eco labeling, green marketing and reverse logistics. Green supply; means providing goods and materials with noticing environmental qualifications like ISO 14000 (environmental standards). Green transportation; implies environmentally friendly vehicles in each step of transportation like using electrical vehicles during the transportation process or using eco-friendly equipment's and fuels. Green purchasing and procurement; refers to procurement and purchasing of products and services that have a reduced effect on human's health and the environment when compared with competing products or services that serve the same purpose (https://financial.ucsc.edu/Pages/Purchasing_GreenPurchasing.aspx#green). Green Products; are reusable or recyclable, as opposed to disposable, made with renewable energy, or contain a significant percentage of recycled post-consumer waste (https://finance.vanderbilt.edu/procurement/procurement/green.shtml). Green distribution; means designing distribution process more efficiently with thinking all parameters (warehouses, distribution centers, retailers) and finding optimum solution with transfer process. Green manufacturing; is an integrated approach to the reduction and elimination of all waste streams associated with the design, manufacture, use and/or disposal of products and materials (Handfield et al., 1997). Green warehousing and Green building/sustainable constructions; using eco-friendly equipment like pallets, forklifts in the warehousing and also designing

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

warehouses with less energy consumption (like solar energy usage windows, warehouses, etc.). The aim of these buildings is using energy, water and other resources efficiently for reducing waste, pollution, etc. Green packaging-eco labeling; implies re-usable or re-cycle packages for reducing environmental impact of packaging. Green marketing; is most frequently associated with the greening of the different aspects of traditional marketing. This generally involves the production of "green" products for sale to "green" consumers who are admonished to recycle the waste from their consumption (Kilbourne, 1998). Reverse logistics; is the process of planning, implementing and controlling the efficient, effective inbound flow, inspection and disposition of returned products and related information for the purpose of recovering value (Srivastava, 2007). Green supply chain processes like green purchasing, green packaging, green manufacturing, etc. can help companies to improve their performance (Green, et. al. 2012).

Integrating environmental management practices into all the supply chain processes to be greener help companies to be competitive in the market (Rao and Holt, 2005). In addition, some researches emphasized that greening activities increase business' profit and market share (Seman et. al. 2012).

The major differences between traditional supply chain and green supply chain can be listed as follows (as shown in Table 1).

In the next part the importance and benefits of being green will be discussed from the third part logistics providers' side with Turkey cases.

THE IMPORTANCE OF BEING GREEN ON FIRM'S PERFORMANCE

Performance and performance indicators are very important for companies especially supply chain firms for measuring their effectiveness and efficiency. Beamon (1999) enhanced that performance tools which include resource measures, output measures and flexibility used for measuring supply chain performance. Key Performance Indicator (KPI) is the another indicator for measuring company's performance. KPI shows actually that company achieved their purposes, goals and objectives or not. Some of the performance indicators that used for measuring supply chain performance are; on time delivery, zero defects,

Table 1. Differences between traditional supply chain and green supply chain

	Traditional Supply Chain	Green Supply Chain
Focus	The main focuses of the traditional supply chains are product, process, capital and information flows. Logistics, marketing, purchasing, distribution, demand forecasting, order fulfillment, customer services, coordination and adding value to the partners and customers are main topic of traditional supply chains. In the traditional supply chains, each member of the chain individually may focus on green like reduction of carbon emission or being environmentally friendly.	The main focuses of the green supply chains are environment, human, energy, waste disposal, and recycling. Green and environmental solutions, green purchasing, green logistics, reverse logistics, green marketing, green packaging, eco labelling and sustainability are main topics of green supply chains. In the green supply chains, all the members of the supply chains responsible to be environmentally friendly and protect environment from raw materials to the end users in each step of processes.
Aims	The aim of traditional supply chain is increasing coordination between partners/members and gaining competitive advantage in the market.	The aim of green supply chain is reducing the impact of wastes, disposals, etc. and protecting environment. Increasing firm's performance and financial performance for taking competitive advantage in the market with increasing company's reputation.
Benefits	Traditional supply chain provides coordination and control between partners. It can help to increase visibility and share information between partners.	Green Supply Chain can help companies to enhance their green image, customer loyalty, positive image, reputation, economic and environmental sustainability.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

customer satisfaction, quality of goods and services, accident ratios, etc. The main goals of supply chain performance indicators are increasing on time delivery, product and service quality, flexibility, value, product/process innovation, information flow, cash flow, response and reducing wastes. Supply chain performance measurement tools are substantial for companies to achieve sustainable competitive advantage (Lee, 2002).

Green Supply Chain Management (GSM) can help companies to develop "win-win" strategies to increase profit, efficiency and market share with reducing environmental risks and their impacts (Van Hoek, 1999). The aim of green supply chain solutions is to improve whole supply chain performance with natural environmental solutions. These solutions divide into 3 performance categories as environmental (reducing air emission, waste, harmful gasses, toxic, etc.), economic (reducing energy consumption, environmental accidents, cost for purchasing materials etc.) and operational (increasing on time delivery, product quality, improving capacity utilization) performance (Zhu, et. al. 2007). There are different studies that emphasize being green or using environmental solution for supply chain processes can help companies to increase companies' performance (Zhu, et.al., 2005). Other researches show that the degree of green supplier assessment and green collaboration has direct impact on company's environmental performance and these performance impact company's purchasing performance positively (Large and Thomsen, 2011; Chiou et al., 2011). Another research emphasis that innovative green solutions (like product, process or material innovation) can help companies to take competitive advantages (Chiou et al., 2011). Chen (2008) emphasized that company's core competences directly affected company's green innovative performance and green images positively. Green supply chain activities/practices improve energy, water and cost saving (Chin et al., 2015).

These studies show that green supply chain solutions can help companies to reduce air pollution, wastes, toxic materials, environmental accidents, scrap rates, energy usage, etc. Actually, many researches and researchers argued that green supply chain solutions can help companies to increase corporate image, product image, employee satisfaction, customer loyalty/satisfaction, brand image/reputation and better relations with customers and partners (Eltayeb et al., 2011; Testa & Iraldo, 2010; Xie and Breen, 2012).

The advantages of green and importance of being green from the Turkey's 3PL service providers' side will be discussed in the next section.

LOGISTICS SERVICE PROVIDERS' GREEN LOGISTICS SOLUTIONS IN TURKEY

There are still limited studies about Green Supply Chain Management activities in developing countries (Seman et al., 2012). This study aims to show the benefits of green logistics solutions form the 3PL service provider's perspective in Turkey. Especially Turkey's major 3PL service providers will be analyzed in this section.

Karagülle (2012) emphasized that fuel consumption and carbon emissions are major dimensions for green logistics activities. Therefore, in this research 3PL service providers' carbon emission reduction and diesel savings were analyzed. To find and measure these dimensions ISO 14001 standards used for evaluating 3PL service providers' green practices. ISO 14001 certificate is the International Standard for Environmental Management Systems (EMS). ISO 14001 is the principal management system standard which specifies the requirements for the formulation and maintenance of an EMS. EMS helps to control company's environmental aspects, reduce impacts and ensure legal compliance (https://www.nqa.com/

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

en-gb/certification/standards/iso-14001-2004). Therefore, Turkey's major logistics service providers divided according to their ISO 14000/14001 certificates.

In this research the sampling selected from the major logistics firms who have ISO 14000/14001 certificates exactly in Turkey. The major logistics service providers who have ISO 14000/14001, etc. certificate are shown in Table 2.

According to Table 2, it was selected only 3PL service providers who have ISO 14000/14001 certificates in Turkey. Therefore, firstly DHL and CEVA were excepted from the sampling. After that other five 3PL service providers' websites were analyzed due to the lack of information about company's green logistics activities for measuring green performance Borusan Logistics and Arkas Logistics also were excepted form the sampling. Therefore, only Ekol Logistics, Omsan Logistics and Mars Logistics' green logistics performance were analyzed in this study. These companies web sites were examined for obtaining much more data and statistics that related to company's green logistics activities. In this process, firstly it was sent questions that related to company's green logistics activities to all the 3PL providers for getting real information about their green logistics activities. Some companies sent a report about their green logistics activities, some of them sent web site links to get information and some of them gave only brief information about their green policies via e-mail and phone. 3PL service provider's green logistics solutions were obtained from face to face meetings, via e-mails and also company's sustainability reports.

Company's green solution capabilities were analyzed according to questions that related to the company's green logistics activities, impact of green solutions to company's performance, carbon emission calculation, carbon footprint calculation, company's green policy, their carbon emissions, etc.

EKOL

Ekol is listed among the pioneering suppliers of integrated logistics services in Turkey and Europe with its distribution centers in Turkey and offices in Germany, Italy, Greece, Ukraine, Bosnia and Romania. Today; Ekol achieved a combined structure to offer 3PL integrated logistics services globally, offering tailor made solutions for variety of customer expectations. Ekol is aware that protecting the nature and the environment is among its most fundamental and vital duties.Therefore, Ekol has adopted the motto "logistics for a better world" for its business operations. This motto is an indication of how Ekol places importance on developing environmental awareness. In that respect, it is extremely attentive to the issue of Green Logistics which covers the industry's environmental implementations (Ekol, 2016).

Table 2. 3PL Service providers who have ISO 14001 certificate in Turkey

3PL Firms	Types of Certificate
Ekol Logistics	ISO 14064-1 Greenhouse Gas Inventory GOLD level "Sustainable Logistics Certificate"
Borusan Logistics	14001
Omsan Logistics	ISO 14001
Mars Logistics	ISO 14001, ISO 14064-1
DHL	ISO 14001 (International Level, not specifically in Turkey)
Ceva Logistics	ISO 14001 (earn this standard only Czech Republic, Slovakia and Hungary, not specifically in Turkey)

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Ekol reduces the mileage on road with its intermodal solution created by combining railroad, land and maritime transportation and minimizes the carbon dioxide, hydrocarbon, particle and nitrogen emission. With this environmentalist approach, Ekol Logistics aims to leave a better world for the next generations (Source: http://www.ekol.com/en/at-a-glance/facts/environmental-data).

Ekol Logistics reduced their carbon emissions 1475% during the last five years (from 2010 to 2015). At the same time, they reduced their diesel consumptions 510,1%. These statistics are shown in Figure 3 and Figure 4.

Ekol logistics is the best company for applying green logistics activities to their processes. Ekol's green logistics activities and their impact on company performance were shown in the figures:

Figure 3. Reduction of carbon dioxide emission (2010-2015)

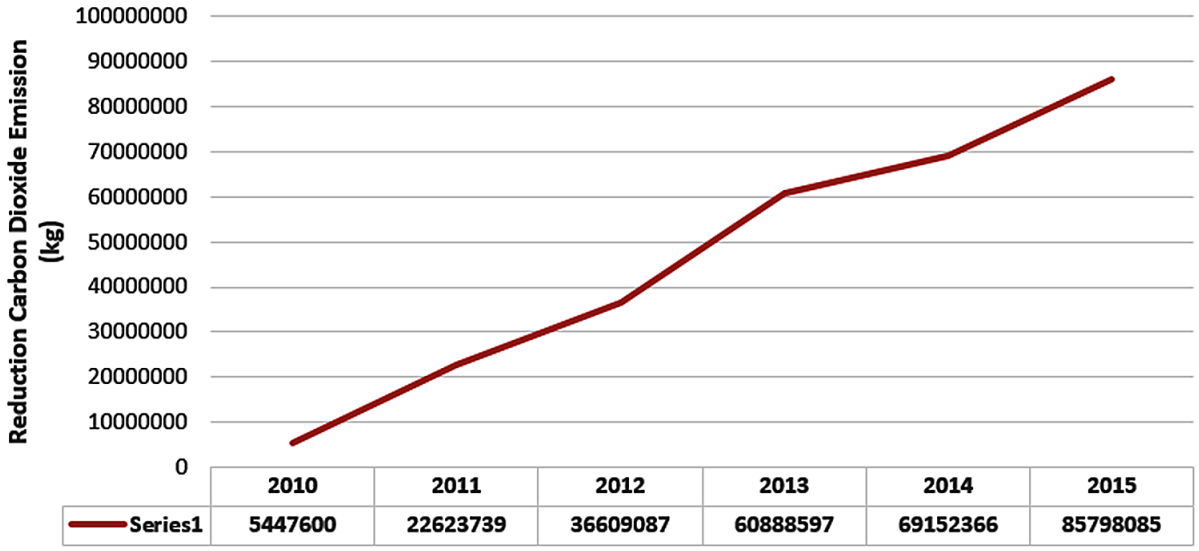
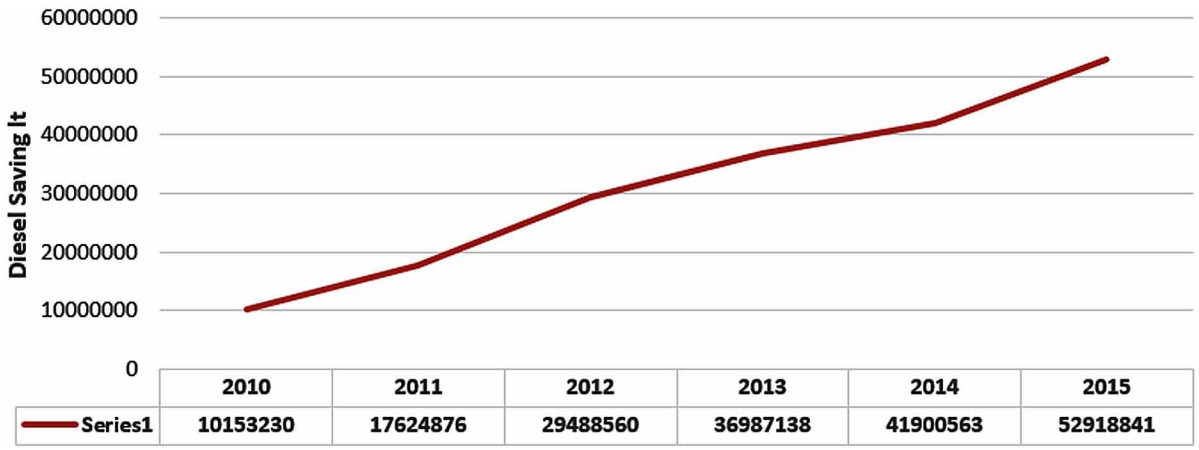


Figure 4. Diesel saving (2010-2015)



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 3 and Figure 4 show that using environmentally friendly vehicles and equipment can help companies to reduce diesel consumption and diesel cost. In other words, these activities can help Ekol Logistics to save diesel, save energy and reduce diesel cots.

EKOL Case

What Is Eco-Performance?

Eco Performance defines the effective integration of ecological, economical and social engagement of a company and its representation of individual responsibility for the realization and sustainability of successful road freight transportation.

The term "Eco" combines the words "Economy" and "Ecology". Eco Performance Award assesses the services of the companies, which will serve as a model for the sustainability in transportation sector.

Ekol, often making an impression with its operations to protect environment, is the winner of 2012 Eco Performance Award.

European Eco Performance Awards, organized by St. Gallen University and sponsored by DKV Euro Service, are granted following an assessment of the companies' environmental conscience against the economic business model and measuring the levels of its implementation.

With a fleet of more than 2000 vehicles, Ekol competed in the category of large scale corporations and was assessed in 3 areas; economic success, environment and social responsibility by the jury.

In the scale of economic success that is assessed in terms of effective service and efficient work process; criteria such as operating in various markets, work capacity, international locations and total cost optimization were taken into consideration.

Ekol has been assessed on the basis of its contribution to environment in terms of efficient fleet, use of telematics, intermodal solutions, reduction of carbon dioxide emission, and cooperation with suppliers, advanced tracking devices, fuel consumption and use of Euro 5 compliant vehicles.

In its approach to social responsibility; Ekol has been assessed on the basis of its education, corporate culture, social activities, motivation and awarding criteria.[1]

OMSAN

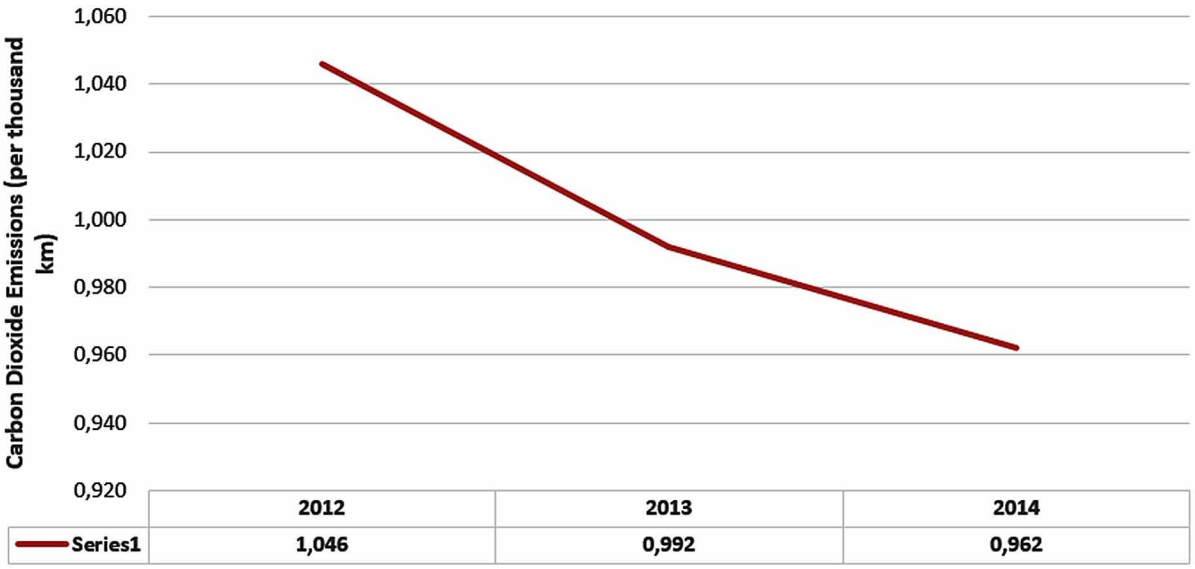
OMSAN established as a subsidiary of OYAK in 1978, OMSAN offers flexible solutions to customers. OMSAN integrates Domestic and International Land, Sea, Air and Rail Transportation, Bonded and Non-Bonded Warehouse Services as well as Home and Office Logistics services for leading enterprises of various industries, primarily including automotive, iron and steel, cement-construction, fuel oil, textile, retail, food and communication (Omsan, 2016).

Omsan has built its transportation strategy to reduce carbon emission and energy consumptions. In parallel with this strategy the company has reduced their carbon emission and fuel consumptions 7,36% from 2012 to 2014 per 1,000 kilometers. Omsan also achieved energy savings success with night deliveries options. Omsan reduced their fuel consumption and carbon emissions 2% with this new delivery strategy. (The statistics are shown in Figure 5).

According to company's real data statistics and their annual reports, it can be said that green logistics activities can help companies to reduce the impact of carbon dioxide emission and diesel consump-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 5. Reduction of carbon dioxide emission (2012-2014)



tion. For this reason, reduction of diesel consumption can help companies to reduce their fuel cost and increase their profit.

OMSAN Case

OMSAN acknowledges the impact of its policies and practices in the field of environmental management on its sustainability performance; it carries out responsible processes going beyond legal requirements. OMSAN identifies environmental risks and design practices that manage them; it both minimizes its environmental footprint and achieves significant economic advantages through concrete practical results such as fuel savings, material efficiency and accident free trips.

OMSAN aims to enhance the environmental awareness of its largest stakeholder network, primarily its employees, through practices it conducts under the headings of Energy Management and Waste and Water Management. OMSAN does not limit its sustainability performance to its organization and it performs measurement and reporting practices encompassing all its value chain. OMSAN achieves its environmental sustainability objectives, which it has constituted with the understanding of preserving global resources and leaving behind a clean world to future generations, through internationally acclaimed systems and standards; it continually improves its performance in this area.

Energy Management

OMSAN makes a tremendous effort to create innovatory and leading solutions in the field of combating climate change, it implements active energy and emission management practices as a responsible logistics company. Not remaining limited to its own organization, it also includes its suppliers in measurement and reporting practices in the field of energy and emission; OMSAN continuously improves its performance in these areas.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

OMSAN manages its internal energy consumption, which includes the energy consumed in its facilities, and the fuel consumption of its self-owned fleet and company vehicles, through practices where it primarily encourages conscious personnel behavior and ensures the development of its technological infrastructure; it minimizes its environmental footprint thanks to innovative solutions OMSAN realizes and fleets renewal practices. It manages its external energy consumption, which is generated by the fuel consumption of its supplier fleet and the personnel shuttle services, with the same sensitivity; it limits the environmental impacts of its supplier fleet through environmentalist vehicle choices at purchasing and fuel saving trainings it provides to drivers, while it controls the fuel consumption of personnel shuttles through efficient route planning practices.

In the reporting period, the energy consumption level of its self-owned fleet was realized as 303,339 GJ, indicating a 24% decrease compared to the last period. In the same period, the amount of energy consumed in its facilities was realized as 14,149 GJ with a 15% reduction compared to the last period. Its energy consumption outside of the organization, which is comprised of its supplier fleet and outsourced services, was realized as 513,841 GJ with an approximately 40% decrease.

Since the year 2012 when it puts into use the Safe and Economic Driving Simulator, it provides efficient driving technique trainings to drivers in its self-owned fleet. Through efficient vehicle use it achieves fuel savings as well as significant reductions in its greenhouse gas emission values. Since the date when the simulator was put into use it has achieved a 7.4% reduction in the fuel consumption rate and greenhouse gas emission of its self-owned fleet.

During the reporting period, the emission intensity rate of its self-owned fleet was realized as 0.969 ton CO2e/1,000 km, with a 2.4% improvement compared to the previous period.

Night Deliveries

OMSAN minimizes the negative impacts of traffic and contribute to the safety and environmental sustainability of cities with night deliveries it conducts as part of its storage and distribution operations. Thanks to the deliveries it makes use of empty road capacities, it reduces energy consumption and carbon emissions, and it enhances driving safety. OMSAN makes an average of 72 night deliveries with its vehicles monthly, thereby consuming 2% less fuel and achieving emission reduction.

In order to ensure energy efficiency in its plants and to minimize the greenhouse gas emissions caused by its operations, it relies on Green IT practices and its environment friendly facility practices; it continuously improves its performance in this field through the controls it provides and the environmental impact targets it puts forth. OMSAN uses LED armatures for external lighting and warehouse interiors which need constant illumination, as well as all its recently constructed plants, it makes use of motion sensors in shared spaces. OMSAN operates 90% of its servers in virtual environments; in its warehouse operations it utilizes 'thin clients' which consume less electricity than PCs.

As a logistics company, it makes significant investments to increase the share of railway and marine transportation in its service portfolio, it actualizes practices that will minimize its environmental footprint in this way. As of the reporting period, maritime transportation and railroad transportation constitute 32% and 2% of its total sales income respectively.

Intermodal Practice in Finished Vehicle Logistics

As part of the intermodal transport project put into use during the reporting period, OMSAN started to use the railroad for the distance between Pitesti and Port of Constanta and marine for the distance be-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

tween Constanta and Derince ports, for the automotive import transportations from Romania to Turkey. With the project, it has carried 19,487 automobiles in the year 2014 and it has reduced the total distance it covers by land by 2.2 million.

Environmental Trainings

OMSAN regards the environmental awareness of its employees and the behavioral changes in practice as a significant opportunity to reduce the environmental impacts of its operations; it aims to enhance its environmental awareness with the trainings it provides. It provides several trainings to its white collar and blue collar employees including the requirements of ISO 14001:2005 Environmental Management System which the OMSAN adopts. It offers trainings aimed at increasing driving competences to its drivers as well as other companies' drivers working in the industry with the Safe and Economic Driving Simulator it has designed. In the reporting period, it has provided 642 man*hour environmental training for its administrative employees and blue collar employees. During the same period, it has provided 1,427 man*hour training to its drivers and 345 man*hour training to sector drivers, as part of the simulator trainings.

Waste and Water Management

OMSAN is thinking of ways to minimize natural resource use in all its operations and it implements practices that will prevent waste generation at the source. It evaluates prospects of recycling and reuses in its waste management processes whereby it deals with wastes according to its type, amount, impact time, environmental impacts, sensitivity of the receiving medium, elimination challenges and costs and it generate solutions; it seeks the help of expert and licensed institutions in this matter.

It classifies the waste coming from offices and the field according to its types in colored containers at Recycling and Waste Stations located in its facilities, it performs its delivery to relevant institutions for recycling or elimination at intervals identified in the" Waste Field Management Instructions". It encourages all its departments to put the waste paper and other safe wastes generated in the offices to the recycle bins located at the offices, it ensures that household wastes that are not suitable for recycling are picked up by municipality vehicles and eliminated at municipality facilities. It conducts the processes of storing, stacking and delivering hazardous wastes according to" Hazardous Waste Instructions"; it sends those hazardous wastes that cannot be recovered to licensed waste elimination facilities to be eliminated.

In the reporting period, it has sent 100% of the nonhazardous wastes generated by its activities to recycling via authorized institutions.

It makes use of its Green IT practices at its facilities and it implements practices that will minimize wastes at the source. With the central printer system integrated with employee cards, it allows for taking printouts only by swiping an employee card at the printer, thereby preventing unnecessary paper use. In this regard, it has achieved 7% paper savings in the reporting period.

In the reporting period, the amount of nonhazardous wastes generated by its operations improved by 7.5% compared to the last period and was realized as 48,870 kg, whereas the amount of hazardous materials improved by 22% and was realized as 30,238 kg.

With the practice started in its Tuzla plant in 2013, it repairs the pallets used in warehouse operations and reuse them, thereby achieving material efficiency. With the technological improvement it realized in the same year, it ensures cardboard recovery in the operations of its specific customers. OMSAN uses

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

its customers' materials efficiently, generating added value for them. The rates of reused pallets in the relevant location were 17% in 2013 and 48% in 2014, whereas the rates of recovered cardboard were realized as 58% in 2013 and 52% in the reporting period.

It works as the only authorized company in the processes of collection, transport and delivery of the practice of collecting waste oils conducted by Petroleum Industry Association (PETDER) within the scope of the Regulations for the Control of Waste Oils. It collects waste oils on behalf of PETDER from service and public terminals and carry them to recycling, elimination or cement facilities, performing an important environmental protection activity. In the reporting period it has collected 17,750 tons of waste motor oil from 6,500 waste oil producers across Turkey. The amount of the waste oil collected in 2014 would have polluted 17.75 billion meter squares of water. This quantity amounts to the annual water need of 84 million people and 15% of all underground and aboveground consumable water potential of Turkey.

By the nature of its business, it conducts non-water intensive operations; it manages its performance in this field on the basis of compliance with legal regulations and savings in personal use. It meets the infrastructural requirements for water to be used efficiently at its facilities, it guarantees that legal values are not exceeded by performing periodical analyses of the waters it discharges, and it ensures efficient water usage through controls that it conducts and water usage targets it follow.

It uses photoelectric armature and pulverized outlet nozzles at all the toilets and showers in its facilities, thereby preventing unnecessary water usage. It collects rain water and assures its reuse through 400 m3 reservoirs located in its Tuzla and Cevizli facilities. It plans to tighten its controls in the next period in order to reduce water usage and to perform the measurement and reporting of reused waters starting from 2015. While there are no water resources that are negatively affected by its operations; it has reduced its water usage rate by 9% as against the last period and realized it as 18,120 m3 through its practices in the reporting period.

OMSAN Logistics does not have an operation field in regions under protection and regions with high biodiversity not under protection, nor does it have a significant operational impact on these fields.

Safe Transport

It handles the transport of various products ranging from retail logistics to hazardous cargo transportation, to industrial material delivery to finished vehicle logistics. It carries out security practices that combine its sector experience with its integrated management systems. It conducts operations that will guarantee environmental and social safety; it carries out safe and environmentally sensitive transportation processes through the right equipment and conscious drivers as an exemplary corporate citizen.

OMSAN organizes regular meetings with its drivers in its regions of operation to remind them about the issues of health, security and environment; it makes announcements concerning using seasonable tires, driver fatigue, safe driving according to weather and road conditions, and equipment that must be kept in the vehicle. It provides extensive safety trainings for all its drivers as part of the Safe and Economic Driving Simulator and it organizes operation-specific trainings for its drivers carrying hazardous materials.

It ensures that its drivers dress suitably for fuel transportation and use antistatic, cotton, long sleeved uniforms, hydrocarbon resistant safety shoes, special fuel resistant valve and solvent gloves, barrettes, protective glasses for fuel vapor and reflective vests for night drives; it installs reflective safety belt pillows on the safety belts in order to ensure the control of safety belt use. It conducts road risk analyses through vehicle tracking systems; it supports its drivers about choosing the safe route.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

It has completed the Safety Management System audits realized by TOTAL Oil Turkey among all its suppliers on October 23rd & 24th, 2014. The audits were conducted according to a total of 13 evaluation criteria; training of managers and employees, emergency preparedness, recognition and communication in health, safety and environment issues, planned control and maintenance operations. It received full points in all the phases of the audits after a challenging evaluation process and were evaluated to be Level 4, which is the highest security level.[2]

MARS

Mars Logistics is a group company that incorporates International Transportation Storage Distribution, Air and Maritime Cargo, Insurance and Logistics companies and provides all logistics services perfectly. Mars Logistics attach importance to certify its modern logistics services with the quality standards on the journey of quality that started in 1998 and became the first company that was awarded ISO 9002 Quality Assurance Certificate in the industry together with its warehouse in the same year. Then, the company started to make revisions in ISO 9001:2000 in 2003 and in ISO 9001:2008 in 2009. It started Total Quality Management works in 2000 and ensured that this philosophy is adopted in the company. As Mars Logistics that is a member of the National Quality Movement, it started ISO 14001 / OHSAS 18001 works in 2008 and ISO 14001 Environment / OHSAS 18001 Occupational Health and Safety Management Systems standard. Company's, first priority is to provide the best service in line with "Customer-Oriented" vision and Omsan awarded ISO 10002 "Customer Satisfaction" and ISO 27001 Information Security certificates in 2013. In 2014, the company awarded validation certificate and certified our environmental sensitivity according to ISO 14064-1 Greenhouse Emissions Calculation standard (Mars,2016).

Mars has started to calculate its carbon emission since 2013. Therefore, there aren't any carbon foot print calculation in their websites and annual reports. The sustainability report (2013 is the latest one) emphasized that their main focus topics are reducing carbon emissions, waste management, energy and water consumptions.

To sum up all, the benefits of green logistics activities can be summarized as shown in Figure 6.

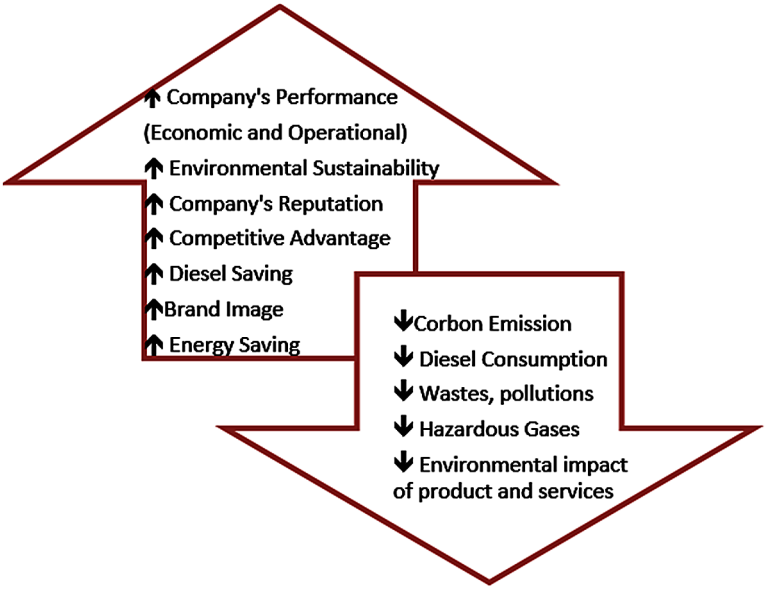
MARS Logistics Case

Sustainability aims at conveying resources to next generations. To achieve this, it guides us about what it should do in economic, environmental and social aspects by considering any current requirements. Even if the first thing that comes to mind when it is said 'sustainability' is protection of the environment, sustainability should be considered in economic and social aspects in order to define it correctly.

- **Environmental Sustainability:** It manages its environmental effects in terms of power efficiency, reduction of CO2 emissions and waste management. It tries to prefer renewable sources when it selects power sources. It measures its power consumption and determine what needs to be done to reduce its power consumption. In this scope, Mars reviews both its operational processes and support activities. It pays utmost attention to protect the environment when it selects the sources

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 6. Benefits of green logistics activities



it uses for lighting and heating purposes, equipment that it uses at its logistics hubs and transportation modes and trucks that it presents to its customers. It is crucial for its business partners that it cooperate in the field of waste management operate in accordance with legal and other requirements.

- **Economic Sustainability:** Mars determined the components of its economic sustainability as operational efficiency and customer satisfaction. Operational efficiency is also critical to maintain customer satisfaction for Mars Logistics. With operational efficiency, it aims to reduce costs and ensure that all its sources are used at optimum level. It utilizes technology to render its operations sustainable. With its ERP applications and investments for trucks and warehouses, it offers services to meet requirements of its customers. It reviews its activities and implements improvement activities to render customer satisfaction sustainable.
- **Social Sustainability:** Mars contributions to the society, satisfaction of its employees and their health and safety constitutes the foundation of its social sustainability. It directs its social investments to the projects that will support professional trainings and increase employment in its sector.

More than 9 thousand organizations in the world and more than 90 organizations in Turkey have so far prepared and shared a report on sustainability activities with their stakeholders* (GRI Sustainability Disclosure Database 2016 March data). It was the first sustainability report that was certified by GRI in the Turkish logistics industry. With its second report, it became one of the first 10 companies in Turkey that published a report at the level GRI A+. It will increase and maintain its business concept that is sensitive to the environment and to the future of the world based on its preferences and projects and also with the support of all its stakeholders.[3]

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

CONCLUSION

The main topic of today's competitive environment is managing green, becoming environmentally friendly and sustainable for all industries and companies. This chapter addresses how green logistics practices can help companies to increase their performance via green solutions with specific practices, cases and results from Turkey's 3PL service providers' side.

In this section the advantages and benefits of being green was discussed from the 3PL service providers' side both business and environment side with current data and real life examples. The main purpose of this discussion is to shed light on green performance indicators and identifying benefits of the being greening for 3PL companies in Turkey.

According to feedbacks from the managers or directors the benefits and advantages of being green can be summarized as follows. These solutions were reported according to 3PL service providers' annual reports, websites statistics and companies' feedbacks. The hypotheses and results of hypotheses can be summarized as shown in Table 3.

The hypothesis and research questions provide some further directions for 3PL companies and managers to cope with problems that related to environmental issues with green and being green view point.

According to real data and current statistics of the 3PL service providers in Turkey the benefits of the green solutions can be summarized like below:

- Green supply chain and logistics activities have positive impact on financial performance with reducing fuel consumption (diesel saving).
- Green solutions are important for companies to reduce environmental risks and risks of legal actions and financial sanctions of environmental disasters.
- In addition, positive financial performance with reducing costs can help companies to increase company's efficiency, service and product quality.
- Green logistics activities can help to protect environment and increase sustainability with reducing carbon-dioxide emissions as shown above the tables.
- Green logistics activities have positive impact on brand image and customer loyalty.

Table 3. Summary of benefits of green logistics activities

Hypotheses	Supporting Method/s	Result
H1: Green supply chain solutions have positive impact on 3PL companies' performance (company performance)	Supported with statistics	✓
H2: Green supply chain can help 3PL companies to reduce air pollution (environmental performance).	Supported with statistics	✓
H3: Green supply chain can help 3PL companies to reduce wastes, toxic materials (environmental performance).	Supported with statistics	✓
H4: Green supply chain can help 3PL companies to reduce energy usage (company and environmental performance).	Supported with statistics	✓
H5: Green supply chain solutions have positive impact on 3PL companies' reputation (company performance).	Supported face to face meetings	✓

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

As for future research, these carbon emissions data can be compared with developed countries or these research can be applied for other industries for finding their carbon emission reduction data and industry's green performance can be benchmarked. In addition, country's carbon emission activities and their success stories can be another research for green topics.

CASES

DHL Case

Green Logistics Solutions

Climate change is one of the greatest challenges facing our generation. Increasingly authorities and consumers expect business to calculate, account for and reduce their emissions.

Carbon accounting is a new science and there is no single way of doing it. With DHL's broad range of green products and services, DHL's GoGreen program can guide you through the processes you'll need to optimize and offset your greenhouse gas emissions. Reliably, conveniently, and with full transparency.

Greening your supply chain can reduce your costs significantly, not to mention help you prepare for key legislation on carbon emissions already in force in several countries.[4]

GoGreen Program: Deutsche Post DHL Group

The transport sector, which also encompasses the logistics industry, is responsible for 23% of the world's energy-related greenhouse gas emissions. As the world's largest logistics service provider, DHL has a special obligation to minimize the negative impact of our business on the environment. At the same time, its stakeholders, including its customers, increasingly expect from DHL to fulfill this obligation.

GoGreen, its Group-wide environmental protection program, is how it act on its responsibility. The main focus of GoGreen is to avoid, reduce and, when necessary, give its customers the chance to offset, greenhouse gas emissions (primarily CO_2). These emissions account for the logistics industry's largest negative impact on the environment.

DHL measures greenhouse gas emissions using standardized procedures, which it continuously adapts and optimizes. This allows it to identify potential efficiency gains and, as a next step, implement the necessary carbon efficiency measures.

DHL develops and deploys innovative technologies across its fleets, offices and facilities. It is making the transition to alternative fuels, optimizing the carbon efficiency of its networks and routes, and increasing environmental awareness among its employees around the world.

It prioritizes this wide-ranging list of measures based on two core principles. First, it focusses its effort on the measures that promise the biggest efficiency gains. Second, it strives to reduce energy and fuel consumption before turning to alternative energy and fuel sources, including alternative fuels.

The Shared Value proposition plays an important role in all of its environmental protection activities. Shared Value means that its contributions to environmental protection and society also enhance the success of its business. In this way, its diverse carbon efficiency measures and portfolio of GOGREEN products and services not only benefit society and the environment, but also create added value for its customers, strengthening its market position.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

GoGreen addresses other environmental factors in addition to greenhouse gas emissions. These include natural resource consumption (e.g. water and paper) as well as local air pollutants and noise pollution. DHL works to continuously reduce the negative environmental impact of its business activities by addressing these areas as well.[5]

CEVA Case

In 2014 CEVA further developed its customers CO2 reporting capability to provide CO2 measurement for the customers' supply chains across a range of transport modes. Carbon emissions are recorded for each air and ocean transaction and calculated automatically in the different types of standards, including GHG, DEFRA and EN16258. Customers have access to emission data related to their logistics operations and can request CEVA to work with them on additional calculations for transparency purposes.

CEVA provides its customers with:

- Dashboards with monthly and quarterly results;
- Standardized reports with agreed-upon measured results.

If needed, they can request CEVA to work with them on additional calculations for transparency purposes.

Carbon Dioxide (CO2): Carbon dioxide is the primary greenhouse gas emitted through human activities. The CO2 accounted for is for more than 80% greenhouse gas emissions from human activities. The main human activity that emits CO2 is the combustion of fossil fuels (coal, natural gas and oil) for energy and transportation, although certain industrial processes and land-use changes also emit CO_2.

The main sources of CO2 emissions are described below.

- **Electricity:** Electricity is a significant source of energy and is used to power homes, businesses and industry. More than 33% of the global amount of man-made emissions, the combustion of fossil fuels to generate electricity is the largest single source of CO_2.
- **Transportation:** The combustion of fossil fuels such as gasoline and diesel to transport people and goods is the second largest source of CO2 emissions of the CO2 emissions with about 30%. This category includes transportation sources such as highway vehicles, air travel, marine transportation and rail.
- **Industry:** Many industrial processes emit CO2 through fossil fuel combustion. Fossil fuel combustion in various industrial processes accounted for about 10% of the total CO2 emissions worldwide. Note that many industrial processes also use electricity and therefore indirectly cause the emissions from the electricity production.

CEVA'S Eco-Sustainable Facilities

Eco-Sustainable Logistics Hubs in Italy

CEVA Italy is aggressively reducing its ecological footprint through new measure and adjustments in its 121 warehouses. Some of the results are:

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- **Recycled Materials:** 85% of total waste produced.
- **Source of Electricity:** 100% hydroelectric.
- **Electricity Saved:** ≈30%.
- **High-Frequency Battery Chargers:** €200/300 yearly saving per unit Italian operations have built and modified 10 warehouses with state-of-the-art solar panels generating in total 18,980 MWh per annum, reducing CO2 emissions by 10,000 tons per year and producing enough power for more than 6,700 households.

CEVA Dubai: LEED Gold Certification

CEVA maintained the LEED Gold certification of its CEVA facility in Dubai (ref. CEVA 4 Unit-1) in 2014, amongst others by managing:

- 6% reduction in electricity consumption in comparison to 2013.
- 11.3% reduction in water consumption in comparison to 2013.

The warehouse is fitted with an efficient lighting system which uses a combination of motion sensors to optimize the lighting inside the warehouse. The exterior lighting is powered by solar panels.

Environment: What CEVA Has Achieved Sustainability in Fleet Performance

In the United States, CEVA continued its commitment to the Environmental Protection Agency's SmartWay Excellence program in 2014. CEVA was a recipient of the EPA's SmartWay Excellence award in 2013, given to the top one percent of supply chain environmental achievers. The award is the EPA's highest recognition for demonstrated leadership in the movement of goods via freight transport. In 2014, the CEVA fleet performed about 4% better on average than the competition, saving more than 5,100 tons in CO2 emissions.

In 2014, CEVA rolled out a major fleet investment program within the UK.

The investment - worth US$ 20 million - added 120 tractor units, 40 rigid vehicles and 180 new trailers to CEVA's UK ground transport fleet. All of the vehicles have telematics and the rigid vehicles will have a load restraint system to enable use across multiple CEVA operations. CEVA and its customers will also benefit from some weight-saving enhancements to the trailers which increase their carrying capacity to 29.2 tons. The telematics will measure, monitor and continually improve the behavior of its drivers in terms of safety and efficiency. The innovations in sustainability, efficiency and environmental credentials are calculated to reduce carbon dioxide emissions by 6,000 tons in 2014.

Environment: What CEVA Has Achieved Sustainability in Driver Behavior

UK: Truck driver training for top performance in the UK, every CEVA truck driver is trained in road safety and has a handbook to consult to operate their truck in compliance with CEVA's health, safety and environmental standards. The training includes information about personal protective equipment, personal accident reporting procedures, environmental impact, safe manual handling, truck driver delivery guidelines, quality, driver duties and responsibilities, environmental and awareness training, safe

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

and fuel efficient driving, spillage training and waste management training. The results of the course are impressive with savings of 2,234 tons in CO2 emissions, a reduction in vehicle wear and tear and a rise in driver retention.

In Italy, CEVA organized a training course developed specifically for truck drivers. Through the training, CEVA achieved two main goals: 1. Improve the safety and prevent accidents and risks 2. Improve awareness with regards to fuel consumption and the environment. The training combines theory and practical lessons focused on fuel consumption and greenhouse gas reduction. The lessons learned can dramatically reduce the impact of transport on environment. CEVA estimates the following savings to be realized:

- **Drive at Optimal Speed:** 10-15% fuel consumption
- **Minimize the Use of Air Conditioning:** 10/15% fuel consumption
- **Remove Unnecessary Weight:** 5-8% fuel consumption
- **Check the Tire Pressure:** 3-4% fuel consumption.[6]

BRIEF SUMMARY OF TURKEY CARBON EMISSION REPORT

Scientists and decision makers agree that climate change is the biggest problem ever faced by humankind. Parties to the United Nations Framework Convention on Climate Change (UNFCCC), including 195 contracting states and the European Union, will meet in Paris in December 2015 and negotiate the new climate agreement that is expected to replace the Kyoto Protocol after 2020 (The Kyoto Protocol is an international treaty which extends the 1992 United Nations Framework Convention on Climate Change (UNFCCC) that commits State Parties to reduce greenhouse gas emissions, based on the premise that (a) global warming exists and (b) human-made CO2 emissions have caused it. The Kyoto Protocol was adopted in Kyoto, Japan, on 11 December 1997 and entered into force on 16 February 2005. There are currently 192 parties (Canada withdrew effective December 2012) to the Protocol. The Kyoto Protocol implemented the objective of the UNFCCC to fight global warming by reducing greenhouse gas concentrations in the atmosphere to "a level that would prevent dangerous anthropogenic interference with the climate system" The Protocol is based on the principle of common but differentiated responsibilities: it puts the obligation to reduce current emissions on developed countries on the basis that they are historically responsible for the current levels of greenhouse gases in the atmosphere.).

This study identified Turkey's share in the remaining carbon budget based on "minimum historical responsibility" and "maximum development needs". Projections suggest that Turkey's CO2 emissions, which amounted to 363 MtCO2 in 2013, will reach 851 MtCO2 by 2030 under high growth scenarios, and 659 MtCO2 by the same year under realistic growth scenarios. Low Carbon Development Pathways and Priorities for Turkey report shows the impact of CO2 emissions on climate change and causes that related to CO2 emissions in Turkey. In this part it will be mentioned only transportation part for more information please visit http://ipc.sabanciuniv.edu/en/wp-content/uploads/2015/11/Low-Carbon-Report1.pdf

Transport: According to 2013 figures, CO2 emissions generated by the transport sector constitute 18.6% of Turkey's total CO2 emissions. After electricity generation, transport is the largest contributor to CO2 emissions.40 Land vehicles account for 90% of transport-generated emissions in Turkey.41 A recent study on Turkey's emission reduction potential proves that an increased fuel efficiency in transport (through the adoption of the 2025 target of 35.9 km/l and the 2030 target of 47.5 km/l for cars

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 4. Annual CO2 emission projections under climate policy package and alternative scenarios

Sectoral Shares in CO2 Emissions (%-Percent)	1990	1995	2000	2005	2010	2011	2012	2013
Fuel combustion in electricity generation (%)	21.99	25.12	28.43	28.49	31.37	31.97	32.66	31.25
Fuel combustion in industry (%)	21.91	20.82	27.77	28.43	18.58	16.68	17.64	17.07
Fuel combustion in transport (%)	16.99	17.89	14.72	14.20	13.64	13.74	16.68	18.61
Fuel combustion in buildings (%)	19.37	18.23	14.60	13.90	19.83	20.49	16.47	15.23
Mineral products manufacturing (%)	9.62	10.24	8.19	8.80	10.36	10.76	10.50	11.37
Metal products manufacturing (%)	8.78	6.55	5.42	5.26	5.48	5.40	5.15	5.63
Other* (%)	1.36	1.14	0.87	0.93	0.74	0.96	0.91	0.84

* "Other" includes CO2 emissions generated by waste, agriculture, non-energy use of fuels and solvents, chemical industry, and leakage CO2 emissions in energy use.

Source: TurkStat, Greenhouse Gas Emissions Inventory, 2013 http://ipc.sabanciuniv.edu/en/wp-content/uploads/2015/11/Low-Carbon-Report1.pdf

registered for the first time, which is an issue under discussion in the EU now) could lead to a decline in GHG emissions by 15 to 19 MtCO2e by 2020, and 50 to 88 MtCO2e (million ton CO2 equivalent) by 2030.42 A further emission reduction may be achieved by transforming the transport infrastructure, and by promoting railroad and maritime transportation rather than land transportation.

Priority Sectors for Climate Change Mitigation

The share of carbon dioxide (CO2) in Turkey's total GHG emissions expanded from 70% to 80% over the period of 1990-2013. Among CO2 sources, the highest growth occurred in the use of fossil fuels for electricity generation. CO2 emissions from electricity generation have risen by 236% since 1990, and the sector's share in total CO2 emissions has increased from 22% to 31%. Besides the electricity sector, the following sectors are the other main contributors to CO2 emissions:

- **Transport:** The period of 1990-2013 witnessed a 159% increase in transport generated CO2 emissions, and thus the share of transport in CO2 emissions rose from 17% to 18.6%.
- **Energy Use in Industry:** CO2 emissions generated by energy use in the industry sector rose by 84% over the period of 1990-2013.
- **Emissions from Industrial Processes:** Process emissions generated by mineral products industry increased by 179%, and those generated by metal products industry by 51%.

REFERENCES

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, *17*(1), 99–120. doi:10.1177/014920639101700108

Beamon, B. M. (1999). Measuring supply chain performance. *International Journal of Operations & Production Management*, *19*(3), 275–292. doi:10.1108/01443579910249714

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Ceva Logistics. (n. d.). Retrieved from http://www.cevalogistics.com/

Chen, Y. S. (2008). The driver of green innovation and green image–green core competence. *Journal of Business Ethics*, *81*(3), 531–543. doi:10.100710551-007-9522-1

Chin, T. A., Tat, H. H., & Sulaiman, Z. (2015). Green Supply Chain Management, Environmental Collaboration and Sustainability Performance. *Procedia CIRP*, *26*, 695–699. doi:10.1016/j.procir.2014.07.035

Chiou, T. Y., Chan, H. K., Lettice, F., & Chung, S. H. (2011). The influence of greening the suppliers and green innovation on environmental performance and competitive advantage in Taiwan. *Transportation Research Part E, Logistics and Transportation Review*, *47*(6), 822–836. doi:10.1016/j.tre.2011.05.016

Connelly, B. L., Ketchen, D. J. Jr, & Slater, S. F. (2011). Toward a theoretical toolbox for sustainability research in marketing. *Journal of the Academy of Marketing Science*, *39*(1), 86–100. doi:10.100711747-010-0199-0

Crozier, M., & Thoenig, J.-C. (1976). The regulation of complex organized systems. *Administrative Science Quarterly*, *21*(4), 547–570. doi:10.2307/2391716

DHL. (n. d.). Retrieved from http://www.dhl.com.tr/en.html

Ekol Logistics. (n. d.). Retrieved from http://www.ekol.com/en

Eltayeb, T. K., Zailani, S., & Ramayah, T. (2011). Green supply chain initiatives among certified companies in Malaysia and environmental sustainability: Investigating the outcomes. *Resources, Conservation and Recycling*, *55*(5), 495–506. doi:10.1016/j.resconrec.2010.09.003

Emmett, S., & Sood, V. (2010). *Green supply chains: an action manifesto*. John Wiley & Sons.

Gil-Saura, I., Berenguer-Contrí, G., & Ruiz-Molina, M. E. (2009). Information and communication technology in retailing: A cross-industry comparison. *Journal of Retailing and Consumer Services*, *16*(3), 232–238. doi:10.1016/j.jretconser.2008.11.018

Green, K. W. Jr, Zelbst, P. J., Meacham, J., & Bhadauria, V. S. (2012). Green supply chain management practices: Impact on performance. *Supply Chain Management: An International Journal*, *17*(3), 290–305. doi:10.1108/13598541211227126

Guo, J. J., & Tsai, S. B. (2015). Discussing and evaluating green supply chain suppliers: A case study of the printed circuit board industry in China. *South African Journal of Industrial Engineering*, *26*(2), 56–67. doi:10.7166/26-2-956

Handfield, R. B., Walton, S. V., Seegers, L. K., & Melnyk, S. A. (1997). Greenvalue chain practices in the furniture industry. *Journal of Operations Management*, *15*(4), 293–315. doi:10.1016/S0272-6963(97)00004-1

Hervani, A. A., Helms, M. M., & Sarkis, J. (2005). Performance measurement for green supply chain management. Benchmarking. *International Journal (Toronto, Ont.)*, *12*(4), 330–353.

Karagülle, A. Ö. (2012). Green business for sustainable development and competitiveness: An overview of Turkish logistics industry. *Procedia: Social and Behavioral Sciences*, *41*, 456–460. doi:10.1016/j.sbspro.2012.04.055

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Kilbourne, W. E. (1998). Green marketing a theoretical perspective. *Journal of Marketing Management*, *14*(6), 641–655. doi:10.1362/026725798784867743

Kurien, G. P., & Qureshi, M. N. (2012). Performance measurement systems for green supply chains using modified balanced score card and analytical hierarchical process. *Scientific Research and Essays*, *7*(36), 3149–3161.

Lai, K. H., & Cheng, T. C. E. (2009). *Just-in-Time Logistics*. England: Gower Publishing.

Large, R. O., & Thomsen, C. G. (2011). Drivers of green supply management performance: Evidence from Germany. *Journal of Purchasing and Supply Management*, *17*(3), 176–184. doi:10.1016/j.pursup.2011.04.006

Lee, H. L. (2002). Aligning supply chain strategies with product uncertainties. *California Management Review*, *44*(3), 105–119. doi:10.2307/41166135

Mathiyazhagan, K., Diabat, A., Al-Refaie, A., & Xu, L. (2015). Application of analytical hierarchy process to evaluate pressures to implement green supply chain management. *Journal of Cleaner Production*, *107*, 229–236. doi:10.1016/j.jclepro.2015.04.110

Mollenkopf, D., Stolze, H., Tate, W. L., & Ueltschy, M. (2010). Green, lean, and global supply chains. *International Journal of Physical Distribution & Logistics Management*, *40*(1/2), 14–41. doi:10.1108/09600031011018028

Omsan. (n. d.). Retrieved from http://www.omsan.com.tr/

Perotti, S., Zorzini, M., Cagno, E., & Micheli, G. J. (2012). Green supply chain practices and company performance: The case of 3PLs in Italy. *International Journal of Physical Distribution & Logistics Management*, *42*(7), 640–672. doi:10.1108/09600031211258138

Rao, P., & Holt, D. (2005). Do green supply chains lead to competitiveness and economic performance? *International Journal of Operations & Production Management*, *25*(9), 898–916. doi:10.1108/01443570510613956

Sarkis, J., Zhu, Q., & Lai, K. H. (2011). An organizational theoretic review of green supply chain management literature. *International Journal of Production Economics*, *130*(1), 1–15. doi:10.1016/j.ijpe.2010.11.010

Seman, N. A. A., Zakuan, N., Jusoh, A., Arif, M. S. M., & Saman, M. Z. M. (2012). Green supply chain management: A review and research direction. *International Journal of Managing Value and Supply Chains*, *3*(1), 1–18. doi:10.5121/ijmvsc.2012.3101

Srivastava, S. K. (2007). Green supply chain management: A state-of-the-art literature review. *International Journal of Management Reviews*, *5*(1), 53–80. doi:10.1111/j.1468-2370.2007.00202.x

Testa, F., & Iraldo, F. (2010). Shadows and lights of GSCM (Green Supply Chain Management): Determinants and effects of these practices based on a multi-national study. *Journal of Cleaner Production*, *18*(10), 953–962. doi:10.1016/j.jclepro.2010.03.005

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Vachon, S., & Klassen, R. D. (2006). Extending green practices across the supply chain: The impact of upstream and downstream integration. *International Journal of Operations & Production Management*, *26*(7), 795–821. doi:10.1108/01443570610672248

Van Hoek, R. I. (1999). From reversed logistics to green supply chains. *Supply Chain Management: An International Journal*, *4*(3), 129–135. doi:10.1108/13598549910279576

Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal*, *5*(2), 171–180. doi:10.1002mj.4250050207

Xie, Y., & Breen, L. (2012). Greening community pharmaceutical supply chain in UK: A cross boundary approach. *Supply Chain Management: An International Journal*, *17*(1), 40–53. doi:10.1108/13598541211212195

Zhu, Q., & Sarkis, J. (2004). Relationships between operational practices and performance among early adopters of green supply chain management practices in Chinese manufacturing enterprises. *Journal of Operations Management*, *22*(3), 265–289. doi:10.1016/j.jom.2004.01.005

Zhu, Q., Sarkis, J., & Geng, Y. (2005). Green supply chain management in China: Pressures, practices and performance. *International Journal of Operations & Production Management*, *25*(5), 449–468. doi:10.1108/01443570510593148

Zhu, Q., Sarkis, J., & Lai, K. H. (2007). Green supply chain management: Pressures, practices and performance within the Chinese automobile industry. *Journal of Cleaner Production*, *15*(11), 1041–1052. doi:10.1016/j.jclepro.2006.05.021

ENDNOTES

1 http://www.ekol.com/en/green-logistics/eco-performance-award
2 http://www.omsan.com/uploads/logistic/media/OMSAN_Logistics_Sustainability_Report.pdf
3 http://www.marslogistics.com/en/sustainability
4 http://www.dhl.com.tr/en/logistics/green_logistics_solutions.html
5 http://www.dpdhl.com/en/responsibility/environmental-protection/gogreen_program.html
6 http://cdn.cevalogistics.com/sites/default/files/Sustainability_report_2014_3.pdf

This research was previously published in Green Initiatives for Business Sustainability and Value Creation edited by Arun Kumar Paul, Dipak Kumar Bhattacharyya, and Sandip Anand, pages 21-44, copyright year 2018 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 70
Green Marketing Strategies and Marketing Performance: The Case of Turkey

Serkan Kılıç
Uludağ University, Turkey

Erkan Özdemir
Uludag University, Turkey

ABSTRACT

Businesses have increasingly paid more attention to the production and marketing of green products. The aim of this study is to establish the marketing mix (4P) strategies that businesses pursuit for their green products and examine the effects of green product, green pricing, green marketing channel and green marketing communication strategies on the marketing performance. The results of the present study are particularly important in terms of shaping the marketing mix strategies of businesses that have already implemented/will implement the production and marketing of green products. The research data were collected by the web based questionnaire method from 258 businesses that operated in Turkey. SPSS 18.0 and AMOS 17.0 softwares were used to conduct the analysis. As a result of multiple regression analysis, it was found that green pricing and green marketing communication strategies had a significant effect on the marketing performance.

INTRODUCTION

Today when environmental interests and awareness of the consumers have come to increase, more and more consumers have started to demand environmentally friendly products and services from the businesses. In addition to the businesses that emphasize the environmental issues, the businesses that have noticed the environmental demands and preferences of the consumers have tended to develop and implement green marketing strategies (Agrawal & Das, 2013) both during the manufacturing processes and in their marketing approaches (Alsmadi, 2007). This particular trend plays various roles such as the creation of legal regulations related to environment, awareness-rising in terms of the costs and the lack of natural resources, increase in the demands by the community and stakeholders and the activities of

DOI: 10.4018/978-1-5225-7915-1.ch070

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

the pressure groups (Jones, Clarke-Hill, Comfort, & Hillier, 2008). In other words, it is possible to say that businesses turn to green marketing for reasons such as government pressure, cost issue, competitive pressure, increase consumer base, subsidies from government and social responsibility (Pawar & Kamble, 2016). Currently, green marketing strategy is a very important issue and if businesses think that they are responsible for long term, they will be able to use this strategy very effectively. The sustainable marketing strategy, which is an important strategy, is also a requirement in ensuring the consumer confidence.

Green marketing is comprised of activities that are designed to satisfy the wants and needs of the individuals, and have minimal detrimental effect on the natural environment (Nair & Menon, 2008). Green marketing is defined as "the holistic management process responsible for identifying, anticipating and satisfying the requirements of customers and society in a profitable and sustainable way" (El Dief & Font, 2010, p. 158). This definition emphasizes the significance of market orientation in the process of environmental marketing (Nair & Menon, 2008). From the perspective of macro marketing, Mitchell et al. (2010), on the other hand, recommended the sustainable market orientation and emphasized its importance. Terms such as environmental marketing, ecological marketing and sustainable marketing are used to mean the same as green marketing (Garg, 2015). These concepts reflect an environmental approach from the perspective of marketing. However, sustainable marketing represents an integrative approach that emphasizes environmental (green marketing), social value (social marketing) and economic / financial issues in the development of marketing strategies (Bridges & Wilhelm, 2008). While social marketing, on the one hand, includes the green marketing and sustainable marketing issues such as environmental pollution, nutritional aspects of products and consumer health, it also includes other social issues such as reducing smoking and excessive alcohol consumption in general, demotivating the use of harmful drugs, and increasing the public prosperity. Social marketing campaigns are aimed at changing people's consciousness, values, actions or behaviors in a positive manner (Kotler & Keller, 2012, p. 638). Although sustainable marketing currently focuses on consumers and their needs, it includes the consumers of next generation and meeting their needs (Seretny & Seretny, 2012). From this point of view, it can be said that responsive and proactive market orientations (Narver, Slater, & MacLachlan, 2004; Atuahene-Gima, Slater, & Olson, 2005; Tsai, Chou, & Kuo, 2008; Li, Lin, & Chu, 2008; Zhang & Duan, 2010; Zhang & Duan, 2010a; Bodlaj, 2010; Bodlaj, Coenders, & Zabkar, 2012; Yannopoulos, Auh, & Menguc, 2012; Oswald, Brettel, & Engelen, 2012) are closely related to sustainable marketing. Within the framework of sustainable marketing, environmental marketing or green marketing strategy signifies that consumers' needs are met not only through the commercialization of green products and services, but also through making the systems and processes green (Fraj-Andrés, Martínez-Salinas, & Matute-Vallejo, 2009b). The concept of sustainable production (Ali & Suleiman, 2016) can also be considered at this point.

The concept and scope of green marketing, in general, is quite comprehensive within the field of marketing. In this sense, green marketing is not only limited to the communication policies of the operator, but is also associated with all the functional areas of marketing. Furthermore, green marketing should be seen as a philosophy guiding all actions of the business, not just a series of procedures, activities and techniques for the design and commercialization of green products. Green marketing philosophy can be expressed as a way of understanding the exchange relationships that go beyond the current needs of consumers and take into account the social interests of protecting the natural environment (Chamorro & Bañegil, 2006). In this respect, the environmental marketing strategy includes decisions at the operational and functional levels. With the commercialization strategies at the business level, the competitive position of the business develops. Functional strategy, on the other hand, manages the planning and processing

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

procedures between different functions such as marketing and research and development. Businesses should demonstrate environmental proactive behavior. Therefore, businesses can have competitive advantages such as cost minimization, quality improvement, and social image enhancement by reducing the consumption of raw materials and energy resources by environmental management and can pursue more profitable marketing opportunities by targeting the ecological consumer segments (Fraj-Andrés et al., 2009b). In addition, the sectors that produce environmentally-friendly products balancing the technical features, price acceptability and compliance with environmental protection (Pap, Ham, & Turalija, 2015) can be financially supported by the state (Garg, 2015). Tax exemptions may be provided to importers, exporters and green businesses for green applications (Ali & Ahmad, 2012).

When the studies in the literature are examined, though rare, the sustainable and green marketing concept and system (Murphy, 2005; Singh & Pandey, 2012; Paramod, 2016; Antony & Pakutharivu, 2016; Nair & Menon, 2008; Pawar & Kamble, 2016; Phalke & Ranade, 2016) green labeling (Chamorro & Bañegil, 2006), design of environmentally sustainable products (Diego-Mas, Poveda-Bautista, & Alcaide-Marzal, 2016), sustainable production (Ali & Suleiman, 2016), green marketing strategies (Banerjee, Iyer, & Kashyap, 2003; Ginsberg & Bloom, 2004; Fraj-Andrés, Martínez-Salinas, & Matute-Vallejo, 2009a; Leonidou, Katsikeas, & Morgan, 2013; Garg, 2015; Pap et al., 2015; Rastogi & Khan, 2015; Villarino & Font, 2015), sustainable market orientation (Mitchell, Wooliscroft, & Higham, 2010) were investigated by different researchers.

Green marketing strategies and the performance relationship were also addressed in various studies (Chen, Lai, & Wen, 2006; Fraj, Martínez, & Matute, 2011; Leonidou et al., 2013; Fraj-Andrés et al., 2009b). In one of those studies, Chen et al. (2006) found that green product and process innovation of businesses had a positive impact on the performance. Fraj-Andrés et al. (2009b) also found that environmental marketing affected the operational and commercial performance of businesses. In a similar study, Fraj et al. (2011) suggested that the environment-oriented businesses had more superior operational and marketing performance. Leonidou et al. (2013) concluded that green products and green distribution had significant effects on the product-market performance. Wu and Lin (2016) investigated the influence of green marketing strategies on business performance and found that green marketing strategies improved the business performance. Al Khattab and As'ad (2015) found that the elements of the green supply chain management "internal environmental management, green purchasing, green information systems, cooperation with customers, eco-design and packaging, and investment recovery" practices affected the environmental-based marketing performance. Richey et al. (2014) also found that the environmental focus of businesses did not lead to superior performance without the support of senior management.

The businesses that wish to make a difference in the minds of consumers position themselves as socially responsible and environmentally with their advertising activities and competitive prices. Green marketing is comprised of aims such as eliminating the concept of waste rather than getting rid of it, developing the concept of product consistent with the environmental commitment, offering value for money to the consumers by enabling to reflect the true costs of the product, and possessing environmental awareness and converting it into profit (Alsmadi, 2007). In line with these aims, the businesses create their marketing strategies and put them into practice. However, it has become an intriguing issue especially for the businesses that have tended to be involved in green marketing whether the green marketing strategies are effective on the marketing performance of the businesses. This issue is even more important especially in the countries where the adoption of the green marketing philosophy is still an ongoing issue.

The aim of this chapter is to review the relevant literature regarding the green marketing and investigate the effects of green marketing strategies of the businesses operating in various sectors in Turkey on

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

their marketing performances. The study aims to investigate and analyze which factors of the marketing mix (4P) will have an impact on the marketing performance of the businesses. Based on the findings to be obtained, recommendations will be offered to the businesses. This paper is structured as follows: Firstly, the existing literature regarding the green marketing strategies and marketing performance are reviewed. Secondly, the research methodology and the results are shown. Next, conclusions are drawn and the limitations of the research are discussed. Finally, some suggestions for future research are made.

LITERATURE REVIEW

Green Marketing Strategies

Businesses can develop green marketing strategies by focusing on 3Rs (Reduce, Reuse, and Recycle) that help green consumption (Alsmadi, 2007; Phalke & Ranade, 2016) and they can become a green business in three ways such as value-addition processes (firm level), management systems (firm level) and/or products (product level) (Prakash, 2002). First of all, the green consumer segments should be identified and consumers' wants / needs should be investigated. As the number of consumers interested in the environment increase, it is observed that the businesses also turn to these target markets (Singh & Pandey, 2012). Demand for green products should be assessed at this point. If consumers demand green products and are willing to pay more for these products, the consumer-oriented businesses should focus on developing environmentally friendly products and adopting the environmental standards (Bhaskaran, Polonsky, Cary, & Fernandez, 2006).

Green consumer segments, on the other hand, can be classified as true blue greens, greenback greens, sprouts, grousers and basic browns (Ginsberg & Bloom, 2004). The importance of value, consequential belief and sense of responsibility are the main factors that affect the consumer behavior towards green products (Shao, Taisch, & Mier, 2017). Green marketing involves the promotion of environmentally safe and useful products. This, in turn, includes the development of ecologically safe products, recyclable packaging, green marketing channels, green promotional efforts and green labeling (Bati, 2016). However, businesses should create green marketing strategies that are appropriate for themselves. Ginsberg and Bloom (2004), according to marketing mix elements, defined these strategies as the lean green strategy, the defensive green strategy, the shaded green strategy, and the extreme green strategy. At this point, businesses should identify the green marketing as a long-term investment with long-term benefits (Garg, 2015) and change their attitudes to "think green, think clean, and think eco-friendly" (Pawar & Kamble, 2016, p. 154). Green marketing strategies can be examined according to four components of marketing mix such as product, price, distribution and promotion. These components are discussed below.

Green Product Strategies

The green products can be identified as naturally grown, recyclable, biodegradable, reusable, containing natural ingredients, recycled contents and nontoxic chemicals; do not harm or pollute the environment; have eco-friendly packaging i.e. reusable and refillable containers (Phalke & Ranade, 2016). Green product characteristics are also related with the manufacturer's production processes, policies and practices, and the social and ecological nature of the product material. It is especially important to integrate ecological characteristics with the concept of quality in the new product development process (Pap et al., 2015).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The green product strategy requires the businesses to emphasize such subjects as easily recyclable products, products using renewable energy sources such as rechargeable batteries, solar powered machines, recyclable packaging, non-destructive products such as organic foods and materials used throughout the production process, consumed energy and packaging regulations (Alsmadi, 2007). Thanks to the businesses that are interested in these issues, automobiles can be designed with alternative energy sources and furniture can be produced with recyclable materials (Murphy, 2005). For instance, Nike used less glue and recycled materials during the production of Air Jordan XX3 shoes (Leonidou et al., 2013).

Green products can be classified as simple, extended and completely green products (Chamorro & Bañegil, 2006). The ISO 14000 environmental management system helps to improve the environmental performance of the products of the businesses with environmental labeling and instruction standards (Bridges & Wilhelm, 2008). Environmentally conscious consumers also rely on green labels as an indicator of green characteristics (Suki, Suki, & Azman, 2016) and use less packaging (Pinto, Nique, Herter, & Borges, 2016). Packaging is important in terms of attracting attention, enabling effective communication and having a critical role in the decision-making process. For instance, in his study, Jerzyk (2016) examined what the consumers expected of the ecological messages in the packaging of products, the characteristics of sustainable packaging in consumer behavior, and how the consumers made the purchasing decisions based on sustainable packaging. Accordingly, packaging design should be environmentally friendly; emphasizing the nature of the product, or the design process should consider sustainable development principles.

Green Pricing Strategies

In connection with the subject of pricing, some green products can be extra costly for the consumers. Therefore, the environmental characteristics of the products may cause the price of the products to be higher. Nevertheless, in many cases green products can be developed at low cost due to the cost savings associated with materials, energy and even processes in comparison to the non-green products and can be sold at a lower price (Alsmadi, 2007). For instance, the 3M firm has publicly introduced the "Pollution Prevention Pays" program in recent years and obtained significant savings from this program (Murphy, 2005). However, this may not be true for every sector. Many businesses consider that the green policies are expensive and they usually set the price of green products higher (Prakash, 2002). Consumers may want to pay higher prices for products if they perceive that the products offer them higher value (such as higher performance, function, design, visual quality and taste) or the products have environmental characteristics (Antony & Pakutharivu, 2016; Rastogi & Khan, 2015). It has also been observed that consumers can pay 5% to 10% more for environmentally friendly products (Kostadinova, 2016; Bati, 2016). It is also seen that when green products with the same value and quality as non-green products are offered to consumers, they may purchase the green products (Kostadinova, 2016).

Green Marketing Channels

In terms of distribution, businesses want their consumers to easily reach their green products. This position must be consistent with the image the business wants to have and distinguish it from its competitors. For this purpose, in-store promotional activities, visual presentations or recyclable materials that emphasize environmentalism and other benefits can be used (Antony & Pakutharivu, 2016). In other words, the fact that channel members have the image of being environmentally committed in the market,

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

and focusing on recycling or re-using will help green marketing practices (Alsmadi, 2007). Regarding the distribution issue, "reverse channel" issue such as investment costs and transportation costs should also be addressed (Murphy, 2005).

Green Marketing Communication

Sustainable communication has two main points: The first one is to raise awareness on the target consumers by specifying how the product will meet consumer needs and the effects related to economic, social and environmental issues; and the second one is to make the necessary communication about the operations and activities with the stakeholders (Villarino & Font, 2015). The target audience should be reached through the convincing environmental messages and communication strategies. In this sense, there are three types of green advertising. Firstly, advertisements should focus on the relationship between a product / service and the biophysical environment; secondly, advertisements contribute to creating a green lifestyle by highlighting a product or service; finally, advertisements should demonstrate the image that the business has environmental responsibility (Singh & Pandey, 2012, p. 28).

The reliability of the message in green communication is very important. Consumers must trust the content of the advertising message. For this reason, in many cases green advertising should be supported by some government agencies and environmentalists in the community (Alsmadi, 2007; Diego-Mas et al., 2016). It is very important for the businesses with regards to promotion to use ecological messages in the advertisements, educate consumers with special programs and cooperate with environmental organizations in the context of green marketing (Fraj-Andrés et al., 2009b). One of the most important obstacles before the purchase of eco-friendly products is the gap between consumers' product-related expectations and perceptions. Information about the sustainability of the product should be presented to the consumers in the purchasing process (Shao et al., 2017). For instance, the Timberland irm has presented its Green Index rating system to the customers to communicate the effect of each product on the environment (Leonidou et al., 2013).

Businesses can sell green shopping bags under the green environment capital by reducing the use of plastic bags (Antony & Pakutharivu, 2016). Businesses can educate the consumers about green marketing by emphasizing the importance of protecting the environment, the ways of protecting the natural environment, the benefits of protecting the environment and the damages of anti-environmental practices in their advertisements (Ali & Ahmad, 2012). They also maintain eco-friendly communications on their websites (Murphy, 2005). It is important for consumers to recommend environmentally friendly products to one another in the development of environmentally friendly behavior. At this point, word of mouth marketing is effective. Social networks such as Facebook and Twitter can also be used for effective communication (Lee, 2008; Ali & Ahmad, 2012). Green marketing communication, which is a requirement for sustainable development, is an important factor in ensuring the consumer confidence (Garg, 2015).

Marketing Performance

Performance defines the number of new-products, the sales percentage of new-products and the frequency of new products offered relative to competitors by a business (Atuahene-Gima, 2005). New-product performance is to be achieved based on the level of organizational aims in areas such as new-product profitability, sales and market share (Yang & Liu, 2006). Marketing performance characterizes the effectiveness of marketing function used to meet the needs of customers and the expectations of the com-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

munity. Marketing performance is considered as the important consequence of green marketing strategies of businesses (Fraj et al., 2011, p. 343). Marketing performance measurement provides performance feedback to the businesses regarding the results of marketing efforts (Clark, Abela, & Ambler, 2006) and can be measured with objective criteria such as profitability, sales growth, and market share (Hacioglu & Gök, 2013), and with subjective criteria based on personal opinions such as consumer satisfaction and employee satisfaction. Performance is also evaluated from the perspective of sales, profitability, and consumer awareness, attitudes, commitment and satisfaction by comparison with the competitors (Erdil & Kitapçı, 2007; Ambler, Kokkinaki, & Puntoni, 2004; Lamberti & Noci, 2010; Beukes & Van Wyk, 2016).

When the literature on green marketing is examined, it is seen that the measurement criteria of performance in the measurement of marketing and / or business performance have been addressed in relation to different issues (Fraj-Andrés et al. 2009a; Fraj et al., 2011; Wu and Lin, 2016, Al Khattab, & As'ad, 2015; Leonidou et al., 2013; Richey, Musgrove, Gillison, & Gabler, 2014). The marketing performance criteria are used not just in assessing the results of the operations of the businesses; at the same time, they are used in the strategic decisions and applications of the businesses (Hacioglu & Gök, 2013). Therefore, addressing the objective and subjective marketing performance criteria together may provide more meaningful results. Marketing performance is measured and evaluated from the perspective of objective and subjective criteria in this chapter. Objective scale items are sales growth, market share, level of customer retention (Fraj-Andrés et al. 2009a; Leonidou et al., 2013) and subjective scale items are customer satisfaction, brand image of products, success of the new products offered to the market, level of adoption between businesses' offers and the market expectations (Fraj-Andrés et al. 2009a; Fraj et al., 2011).

Businesses can meet the environmentalist expectations of consumers through specific abilities and resources by focusing on the expectations of the market. Thanks to the development of environmental marketing programs or strategies, some marketing benefits such as better commercial brand image, more satisfied and loyal customers, and removing the negative image can be enabled. Eventually, environmentalist responsibility can generate positive relations in the mind of individuals, develop positive attitudes towards the business and its brands and enhance the perception of consumers about the product quality. Finally, the green marketing strategies enable the optimization of marketing performance of businesses and this contributes to the increase in economic performance (Fraj et al., 2011). Consequently, it is proposed that green marketing strategies have a positive effect on businesses' marketing performances. Following this idea, four hypotheses are stated:

H1: Green product strategy has a positive effect on marketing performance.
H2: Green pricing strategy has a positive effect on marketing performance.
H3: Green marketing channel strategy has a positive effect on marketing performance.
H4: Green marketing communication strategy has a positive effect on marketing performance.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

METHODOLOGY

Purpose

The purpose of this paper is to determine the effects of green marketing strategies on marketing performance of businesses. The basic research problem is to determine which strategies have significant effects on marketing performance. Hence, multiple regression analysis was used to fulfill this purpose. AMOS 17.0 software was used to conduct the fitness analysis of research model and SPSS 18.0 software was used to conduct the multiple regression analysis.

Sampling and Data Collection

There is no perfect listing of green businesses that can be used for sampling in Turkey. For this reason, it was decided to reach to Turkish Exporters Assembly (TIM). As the sampling framework, it was decided by the researchers that it would be appropriate to conduct the study on the businesses registered in this assembly thought to implement green marketing applications. Therefore, the judgement sampling method was used in this study. Turkish Exporters Assembly (TIM) is the roof organization of the exporting businesses in Turkey. There are 13 exporting associations under this roof organization. For the study, initially, the exporters' assembly was contacted with. A web-based questionnaire was used in the study. For the study, a link containing the questionnaire form was intermittently sent twice to the registered members of this assembly. However, nearly half of the sent emails bounced back due to various reasons. Totally, 258 businesses replied to the questionnaire.

Questionnaire

Firstly, a literature review was conducted to determine the green marketing strategies and marketing performance. A total of 29 items were found. Secondly, 15 businesses were interviewed to check these factors related to the strategies of green marketing. Seven items were assumed to represent marketing performance and the other twenty two items describe green marketing strategies. All respondents were asked to evaluate the green marketing strategies by using a 5-point Likert scale (1= not at all important, 2= not important, 3= Neutral, 4= important, 5= very important). Marketing performance items were evaluated by using a 5-point Likert scale (1= Not very satisfied, 2= Not Satisfied, 3= Neutral, 4= Satisfied, 5= very satisfied).

RESULTS

Participants' Characteristics

The respondents consisted of owners (42.8%) and managers (57.2%) of the businesses. The participants of the study were composed of 78.3% males and 21.7% females. When the education levels of business owners and managers are examined, it is seen that 2.3% had elementary school degrees, 14.3% high school degrees, 58.9% undergraduate degrees and 24.4% post-graduate degrees. The participants of the

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

study can be divided into 5 groups in terms of experience: Those with 1-5 years of experience, (13.6%), with 6-10 years of experience (12.8%), with 11-15 years of experience (18.6%), with 16-20 years of experience (18.6%) and finally those with 21 years or more experience (36.4%). Sizes of the participant businesses were classified into four groups: 69.7% were small-sized businesses (1-49 employees) 21.7% medium-sized businesses (50-249 employees), and 8.5% large-sized businesses (250 and more employees).

Measures

- **Marketing Performance Scale:** This scale was adopted from Fraj-Andrés et al. (2009a), Fraj et al. (2011) and Leonidou et al. (2013). Marketing performance scale had seven items. Reliability was (Cronbach alpha) 0.882. Validity results indicated a good fit as shown in Table 1. In the literature, the accepted values of these indices were χ^2 / df ≤ 3; GFI $\geq .90$; CFI $\geq .90$; $0.05 \leq$ RMSEA ≤ 0.08 (Baumgartner & Homburg, 1996; Iacobucci, 2010; Weston & Gore, 2006). Scale items were; sales growth, market share, customer satisfaction, level of customer retention, brand image of products, success of the new products offered to the market, level of adoption between businesses' offers and the market expectations.
- **Green Marketing Strategies Scale:** This scale was adopted from Fraj-Andrés et al. (2009a), Banerjee et al. (2003) and Leonidou et al. (2013). Green marketing strategies scale had twenty-two items. The reliability of green marketing strategies items was 0.958, no items were dropped from the list to increase Cronbach alpha. Then, an exploratory factor analysis was conducted to identify the main groups. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.93, which suggested that the data were suitable for factor analysis. Initially, using a scree plot test to determine the factor number, four factors were identified and therefore extracted, accounting for 73.75% of the variance with varimax rotation. As a result, four main factors were maintained in the exploratory factor analysis. Common method bias was examined using Harman's one factor test and was found to be a non-issue in this study. Consequently, the green marketing strategies scale consisted of four main factors and 22 sub-items in total and the factor loadings were strong. Four first- order factor model (correlated) had a good model fit as shown in Table 2. The results of the confirmatory factor analysis showed a good fit.

Table 1. Fit Indices

χ^2 / df	p-value	CFI	GFI	AGFI	RMSEA	RMR
1.32	0.264	0.99	0.99	0.95	0.03	0.008

Table 2. The Fitness Analysis of Model

χ^2 / df	p-value	CFI	GFI	AGFI	RMSEA	RMR
1.74	0.001	0.97	0.90	0.86	0.054	0.08

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

These factors can be included to the regression analysis. Factor 1 (Green marketing communication) included six items. Factor 2 (Green product strategies) included six items. Factor 3 (Green marketing channels) included six items. Factor 4 (Green pricing) included four items as shown in Table 3.

Research Model

Based on the literature, a research model showing four research hypotheses for empirical testing is shown in Figure 1.

To test the hypotheses, a multiple regression analysis was conducted. Inter-correlations of variables can be seen in table 4. Normality assumption was tested for using the normal probability plot and scatter plot tables to ensure that the score distributions were normal and linear. All variables were distributed as normal according to P-P plot and scatter plot. There was also no evidence of multicollinearity among the independent variables according to inter-correlations and variance inflation factor that did not exceed 5.0 (in this study VIF was found at 1.85 and 3.72 level for each construct).

Table 5 presents the results for the multiple regression analysis for each of the four green marketing strategy factors of businesses on marketing performance. The regression coefficients, p values for the significance of the relationships and the associated coefficients of determination were reported. The sign and the statistical significance, rather than the magnitude, of each regression coefficient were of primary interest here. For each of the green marketing strategy measures, the final model p value, the model R^2, the independent variables entered in the model, their beta coefficients and the p values for the independent variables were listed.

Two factors were significant at $p < 0.05$ and two independent variables did not meet this significance level. Multiple regression analysis showed that green pricing strategy ($\beta = -.161$, $p < 0.05$) and green marketing communication ($\beta = .303$, $p < 0.05$) factors had a positive effect on marketing performance at a significance level of 0.05. Green product strategy and green marketing channel factors did not have a significant effect on marketing performance. As a result, H2 and H4 hypotheses were accepted, but H1 and H3 hypotheses were rejected.

CONCLUSION AND MANAGERIAL IMPLICATIONS

This study focused on the effects of the green marketing strategies on marketing performance of businesses. The research was conducted with the businesses which were the members of Turkish Exporters Assembly and the basic research problem was to determine which green marketing strategies had a significant effect on marketing performance. Although some studies were conducted on green products in Turkey (Daştan & Gürler, 2016; Tayfun & Öçlü, 2016), little attention was given to the green marketing strategies of Turkish businesses. The findings of this study will give valuable insights to businesses to learn the effects of manufacturing these products on marketing performance. It was found that two main green marketing strategy (green pricing strategy and green marketing communication strategy) factors had a significant effect on marketing performance. This result is not compatible with the results of the study conducted by Leonidou et al. (2013) in England. In their study, Leonidou et al. (2013) concluded that green products and green distribution had significant effects on the product-market performance. It is possible to think that this different result might be due to the different sampling in both studies. Especially the fact that the income capita per consumer in a developing country like Turkey is low in

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 3. Exploratory Factor Analysis Results

The Statements of Green Marketing Strategies	Green Marketing Communication	Green Product	Green Marketing Channels	Green Pricing
Emphasizing the responsibility regarding the protection of the environment in the business communications	.825			
Informing the customers and institutions about the environmental efforts/management of the business in the promotions	.804			
Supporting or sponsoring the environmental groups or activities	.787			
Efforts to minimize the negative effect of marketing promotions on the natural environment	.774			
Emphasizing the environmental aspect of products in the advertisements	.728			
While positioning the product characteristics and content in branding efforts, communicating the eco-friendly aspect of the product	.594			
Orientation towards eco-friendly product designs		.850		
Developing products with minimal negative effects to the environment		.821		
Pay attention to the content and the raw material of the products are friendly to the environment		.775		
Focusing on environmental benefits in the packaging and labelling decisions (such as ecological and clean materials)		.667		
Maintaining and increasing the recyclable content of product packaging for a long time		.655		
Using recyclable and reusable materials in the products		.546		
Encouraging the suppliers and distributers to establish and demonstrate environmental responsibility and obligations			.722	
Cooperating with the suppliers and distributors to develop eco-friendly marketing programs			.651	
Establishing clear / specific guidelines and specifications to monitor the reactions and environmental responsibilities of the channel members			.630	
Using reusable or recycled containers in logistics			.627	
Working as a team with the members of the channel to improve the product and packaging appropriate to the regulations after use			.599	
Cooperating with the members of the channel to take on responsibility aimed at protecting the environment			.571	
Evaluating the costs of eco-friendliness within the price of the product				.859
Setting higher prices for the eco-friendly versions of products				.804
Evaluating the benefits of eco-friendliness within the price of the product				. 792
Using pricing tactics (such as discounts and product return) to encourage end-users to take environmental actions (reuse and recycling)				.584
Explained variance %	53.41	9.16	6.04	5.14
Cronbach alpha	.934	.895	.918	.885

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 1. Research model

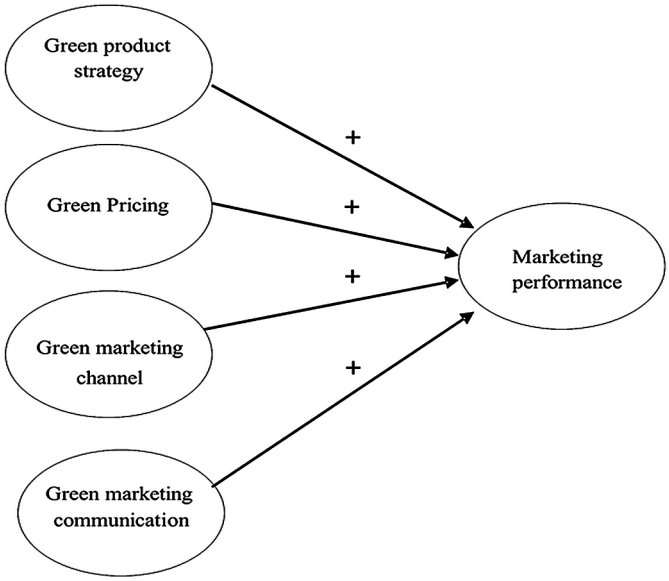


Table 4. Intercorrelations of variables

		1	2	3	4	5
Green Product Strategy	1	1.00				
Green Pricing Strategy	2	.482*	1.00			
Green Marketing Channel	3	.659*	.705*	1.00		
Green Marketing Communication	4	.624*	.636*	.798*	1.00	
Marketing Performance	5	.331*	.206*	.374*	.406*	1.00

Note: Significant at *p < 0.01

Table 5. Multiple regression analysis results

	Unstandardized Coefficients		Standardized Coefficients	
Factors	β	SE	β	Sig.
Green product strategy	.080	.061	.102	.189
Green pricing strategy	-.096	.048	-.161	.047*
Green marketing channel strategy	.108	.066	.179	.102
Green marketing communication strategy	.174	.056	.303	.002*

Dependent variable = Marketing performance; *p < 0.05
Adjusted R^2 = .178; F = 14.86; p < 0.05

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

comparison to the developed countries may cause the price flexibility to be high. This particular result might be due to the fact that the consumers paid more attention to the price of eco-friendly products. At this point, the communication strategies of businesses also played an important role in specifying the price and eco-friendly characteristics of the products.

The fact that businesses are green oriented may provide the businesses with higher financial gains, market share and business performance, and help their abilities to increase. At this point, implementing the right green marketing strategies is a crucial factor for businesses in green competition. Consumers are inquisitive to know "the true" green businesses. Therefore, the green marketing strategies of businesses aimed at reluctant customers are critically important. In order to overcome the reluctance and skepticism of consumers, the businesses should focus on sustainable activities more, be more transparent and minimize the environmentally threatening wastes (Cronin, Smith, Gleim, Ramirez, & Martinez, 2011). Therefore, marketing managers should be more aware of the increasing environmental responsibility of businesses and implement the green marketing strategies in a way to secure their reliability from the perspective of shareholders without sacrificing the profitability (El Dief & Font, 2010). In fact, as also stated by Fraj et al. (2011), green marketing strategies contributed to the optimizations of businesses' marketing performance and enhanced their profitability by reducing the production costs. One of the most important results revealed by the present study was that environment-oriented businesses had more superior operational and marketing performance. Businesses should continuously improve their values that they offer to meet the mixed needs of consumers and consumer-oriented benchmarking approach should be adopted (Shamma & Hassan, 2013). Chen et al. (2006) also found that the green product and process innovation of businesses had a positive impact on the performance and competitive advantage. Banerjee et al. (2003), on the other hand, found that competitive advantage affected the environmental marketing strategies of businesses. In their study, Fraj-Andrés et al. (2009b) also found that environmental marketing affected the operational and commercial performance of businesses and this, in turn, was reflected on the economic results of the businesses. Environmental marketing positively influenced competitiveness of businesses and benefited them in gaining competitive advantage and product differentiation.

For the creating of marketing strategies, food safety, health information and environmental values should be emphasized. It is because, as Juwaheer et al. (2012) also stated, there is a relationship between the green marketing strategies of businesses and the purchasing decisions of consumers. For instance, Saba and Messina (2003) concluded in their study that consumers found the organic products healthier, more eco-friendly, more delicious and more nutritious in comparison to the traditional products. It is clearly observed that especially the health and environmental-related benefits (Gracia & Magistris, 2007) and economic benefits (Maniatis, 2016) are the most important factors in consumers' purchasing decisions of green and organic products. Accordingly, businesses should develop their green products considering their target markets, their characteristics and preferences of this market (Vernekar & Wadhwa, 2011). For instance, marketing managers should carefully consider all the information that the green consumers look at before purchasing the product and the factors that demonstrate the reliability of all information products (Maniatis, 2016).

Businesses should also adopt an appropriate pricing strategy for green products, considering the issues related to the quality and product category. In fact, Hughner et al. (2007) found that consumers integrated high price with high quality and taste. It should be aimed to protect the products from the chemicals and save the costs by using as few channel member as possible for the distribution of the green products. Offering the green products to consumers at more affordable or lower prices and through more

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

efficient distribution channels may increase the demand for green products. In the promotion of green products, businesses need to attend training courses and fairs in order to inform the consumers, implement promotional and advertising efforts, arrange the sections in the store together with the retailers to make it easy for the consumers to compare the green products, and organize in-store promotions of the green products and showcase them in the best possible way. In this respect, it is also important to provide the seller support in marketing the green products (Vernekar & Wadhwa, 2011). In this regard, Richter and Hempfling (2003) stated that organic products should be displayed on the shelves separately from the traditional products, so consumers should be able to find organic products more easily by showing them with different signs and colors in the product classification. Similarly, La Via and Nucifora (2002) also stated that consumers should be better informed about product certification and quality issues and that advertising should be regulated in such a way to increase the demand for organic products. In this regard, Tayfun and Öçlü (2016) also demonstrated that consumers received information about products' level of environmentalism more through advertisements.

Green marketing involves proactive activities in the management of business resources. For instance, it is possible to reduce consumption by designing and producing environmentally friendly products, using recyclable materials or by implementing efficient systems. The integration of environmental issues into distribution reduces the production costs of businesses by helping the economic and environmental objectives. For this reason, businesses can reduce their costs and improve their efficiency with some process-oriented activities such as eco-design, reverse logistics or by using the clean materials in their products and packaging, and clean transportation systems. For instance, they can improve their products and packaging with cheaper and alternative raw materials. Integrating the green values with marketing strategies will contribute to the development of corporate reputation and image as well as helping to use the resources effectively. All these affect the operational results of the businesses positively and enable the business to be more economical and have better performance results (Fraj et al., 2011).

LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

The present study has some limitations. Firstly, only the opinions of businesses' managers who were members of the Turkish Exporters Assembly were considered. In future studies, certain green product categories can be selected and consumers' reactions to the marketing applications of these green products can be investigated. Therefore, if the present study conducted on the businesses in different sectors is carried out on the businesses operating in the same sector, more in-depth results can be obtained. Another limitation is the analyses of data from only one country. In this context, a cross-cultural study might be conducted to analyze the structure of businesses and their reactions to environmental issues.

In future studies, it would be beneficial to consider the opinions of businesses about the green marketing strategies and make a comparison of the businesses according to their size and experiences. Again, in future studies, the effect of green marketing strategies on the marketing performance can be examined within the framework of a model together with the moderating effect of idle resources and competitive intensity.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

REFERENCES

Agrawal, A. D., & Das, M. (2013). Green marketing: Sustainable marketing strategy. *Indira Management Review*, *7*(1), 17–31.

Al Khattab, S. A., & Asad, H. (2015). The Impact of the Green Supply Chain Management on Environmental-Based Marketing Performance. *Journal of Service Science and Management*, *8*(4), 588–597. doi:10.4236/jssm.2015.84059

Ali, A., & Ahmad, I. (2012). Environment Friendly Products: Factors that influence the green purchase intentions of Pakistani consumers. *Pak. J. Eng. Technol. Sci.*, *2*(1), 84–117.

Ali, M. H., & Suleiman, N. (2016). Sustainable food production: Insights of Malaysian halal small and medium sized enterprises. *International Journal of Production Economics*, 1–12.

Alsmadi, S. (2007). Green marketing and the concern over the environment: Measuring environmental consciousness of Jordanian consumers. *Journal of Promotion Management*, *13*(3-4), 339–361. doi:10.1080/10496490802306905

Ambler, T., Kokkinaki, F., & Puntoni, S. (2004). Assessing marketing performance: Reasons for metrics selection. *Journal of Marketing Management*, *20*(3-4), 475–498. doi:10.1362/026725704323080506

Antony, T. K., & Pakutharıvu, D. N. (2016). Go green and save green (Issues faced by green marketing). *Indian Journal of Applied Research*, *6*(5), 191–193.

Atuahene-Gima, K. (2005). Resolving the capability—rigidity paradox in new product innovation. *Journal of Marketing*, *69*(4), 61–83. doi:10.1509/jmkg.2005.69.4.61

Atuahene-Gima, K., Slater, S. F., & Olson, E. M. (2005). The contingent value of responsive and proactive market orientations for new product program performance. *Journal of Product Innovation Management*, *22*(6), 464–482. doi:10.1111/j.1540-5885.2005.00144.x

Banerjee, S. B., Iyer, E. S., & Kashyap, R. K. (2003). Corporate environmentalism: Antecedents and influence of industry type. *Journal of Marketing*, *67*(2), 106–122. doi:10.1509/jmkg.67.2.106.18604

Bati, U. (2016). Green marketing activities to support corporate reputation on a sample from Turkey. *International Journal of Marketing Studies*, *8*(3), 189–201. doi:10.5539/ijms.v8n3p189

Baumgartner, H., & Homburg, C. (1996). Applications of structural equation modeling in marketing and consumer research: A review. *International Journal of Research in Marketing*, *13*(2), 139–161. doi:10.1016/0167-8116(95)00038-0

Beukes, C., & Van Wyk, G. (2016). An investigation of the marketing performance measurement practices in Hatfield Volkswagen group. *African Journal of Business Management*, *10*(6), 131–139. doi:10.5897/AJBM2015.7772

Bhaskaran, S., Polonsky, M., Cary, J., & Fernandez, S. (2006). Environmentally sustainable food production and marketing: Opportunity or hype? *British Food Journal*, *108*(8), 677–690. doi:10.1108/00070700610682355

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Bodlaj, M. (2010). The impact of a responsive and proactive market orientation on innovation and business performance. *Economic and Business Review for Central and South-Eastern Europe*, *12*(4), 241–261.

Bodlaj, M., Coenders, G., & Zabkar, V. (2012). Responsive and proactive market orientation and innovation success under market and technological turbulence. *Journal of Business Economics and Management*, *13*(4), 666–687. doi:10.3846/16111699.2011.620143

Bridges, C. M., & Wilhelm, W. B. (2008). Going beyond green: The why and how of integrating sustainability into the marketing curriculum. *Journal of Marketing Education*, *30*(1), 33–46. doi:10.1177/0273475307312196

Chamorro, A., & Bañegil, T. M. (2006). Green marketing philosophy: A study of Spanish firms with ecolabels. *Corporate Social Responsibility and Environmental Management*, *13*(1), 11–24. doi:10.1002/csr.83

Chen, Y. S., Lai, S. B., & Wen, C. T. (2006). The influence of green innovation performance on corporate advantage in Taiwan. *Journal of Business Ethics*, *67*(4), 331–339. doi:10.100710551-006-9025-5

Clark, B. H., Abela, A. V., & Ambler, T. (2006). An information processing model of marketing performance measurement. *Journal of Marketing Theory and Practice*, *14*(3), 191–208. doi:10.2753/MTP1069-6679140302

Costa, Pinto, D., Nique, W. M., Herter M., M., & Borges, A. (2016). Green consumers and their identities: How identities change the motivation for green consumption. *International Journal of Consumer Studies*, 1–12.

Cronin, J. J. Jr, Smith, J. S., Gleim, M. R., Ramirez, E., & Martinez, J. D. (2011). Green marketing strategies: An examination of stakeholders and the opportunities they present. *Journal of the Academy of Marketing Science*, *39*(1), 158–174. doi:10.100711747-010-0227-0

Daştan, İ., & Gürler, C. (2016). Yeşil bilgi teknolojileri ürün tercihinde tüketici satın alma niyetlerini etkileyen faktörlerin tespiti. *Atatürk University Journal of Economics & Administrative Sciences*, *30*(1), 173–186.

Devi Juwaheer, T., Pudaruth, S., & Monique Emmanuelle Noyaux, M. (2012). Analysing the impact of green marketing strategies on consumer purchasing patterns in Mauritius. *World Journal of Entrepreneurship. Management and Sustainable Development*, *8*(1), 36–59.

Dief, M. E., & Font, X. (2010). The determinants of hotels marketing managers green marketing behaviour. *Journal of Sustainable Tourism*, *18*(2), 157–174. doi:10.1080/09669580903464232

Diego-Mas, J. A., Poveda-Bautista, R., & Alcaide-Marzal, J. (2016). Designing the appearance of environmentally sustainable products. *Journal of Cleaner Production*, *135*, 784–793. doi:10.1016/j.jclepro.2016.06.173

Erdil, O., & Kitapçı, H. (2007). TKY araçlarının kullanımı ve firma yenilikçiliğinin yeni ürün geliştirme hızı ve işletme performansına etkisi. *Atatürk Üniversitesi İktisadi ve İdari Bilimler Dergisi*, *21*(1), 233–145.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Fraj, E., Martínez, E., & Matute, J. (2011). Green marketing strategy and the firms performance: The moderating role of environmental culture. *Journal of Strategic Marketing*, *19*(4), 339–355. doi:10.1080/0965254X.2011.581382

Fraj-Andrés, E., Martinez-Salinas, E., & Matute-Vallejo, J. (2009a). A multidimensional approach to the influence of environmental marketing and orientation on the firms organizational performance. *Journal of Business Ethics*, *88*(2), 263–286. doi:10.100710551-008-9962-2

Fraj-Andrés, E., Martínez Salinas, E., & Matute Vallejo, J. (2009b). Factors affecting corporate environmental strategy in Spanish industrial firms. *Business Strategy and the Environment*, *18*(8), 500–514. doi:10.1002/bse.611

Garg, A. (2015). Green marketing for sustainable development: An industry perspective. *Sustainable Development*, *23*(5), 301–316. doi:10.1002d.1592

Ginsberg, J. M., & Bloom, P. N. (2004). Choosing the right green-marketing strategy. *MIT Sloan Management Review*, *46*(1), 79–84.

Gracia, A., & de Magistris, T. (2013). Organic food product purchase behaviour: A pilot study for urban consumers in the South of Italy. *Spanish Journal of Agricultural Research*, *5*(4), 439–451. doi:10.5424jar/2007054-5356

Hacioglu, G., & Gök, O. (2013). Marketing performance measurement: marketing metrics in Turkish firms. *Journal of Business Economics and Management, 14*(sup1), 413-432.

Hughner, R. S., McDonagh, P., Prothero, A., Shultz, C. J., & Stanton, J. (2007). Who are organic food consumers? A compilation and review of why people purchase organic food. *Journal of Consumer Behaviour*, *6*(23), 94–110. doi:10.1002/cb.210

Iacobucci, D. (2010). Structural equations modeling: Fit indices, sample size, and advanced topics. *Journal of Consumer Psychology*, *20*(1), 90–98. doi:10.1016/j.jcps.2009.09.003

Jerzyk, E. (2016). Design and communication of ecological content on sustainable packaging in young consumers opinions. *Journal of Food Products Marketing*, *22*(6), 707–716. doi:10.1080/10454446.2015.1121435

Jones, P., Clarke-Hill, C., Comfort, D., & Hillier, D. (2008). Marketing and sustainability. *Marketing Intelligence & Planning*, *26*(2), 123–130. doi:10.1108/02634500810860584

Kostadinova, E. (2016). Sustainable consumer behavior: Literature overview. *Economic Alternatives*, (2), 224-234.

Kotler, P., & Keller, K. L. (2012). *Marketing Management* (14th ed.). Boston: Prentice-Hall.

La Via, G., Antonio, & Nucifora, M. D. (2002). The determinants of the price mark-up for organic fruit and vegetable products in the European Union. *British Food Journal, 104*(3/4/5), 319-336.

Lamberti, L., & Noci, G. (2010). Marketing strategy and marketing performance measurement system: Exploring the relationship. *European Management Journal*, *28*(2), 139–152. doi:10.1016/j.emj.2009.04.007

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Lee, K. (2008). Opportunities for green marketing: Young consumers. *Marketing Intelligence & Planning*, *26*(6), 573–586. doi:10.1108/02634500810902839

Leonidou, C. N., Katsikeas, C. S., & Morgan, N. A. (2013). Greening the marketing mix: Do firms do it and does it pay off? *Journal of the Academy of Marketing Science*, *41*(2), 151–170. doi:10.100711747-012-0317-2

Li, C. R., Lin, C. J., & Chu, C. P. (2008). The nature of market orientation and the ambidexterity of innovations. *Management Decision*, *46*(7), 1002–1026. doi:10.1108/00251740810890186

Maniatis, P. (2016). Investigating factors influencing consumer decision-making while choosing green products. *Journal of Cleaner Production*, *132*, 215–228. doi:10.1016/j.jclepro.2015.02.067

Mitchell, R. W., Wooliscroft, B., & Higham, J. (2010). Sustainable market orientation: A new approach to managing marketing strategy. *Journal of Macromarketing*, *30*(2), 160–170. doi:10.1177/0276146710361928

Murphy, P. E. (2005). Sustainable marketing. *Business & Professional Ethics Journal*, *24*(1/2), 171–198. doi:10.5840/bpej2005241/210

Nair, S. R., & Menon, C. G. (2008). An environmental marketing system–a proposed model based on Indian experience. *Business Strategy and the Environment*, *17*(8), 467–479. doi:10.1002/bse.586

Narver, J. C., Slater, S. F., & MacLachlan, D. L. (2004). Responsive and proactive market orientation and new product success. *Journal of Product Innovation Management*, *21*(5), 334–347. doi:10.1111/j.0737-6782.2004.00086.x

Oswald, M., Brettel, M., & Engelen, A. (2012). How departments decision-making influence and interdepartmental dynamics relate to two facets of strategic market orientation. *Journal of Strategic Marketing*, *20*(6), 483–507. doi:10.1080/0965254X.2012.711346

Pap, A., Ham, M., & Turalija, A. (2015). Product policy management as part of sustainable marketing strategy. *Interdisciplinary Management Research*, *11*, 131–140.

Pawar, R., & Kambale, R. N. (2016). Green marketing-future challenges and opportunities. *Asian Journal of Multidisciplinary Studies*, *4*(3), 149–155.

Phalke, V., & Ranade, A. (2016). Green marketing: Complementing Swachh Bharat mission (SBM). *Asian Journal of Multidisciplinary Studies*, *4*(4), 167–173.

Prakash, A. (2002). Green marketing, public policy and managerial strategies. *Business Strategy and the Environment*, *11*(5), 285–297. doi:10.1002/bse.338

Pramod, V. (2016). Green marketing -an eco-friendly revolution. *Indian Journal of Applied Research*, *6*(1), 594–596.

Rastogi, E., & Khan, M. S. (2015). An analytical study of online advertising and its co-relationship with green marketing for facilitating sustainable marketing effectiveness. *International Journal of Applied Research*, *1*(5), 182–184.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Richey, R. G. Jr, Musgrove, C. F., Gillison, S. T., & Gabler, C. B. (2014). The effects of environmental focus and program timing on green marketing performance and the moderating role of resource commitment. *Industrial Marketing Management*, *43*(7), 1246–1257. doi:10.1016/j.indmarman.2014.06.014

Richter, T., & Hempfling, G. (2003). Supermarket study 2002: Organic products in European supermarkets. *FiBL*, 1-182.

Saba, A., & Messina, F. (2003). Attitudes towards organic foods and risk/benefit perception associated with pesticides. *Food Quality and Preference*, *14*(8), 637–645. doi:10.1016/S0950-3293(02)00188-X

Seretny, M., & Seretny, A. (2012). Sustainable marketing -a new era in the responsible marketing development. *Foundations of Management*, *4*(2), 63–76. doi:10.2478/fman-2013-0011

Shamma, H., & Hassan, S. (2013). Customer-driven benchmarking: A strategic approach toward a sustainable marketing performance. *Benchmarking: An International Journal*, *20*(3), 377–395. doi:10.1108/14635771311318144

Shao, J., Taisch, M., & Mier, M. O. (2017). Influencing factors to facilitate sustainable consumption: From the experts viewpoints. *Journal of Cleaner Production*, *142*(1), 203–216. doi:10.1016/j.jclepro.2015.12.111

Singh, P. B., & Pandey, K. K. (2012). Green marketing: Policies and practices for sustainable development. *Integral Review*, *5*(1), 22–30.

Suki, N. M., Suki, N. M., & Azman, N. S. (2016). Impacts of corporate social responsibility on the links between green marketing awareness and consumer purchase intentions. *Procedia Economics and Finance*, *37*, 262–268. doi:10.1016/S2212-5671(16)30123-X

Tayfun, N. Ö., & Öçlü, B. (2016). Çevreci ürünlerin tüketicilerin satın alma kararlarındaki yeri üzerine bir uygulama. *Ömer Halisdemir Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi, 9*(3), 185-198.

Tsai, K. H., Chou, C., & Kuo, J. H. (2008). The curvilinear relationships between responsive and proactive market orientations and new product performance: A contingent link. *Industrial Marketing Management*, *37*(8), 884–894. doi:10.1016/j.indmarman.2007.03.005

Vernekar, S. S., & Wadhwa, P. (2011). Green consumption: An empirical study of consumers attitudes and perception regarding eco-friendly FMCG products, with special reference to Delhi and NCR Region. *Opinion*, *1*(1), 64–74.

Villarino, J., & Font, X. (2015). Sustainability marketing myopia: The lack of persuasiveness in sustainability communication. *Journal of Vacation Marketing*, *21*(4), 326–335. doi:10.1177/1356766715589428

Weston, R., & Gore, P. A. Jr. (2006). A brief guide to structural equation modeling. *The Counseling Psychologist*, *34*(5), 719–751. doi:10.1177/0011000006286345

Wu, S. I., & Lin, S. R. (2016). The effect of green marketing strategy on business performance: A study of organic farms in Taiwan. *Total Quality Management & Business Excellence*, *27*(1-2), 141–156. doi :10.1080/14783363.2014.959256

Yang, J., & Liu, C. Y. (2006). New product development: An innovation diffusion perspective. *The Journal of High Technology Management Research*, *17*(1), 17–26. doi:10.1016/j.hitech.2006.05.002

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Yannopoulos, P., Auh, S., & Menguc, B. (2012). Achieving fit between learning and market orientation: Implications for new product performance. *Journal of Product Innovation Management*, *29*(4), 531–545. doi:10.1111/j.1540-5885.2012.00923.x

Zhang, J., & Duan, Y. (2010). The impact of different types of market orientation on product innovation performance: Evidence from Chinese manufacturers. *Management Decision*, *48*(6), 849–867. doi:10.1108/00251741011053433

Zhang, J., & Duan, Y. (2010a). Empirical study on the impact of market orientation and innovation orientation on new product performance of Chinese manufacturers. *Nankai Business Review International*, *1*(2), 214–231. doi:10.1108/20408741011052609

KEY TERMS AND DEFINITIONS

Green Marketing: Green marketing is the marketing of products that satisfy the wants and needs of the consumers, and have minimal detrimental effect on the natural environment.

Green Marketing Mix: Green marketing mix can be defined as the creation of the traditional marketing mix, known as 4P, as being environmentally friendly.

Green Marketing Strategy: The Green Marketing Strategy is a set of marketing strategies that are environmentally friendly.

Marketing Performance: Marketing performance is marketing outputs compared to the determined marketing objectives of the businesses.

Strategy: Strategy is the way to reach the aims and objectives of the businesses in an uncertain environment.

Sustainable Marketing: Sustainable marketing is an integrative approach that emphasizes environmental, social value and economic issues in the development of marketing strategies.

Turkey: Turkey is a developing country with a democratic, secular, unitary, parliamentary republic and various cultural heritages in Eurasia.

This research was previously published in Driving Green Consumerism Through Strategic Sustainability Marketing edited by Farzana Quoquab, Ramayah Thurasamy, and Jihad Mohammad, pages 135-154, copyright year 2018 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 71
Identification of Contextual Relationship Among Collaboration, Cooperation, Coordination, and Innovative Green Procurement Practices

Surajit Bag
Tega Industries South Africa Pty Ltd, South Africa

ABSTRACT

Globally, every organization is focusing on minimizing the usage of scarce resources in production. The authors have used resource dependence theory (RDT) as the theoretical lens to develop the foundation of the chapter. RDT suggests that firms within the supply chain network should coordinate and collaborate to achieve superior performance. Under RDT, the most important assumption is that firms cannot be fully independent with regards to strategically critical resources for survival. The purpose of this chapter is to explain the contextual relationships between collaboration, coordination, cooperation, and innovative green procurement practices. Here, interpretive structural modeling (ISM) technique has been used to develop the SSIM matrix with the assistance from five experts based in the South African steel and engineering sectors. The ISM model depicts the contextual interrelationships that may help supply chain managers in quality decision making. The chapter concludes with managerial implications and directions of future research.

INTRODUCTION

In today's competitive era focal companies have supplier networks comprising of multi tier suppliers located in different countries and continents. The purpose of sourcing from both local and international suppliers is primarily to mitigate supply risks and gain costs benefits. Many past studies have reported about numerous big suppliers of reputed firms were actually involved in child labor practices, polluting the surrounding environment and not complying with local and international laws and regulations. There

DOI: 10.4018/978-1-5225-7915-1.ch071

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

are high risks involved in doing business with such suppliers who fails to adhere to the triple bottom line principles. Thus the concept of sustainability has gradually extended towards supplier networks and attracted attention of SCM researchers.

In this study we use Resource Dependence theory (RDT) as a theoretical lens for preparing the research foundation. RDT suggests that member firms within the supply chain should coordinate and collaborate to achieve superior performance. Under RDT the most important assumption is that firms cannot be fully independent with regards to strategically critical resources for survival (Sarkis et al., 2011).

Under Green procurement practices, the eco-design of products and materials recovery is outstanding organizational resources requiring partnership with key suppliers to extract performance benefits (Zhu et al., 2005). From the RDT viewpoint, customer and supplier relationships are important links for firms to reduce the uncertainty surrounding their operating environment (Carter & Rogers, 2008).

While establishing theoretical foundations for three Cs' and innovative green procurement practices, the following research question is proposed: Do Collaboration, Coordination and Cooperation create value in improving innovative green procurement practices of firm?

There are few brilliant studies available in the area of supplier relationship management, supplier integration and collaboration and has been discussed further to understand the breadth and depth of study available in the area of sustainable procurement.

Bag (2016b) studied the interrelationship between green strategy, supplier relationship management and supply chain performance. Important variables such as supplier integration, ethics, trust, culture and flexibility has been considered in the study to develop supplier relationship model. Green purchasing positively influences flexible systems which in turn reduces operational cost. Bag (2016c) also argued that flexible procurement systems is key to supply chain sustainability. In that study the important variables considered were supplier integration, supplier responsiveness and strategic sourcing. The findings suggest that manufacturing organizations having a strong sourcing policy successfully integrate suppliers. This helps to achieve greater level of flexibility and develops more innovative products successfully. It was also suggested that trust and collaborative efforts between buyers and suppliers improve delivery and product quality, which enhance customer satisfaction and considered as a right move towards sustainability.

In a recent study by Bag and Anand (2016) we find the importance of innovation leadership in cultivating sustainable supply chain practices of an organisation. One interesting finding from the study is that empowering junior managers and creating innovation culture among employees facilitate green practices.

The above studies are some of the recent exceptional work in the area of sustainable practices where different links has been examined. However, the missing link in all the past studies is the role of 3 Cs' in influencing innovative green procurement practices.

Firms mostly emphasizes on innovation for creating eco-friendly designs, reducing level of wastage and value addition. Firms apply different tools and techniques to measure performance of green practices which generally differ from the conventional practices.

Research Gaps

The research gaps which evolved from the review of literature have been presented here to further develop the research objectives for the present study.

Existing studies mainly focused on identifying green procurement drivers and barriers. There is lack of studies considering the soft dimensions of green procurement such as collaboration, coordination and cooperation and therefore require more research focus.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Although existing studies discussed about innovative approaches and its importance for environmental practices but there is hardly any study where scholars have argued that innovation and green procurement is intertwined together and has drawn our attention.

Thirdly, no existing study explains the contextual interrelationships between innovative green practices and the 3 Cs'. There are existing studies showing links between resource dependency theory and green practices (Cooper & Ellram, 1993; Carter & Carter, 1998; Buvik., 2001; Carter & Rogers, 2008; Zhu et al., 2008; Sarkis et al., 2011; Sarkis, 2012; Lee et al., 2012). However, there is a scope for further developing new theory and extending the knowledge base.

Research Objectives

Thorough review of literature has revealed the research gaps and provides direction for developing the following research objectives:

- To identify the contextual relationships between Collaboration, Cooperation, Coordination and innovative green procurement practices.
- To develop a conceptual model for sustainable supply management

The manuscript has been organized as follows. The next section describes the key constructs used in this study. Third section covers the research methodology followed by section four on analysis and discussion. Finally, the manuscript concludes with a discussion of managerial implications, unique contribution, limitations and suggested future research.

LITERATURE REVIEW

Here we have done review from selected articles which are suitable for our study and described the key constructs used in the study.

Collaboration

We argue in light with Attaran & Attaran, (2007) that trust building and ethical behavior is necessary to develop good business relationship with suppliers and integrate them with the buying organization system. This will ensure collaborative planning, accurate forecasting and replenishment which will provide greater level of visibility in uncertain times and flexibility in operations.

It is necessary to develop specialist suppliers and involve them in the green design stage for finalizing blueprint for remanufacturing and disassembly (Ayres et al., 1997; Charter & Gray, 2008; Subramoniam et al., 2009; Gunasekaran, & Spalanzani, 2012).

Vachon, (2007) suggested that environmental collaboration with suppliers is positively associated with greater investment in pollution prevention technologies. Previous seminal studies by Carter & Carter, (1998); Bowen et al., (2001); Vachon & Klassen, (2006) and Dubey et al., (2013) also suggest that buying organization environmental and logistical collaboration with suppliers positively influences adoption of green purchasing practices.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The study by Eltayeb et al., (2011) and Green et al., (2012) also supports that environmental collaboration and monitoring practices among supply chain network partners' results to improved environmental performance and organizational performance.

However, the impact of commitment on green collaboration is mediated by purchasing capabilities (Large & Thomsen, 2011).

Cooperation

This construct selection is supported by the seminal work of Chen, (2005). It was suggested by Chen, (2005) that support and cooperation of suppliers is a prerequisite of green procurement implementation. Further Zhu et al., (2008) argued that cooperation with environmental concerns is important for successful green procurement programs. Such environmental programs cross all boundaries within and between organizations and therefore, cooperation from all functions are necessary for achieving the environmental goals. Also customer cooperation is required for meeting environmental goals such as cleaner production, greener packaging and green logistics.

Coordination

Carter and Carter, (1998) argued that coordination between buying and supplying organizations is critical for success of green procurement programs. The findings of Carter and Carter, (1998) have also been supported by recent studies conducted by Srivastava, (2007); Varnas et al., (2009); Yen and Yen, (2012); Zhu et al., (2012) and Swami & Shah, (2013).

Therefore, green purchasing actions will be facilitated through increased internal cross function coordination between operations, sales and design departments (Carr et al., 2008) and coordination with suppliers and downstream members of the supply chain (Yang & Zhang, 2012) which will result to enhanced management of process and products in the global network and reduce uncertainties in dynamic business environment (Foerstl et al., 2013).

Ryoo & Koo (2013) suggested that organization's green practices-IS alignment is having a positive effect on both green practices manufacturing coordination and green practices-marketing coordination.

Innovative Green Procurement

Innovation green procurement key dimensions include Innovation capability; ISO 14000 standards adoption; Environment, Health and Safety programs; Life Cycle assessment; SA 8000 adoption; Customer satisfaction; Supplier satisfaction and Better risk management.

Innovation capability is correlated to the way an organization manage innovation. World class organizations nurture this capability and enhance organization performance by developing new products and services (Lawson & Samson, 2001; Calantone et al., 2002). It was found that employee willingness to both donate and collect knowledge enable the firm to improve innovation capability (Lin, 2007). Further Liao et al., (2007) argued that absorptive capacity is the intervening factor between knowledge sharing and innovation capability.

ISO 14000 is the series of environmental management standards which are published by International Organization for Standardization. However, ISO 14001 is the most important standard and aims

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

at environment management system for any organization. ISO 14001 is based on the principle of Plan, Check, Do, Review and Improve cycle.

Environment, Health and Safety (EHS) programs are linked with green procurement actions because any procurement decisions directly influence the EHS program. Therefore, cross functional coordination, cooperation and both supplier and customer collaboration helps to smoothly run EHS programs.

Life Cycle assessment (LCA) approach can be used to check the design of any new component or assess the design of an existing product. This method is used to evaluate the environmental impact of a product from birth to its end. Green procurement includes LCA policy making which develop regulations on materials selection and usage for production and release in the environment. LCA involves comparing alternative raw material and change in manufacturing process to minimize environmental impact. It also compares resource use and pollution information with those of competitors. To make LCA process successful organization must train and educate designers, production engineers and buyers for better understanding of the subject matter.

Green procurement also involves SA 8000 adoption where buying organizations do not support any supplying organizations involved in child labor practices. SA8000 is set to embrace existing international agreements, including International Labour Organization conventions, the Universal Declaration on Human Rights, and the UN Convention on the Rights of the Child.

Green procurement is also found to enhance customer satisfaction and supplier satisfaction. It also helps organization to manage risks (Dubey et al., 2013).

Theoretical Perspectives on Collaboration, Cooperation, Coordination, and Innovative Green Procurement Practices

Let us understand particularly why the term "innovative green procurement practices" has been used for the study; the underlying reason is that any firm practicing green practices basically performs out of the box thinking, i.e. innovation. Firms are innovating using newer appaches to come out with eco-friendly designs, reduce wastage, reclaim, add value and also save costs. Firms use different tools and techniques to measure performance under green practices which differ from the traditional or standard practices. If we consider any world class firm practicing sustainable practices such as Apple, Dell, Ford and Toyota, we can see the approaches of individual firms are different from each other, although the ultimate objective is to save natural resources and reduce carbon footprint. Innovation and green practices is intertwined and no common or standard practice can yield the same result to every firm. The central concept is to innovate and come out with better ideas for sustainability. In this study resource dependence theory is used as a theoretical lens to further disseminate and enhance the existing knowledge base. It is interesting to note that resource scarcity can generate huge risks both internally and externally. Therefore, author felt the need to identify the interrelationships among innovative green practices and the internal (trust building, internal coordination) and external (supplier collaboration, supplier cooperation, customer cooperation and external coordination) dimensions. The present study will generate rich insight mainly for supply chain professionals involved in green practices. The findings will help in developing practical tools for green performance measurement.

Since natural resources are widely used, there are chances of resources becoming scarce and expensive to acquire. In that scenario firms need to innovative for sourcing alternate resources. Here firms deviate from the standard practices and adopts the best practices which enhance the brand image in the business world. As per RDT, scarcity can occur internally or externally (Leblebici et al., 1991). When

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

firms have unskilled manpower demonstrating poor cooperation and poor coordination may result in resource scarcity. Externally if the firm does not collaborate with customers and suppliers, then the firm might run out of resources and which generally becomes costlier to acquire at the last moment. Also the growth in demand for the eco designed product increase the demand of the resource. Scarcity of the input resource will lead to difficulty in manufacturing of the product. Competitive pressures also restrict firms in raising the prices of final products. The internal and external forces compound together and act on the firm. This is a burning problem for the firm and often results in unsuccessful green procurement practices and financial losses.

As per the NSF (2010) study, existing green initiatives have mainly focused on investment in new technology and developing energy saving equipment and facilities. Such initiatives are valuable but they tend to ignore the green production economics, interaction, and coordination where the flow of products to final customers engages multiple firms in long and complex supply chains. Therefore, the present study is necessary to bring out the richness of 3 C' and its importance in enhancing innovating green procurement practices in today's complex supply chain structure operating under uncertainty.

In this turbulent business scenario every supply chain practitioner is struggling to mitigate the risks. The level of uncertainty is more due to long and complex supply chains (Applequist et al., 2000; Juttner et al., 2003 and Kleindorfer and Saad, 2005). In this scenario, every supply chain practitioner spends their time majorly in aligning supply chain strategies with product uncertainties (Lee, 2002). The problem has aggravated with tight competition in the market and strict government regulations. This has raised the question of firm's sustainability and created difficulty to stay in the business (Walker, 2008; Wagner and Bode, 2008). To change the game and remain in business, supply chain practitioners innovated and shifted the focus towards triple bottom line concept and focusing on environmental, social and economic aspects of business sustainability (Carter and Rogers, 2008; Dubey & Bag, 2014; Dubey et al., 2015). Further they adopted green procurement practices where firms emphasize on reduction of wastage; material substitution through environmental sourcing of raw materials and reduce usage of hazardous materials. Basically green procurement focuses on life cycle thinking whereas the traditional procurement system used to focus only on costs (Kaiser et al., 2001). In response to the internal and external changes firms have instituted socially responsible buying process (Carter et al., 1998). Currently green procurement is considered as a noble approach to improve the performance of firms (Hamner & del Rosario 1998; Dubey et al., 2013; Dubey et al., 2014a). Green procurement is controlled by the internal and external forces and the balance between the two forces is necessary for successful green procurement practices. The internal forces are the forces within the firm and the external forces are basically supplier and customer pressures. From the internal viewpoint the team coordination and cross functional cooperation among members are necessary for running any projects successfully (Pinto and Pinto, 1990). The tasks and roles embedded in driving innovative green practices as well as rules and procedures to coordinate the project needs attention of members (Tjosvold, 1988; Hoegl et al., 2004). It is the responsibility of top management to cultivate effective communication, cooperation and trust to achieve rapid milestones in green procurement (Kerzner, 2013).

Also, it is essential to understand the external forces such as supplier pressures and customer pressures. The strict regulations drive firm to form an alliance with suppliers and integrating suppliers into environmental management practices. Green procurement demands environmentally conscious suppliers who have implemented ISO 14001. This necessitates firms in developing environmental policy and environmental supplier evaluation criteria (Green et al., 1996; Green et al., 1998; Chen, 2005; Zhu et al., 2005; Zhu & Sarkis, 2006; Zhu & Sarkis, 2007; ElTayeb et al., 2010; Dubey et al., 2013). Supplier

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

collaboration is an important component of green procurement. Collaborative strategies facilitate closer cooperation between buyer and supplier firms, provides flexibility in handling projects (Bowen et al., 2001). It was found that firms achieved greatest success in innovative green practices when suppliers are physically involved with buyer's plant and also when the buyer spend maximum time in the supplier's plant (Simpson and Power, 2005). In some of the earlier studies, researchers have used the term innovative practices under green procurement practices such as innovative packaging based on customers' willingness to buy biodegradable packages and they even discussed on green firms being innovative in their environmental practices and innovative approaches in managing waste at source. There is evidence in certain papers where discussions have been done on ways to bring innovative green products in the market (Green et al., 1996; Min & Galle., 1997; Min & Galle., 2001).

RESEARCH METHODS

Research design is the most critical step in any research study. The research design is different for both qualitative and quantitative approaches. Some of the seminal papers available in the area of qualitative research design under management sciences are (e.g., Eisenhardt, 1989; Eisenhardt & Graebner, 2007; Suering, 2008; Stock & Boyer, 2009). From existing literature, it is seen that case study research is the most popular technique under qualitative approach. Therefore, keeping in mind the qualitative approach for the present study we have several options for addressing the research objectives. But the author adopted the ISM methodology for identifying the contextual relationships between identified variables. The reason for adopting ISM methodology is basically to generate a robust model from the complex links and for which ISM is the perfect tool. The ISM methodology is interpretive from the fact that as the expert group decides whether one variable enhance other variable, therefore an overall structure is extracted from the relationships of the variables and is further validated using MICMAC analysis. ISM has gained popularity in the branch of supply chain management and the seminal work available are (Mandal & Deshmukh, 1994; Singh et al., 2003; Luthra et al., 2011; Pfohl et al., 2011; Shahabadkar, 2012; Sushil,2012; Attri et al., 2013; Bag & Anand, 2014a,b; Bag., 2014; Dubey et al., 2014b; Dubey & Singh, 2015).

We conducted literature review and identified 20 variables which were finally reduced to 15 based on the opinion of industry experts. The final fifteen and sources have been presented in Table 1.

ANALYSIS AND DISCUSSION

Interpretive Structural Modeling

Step 1: Developing the Structural Self Interaction Matrix

For developing structural self interaction matrix (SSIM) in Table 2, the below symbols have been used to denote the direction of relationships between variables (i and j):

V i lead to j but j does not lead to i
A i do not lead to j but j lead to i

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 1. Final variables

Purpose	Element No.	Elements	Source
Innovative Green Procurement Practices	C1	Innovation capability	Bag, (2016a); Bag and Gupta, (2017)
	C2	ISO 14000 standards adoption	Dubey et al., (2013); Bag, (2016b)
	C3	Environment, Health and Safety programs	Bag, (2016b)
	C4	Life Cycle assessment	Bag, (2016b)
	C5	SA 8000 adoption	Bag, (2016b)
	C6	Customer satisfaction	Dubey et al., (2013); Bag, (2016b)
	C7	Supplier satisfaction	Dubey et al., (2013); Bag, (2016b)
	C8	Green supply chain risk management	Dubey et al., (2014a); Bag, (2016b)
Collaboration	C9	Trust building	Zhu et al., (2005); Anvuur & Kumaraswamy, (2008); Chen, (2010); Rahbar and Abdul Wahid, (2011)
	C10	Ethical Behaviour	Chan & Lau, (2002); Roberts, (2003); Young et al., (2010)
	C11	Integration with suppliers	Rao & Holt, (2005); Darnall et al., (2008); Walton et al., (2008); Chan et al., (2012); Hietajärvi, & Karvonen, (2016)
Cooperation	C12	Support and cooperation of suppliers and sub-suppliers	Chen, (2005); Mahama, (2006)
	C13	Customer cooperation for environmental objectives	Zhu et al., (2008)
Coordination	C14	External coordination between buying and supplying organizations	Foerstl et al., (2013)
	C15	Internal coordination among different departments of buyer organization	Zhu and Geng, (2006); Carr et al., (2008)

Table 2. Structural self interaction matrix (SSIM)

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
1	A	A	V	A	A	A	A	V	A	V	O	A	A	A	
2	A	A	A	A	A	A	A	V	V	V	X	V	V		
3	A	A	A	A	A	A	A	V	V	V	X	V			
4	A	A	A	A	A	A	A	V	V	V	O				
5	A	A	A	A	A	A	A	A	V	V					
6	A	A	V	A	A	A	A	A	X						
7	A	A	A	V	A	A	A	V							
8	A	A	A	A	A	A	A								
9	V	V	V	V	V	X									
10	V	V	V	V	V										
11	A	A	A	A											
12	A	A	A												
13	A	A													
14	A														
15															

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

X i lead to j and j lead to i
O i and j are unrelated to each other.

Step 2: Develop Reachability Matrix

The SSIM has been converted into a binary matrix, i.e., the rechability matrix (Table 3) by substituting V, A X and O by 1 and 0. The substitutions of '1' and '0' is done as below:

1. If the (i, j) entry in the SSIM is V, then the (i,j) entry in the rechability matrix becomes '1' and (j,i) entry becomes '0'
2. If the (i, j) entry in the SSIM is A, then the (i,j) entry in the rechability matrix becomes '0' and (j,i) entry becomes '1'
3. If the (i, j) entry in the SSIM is X, then the (i,j) entry in the rechability matrix becomes '1' and (j,i) entry also becomes '1'
4. If the (i, j) entry in the SSIM is O, then the (i,j) entry in the rechability matrix becomes '0' and (j,i) entry also becomes '0'

In this step the concept of transitivity is introduced so that some of the cells of the initial reachability matrix are filled by inference. Transitivity can be explained with the following example if element 'i' relates to element 'j' and element 'j' relates to element 'k', then transitivity implies element 'i' relates to element 'k'. Transitivity is the basic assumption in ISM and is always used in this modelling approach. It also helps in maintaining the conceptual consistency. The final reachability matrix will then consist of some entries from the pair-wise comparisons and some inferred entries. The transitivity concept is used to fill the gap, if any. Following the above rules, the initial reachability matrix is prepared. After incorporating the transitivity concept as described above, the final reachability matrix is obtained in Table 4.

Table 3. Initial reachability matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	1	0	0	0	0	1	0	1	0	0	0	0	1	0	0
2	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
3	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0
4	1	0	0	1	0	1	1	1	0	0	0	0	0	0	0
5	0	1	1	0	1	1	1	0	0	0	0	0	0	0	0
6	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0
7	1	0	0	0	0	1	1	1	0	0	0	1	0	0	0
8	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0
9	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
11	1	1	1	1	1	1	1	1	0	0	1	0	0	0	0
12	1	1	1	1	1	1	0	1	0	0	1	1	0	0	0
13	0	1	1	1	1	0	1	1	0	0	1	1	1	0	0
14	1	1	1	1	1	1	1	1	0	0	1	1	1	1	0
15	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Step 3: Level Partition

The final reachability matrix obtained above in Table 4 is now partitioned into different levels. After the first iteration, the element classified to level 1 is discarded and the partitioning procedure is repeated on the remaining element to determine the level 2. These iterations are continued until the level of each variable has been determined.

Step 4: Diagraph

From the final reachability matrix and level partitions, the structural model is generated by means of nodes and lines of edges. If there is a relationship between the elements j and i, this is shown by an arrow which points from i to j. This graph is called digraph.

Step 5: Interpretive Structural Model

From the connective information shown in diagraph we further create the structural model. The particulars of elements are indicated in the respective boxes with indicated relations as designed in the digraph, thus obtaining the interpretive structural model for fifteen elements. The interpretive structural model shows the elements and their reachability to the higher level elements and provides a clear picture with an understanding of the inter-relationships among the elements.

Table 4. Final reachability matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Driving Power (Y)
1	1	1*	1*	1*	1*	1	1*	1	0	0	1*	1*	1	0	0	11
2	1	1	1	1	1	1	1	1	0	0	0	1*	1*	0	0	10
3	1	1*	1	1	1	1	1	1	0	0	0	1*	1*	0	0	10
4	1	0	0	1	1*	1	1	1	0	0	0	1*	1*	0	0	8
5	1*	1	1	1*	1	1	1	1*	0	0	0	1*	1*	0	0	10
6	1*	1*	1*	1*	1*	1	1	1*	0	0	1*	1*	1	0	0	11
7	1	1*	1*	1*	1*	1	1	1	0	0	1*	1	0	0	0	10
8	0	1*	1*	0	1	1	1*	1	0	0	0	0	1*	0	0	7
9	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
11	1	1	1	1	1	1	1	1	0	0	1	1*	1*	0	0	11
12	1	1	1	1	1	1	1*	1	0	0	1	1	1*	0	0	11
13	0	1	1	1	1	1*	1	1	0	0	1	1	1	0	0	10
14	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1*	13
15	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	13
Dependence Power (X)	13	14	14	14	15	15	15	15	2	2	10	14	14	4	4	

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 5. Level Partition (Level 1)

Variables	Reachability set	Antecedent set	Intersection set	Level
1	1,2,3,4,5,6,7,8,11,12,13	1,2,3,4,5,6,7,9,10,11,12,14,15	1,2,3,4,5,6,7,11,12	
2	1,2,3,4,5,6,7,8,12,13	1,2,3,5,6,7,8,9,10,11,12,13,14,15	1,2,3,5,6,7,8,12,13	
3	1,2,3,4,5,6,7,8,12,13	1,2,3,5,6,7,8,9,10,11,12,13,14,15	1,2,3,5,6,7,8,12,13	
4	1,4,5,6,7,8,12,13	1,2,3,4,5,6,7,9,10,11,12,13,14,15	1,4,5,6,7,12,13	
5	1,2,3,4,5,6,7,8,12,13	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15	1,2,3,4,5,6,7,8,12,13	I
6	1,2,3,4,5,6,7,8,11,12,13	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15	1,2,3,4,5,6,7,8,11,12,13	I
7	1,2,3,4,5,6,7,8,11,12	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15	1,2,3,4,5,6,7,8,11,12	I
8	2,3,5,6,7,8,13	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15	2,3,5,6,7,8,13	I
9	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15	9,10	9,10	
10	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15	9,10	9,10	
11	1,2,3,4,5,6,7,8,11,12,13	1,6,7,9,10,11,12,13,14,15	1,6,7,11,12,13	
12	1,2,3,4,5,6,7,8,11,12,13	1,2,3,4,5,6,7,9,10,12,13,14,15	1,2,3,4,5,6,7,12,13	
13	2,3,4,5,6,7,8,11,12,13	1,2,3,4,5,6,8,9,10,11,12,13,14,15	2,3,4,5,6,8,11,12,13	
14	1,2,3,4,5,6,7,8,11,12,13,14,15	9,10,14,15	14,15	
15	1,2,3,4,5,6,7,8,11,12,13,14,15	9,10,14,15	14,15	

Table 6. Level Partition (Level 2)

Variables	Reachability set	Antecedent set	Intersection set	Level
1	1,2,3,4,11,12,13	1,2,3,4,9,10,11,12,14,15	1,2,3,4,11,12	
2	1,2,3,4,12,13	1,2,3,9,10,11,12,13,14,15	1,2,3,12,13	
3	1,2,3,4,12,13	1,2,3,9,10,11,12,13,14,15	1,2,3,12,13	
4	1,4,12,13	1,2,3,4,9,10,11,12,13,14,15	1,4,12,13	II
9	1,2,3,4,9,10,11,12,13,14,15	9,10	9,10	
10	1,2,3,4,9,10,11,12,13,14,15	9,10	9,10	
11	1,2,3,4,11,12,13	1,9,10,11,12,13,14,15	1,11,12,13	
12	1,2,3,4,11,12,13	1,2,3,4,9,10,12,13,14,15	1,2,3,4,12,13	
13	2,3,4,11,12,13	1,2,3,4,9,10,11,12,13,14,15	2,3,4,11,12,13	II
14	1,2,3,4,11,12,13,14,15	9,10,14,15	14,15	
15	1,2,3,4,11,12,13,14,15	9,10,14,15	14,15	

Table 7. Level Partition (Level 3)

Variables	Reachability set	Antecedent set	Intersection set	Level
1	1,2,3,11,12	1,2,3,9,10,11,12,14,15	1,2,3,11,12	III
2	1,2,3,12	1,2,3,9,10,11,12,14,15	1,2,3,12	III
3	1,2,3,12	1,2,3,9,10,11,12,14,15	1,2,3,12	III
9	1,2,3,9,10,11,12,14,15	9,10	9,10	
10	1,2,3,9,10,11,12,14,15	9,10	9,10	
11	1,2,3,11,12	1,9,10,11,12,14,15	1,11,12	
12	1,2,3,11,12	1,2,3,9,10,12,14,15	1,2,3,12	
14	1,2,3,11,12,14,15	9,10,14,15	14,15	
15	1,2,3,11,12,14,15	9,10,14,15	14,15	

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 8. Level Partition (Level 4)

Variables	Reachability set	Antecedent set	Intersection set	Level
9	9,10,11,12,14,15	9,10	9,10	
10	9,10,11,12,14,15	9,10	9,10	
11	11,12	9,10,11,12,14,15	11,12	IV
12	11,12	9,10,12,14,15	12	
14	11,12,14,15	9,10,14,15	14,15	
15	11,12,14,15	9,10,14,15	14,15	

Table 9. Level Partition (Level 5)

Variables	Reachability set	Antecedent set	Intersection set	Level
9	9,10,12,14,15	9,10	9,10	
10	9,10,12,14,15	9,10	9,10	
12	12	9,10,12,14,15	12	V
14	12,14,15	9,10,14,15	14,15	
15	12,14,15	9,10,14,15	14,15	

Table 10. Level Partition (Level 6)

Variables	Reachability set	Antecedent set	Intersection set	Level
9	9,10,14,15	9,10	9,10	
10	9,10,14,15	9,10	9,10	
14	14,15	9,10,14,15	14,15	VI
15	14,15	9,10,14,15	14,15	VI

Table 11. Level Partition (Level 7)

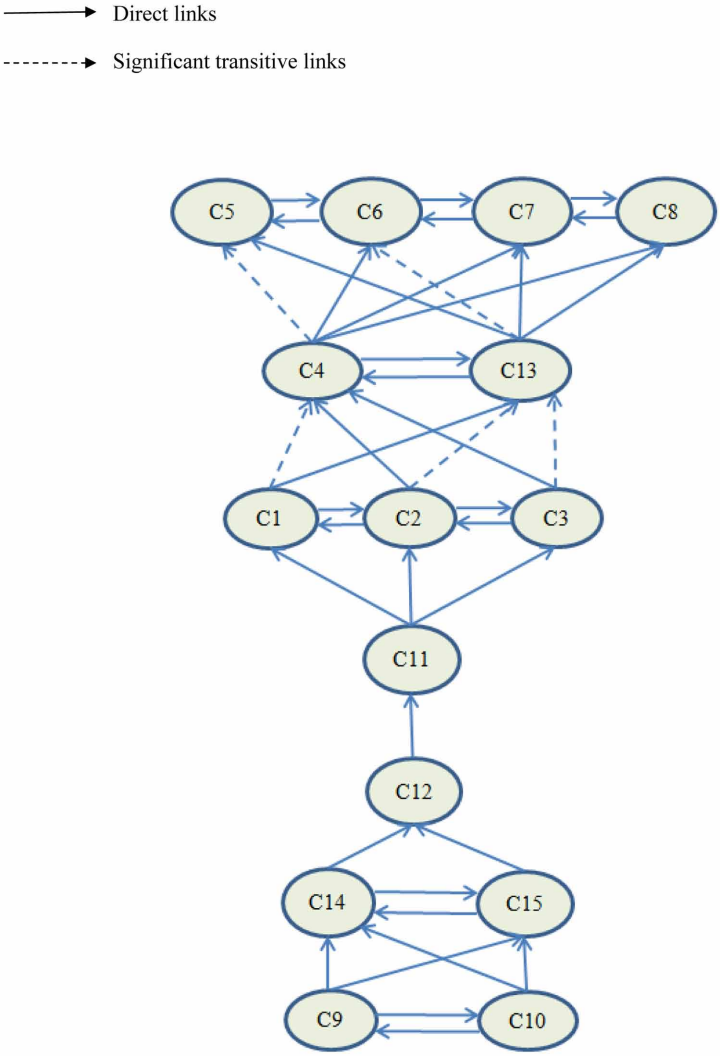
Variables	Reachability set	Antecedent set	Intersection set	Level
9	9,10	9,10	9,10	VII
10	9,10	9,10	9,10	VII

MICMAC Analysis

MICMAC analysis Matrice d' Impacts croises multiplication appliqué and classment (cross-impact matrix multiplication applied to classification) is abbreviated as MICMAC. The objective of MICMAC analysis is to analyse the drive power and dependence power of variables. Based on the drive power and dependence power the variables have been classified into four sectors: autonomous variables, linkage variables, dependent and independent variables and presented in Figure 3.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 1. Diagraph with significant transitive links



The results of MICMAC analysis has been presented in tabulated form (Table 12).

Based on the findings of MICMAC analysis we have drawn the conceptual model (refer figure 4) which shows the links between independent, linkage and dependent variables. This conceptual model is very unique in terms of coverage and will be useful for conducting structural equation modelling.

CONCLUSION

The paper is an unique attempt to uncover new links between collaboration, cooperation, coordination and innovative green procurement practices. This paper is an extension of the study conducted previously by Bag (2016a). Initially effort was given to describe the constructs in details followed by identification of associated elements. Further, interpretive structural modelling technique has been used to identify

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 2. ISM model

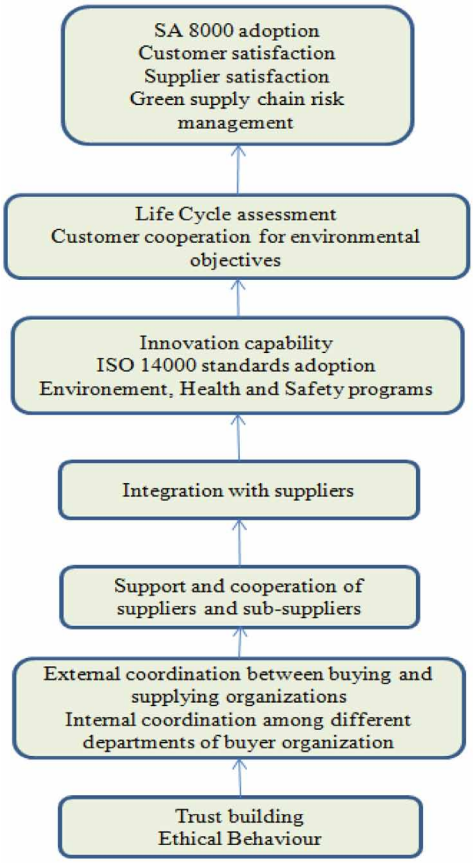
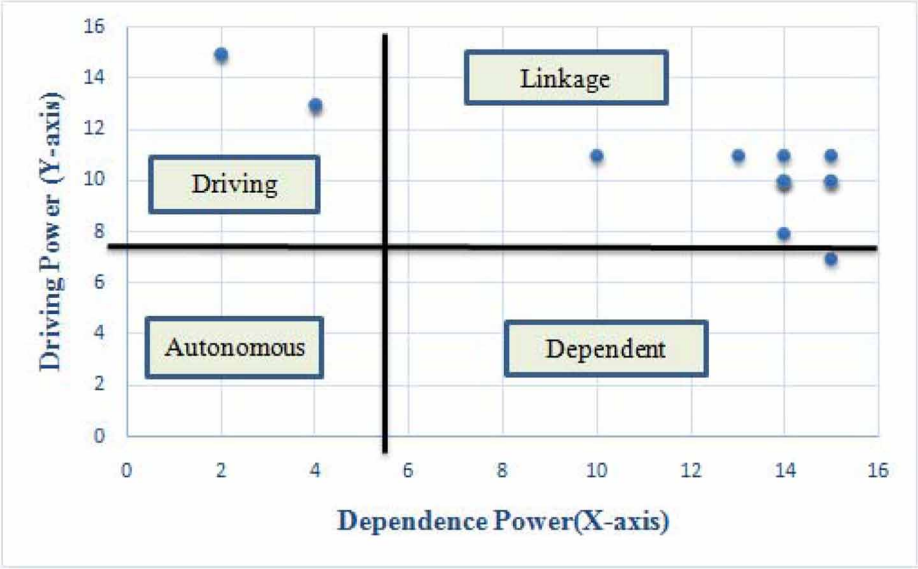


Figure 3. MICMAC analysis plot

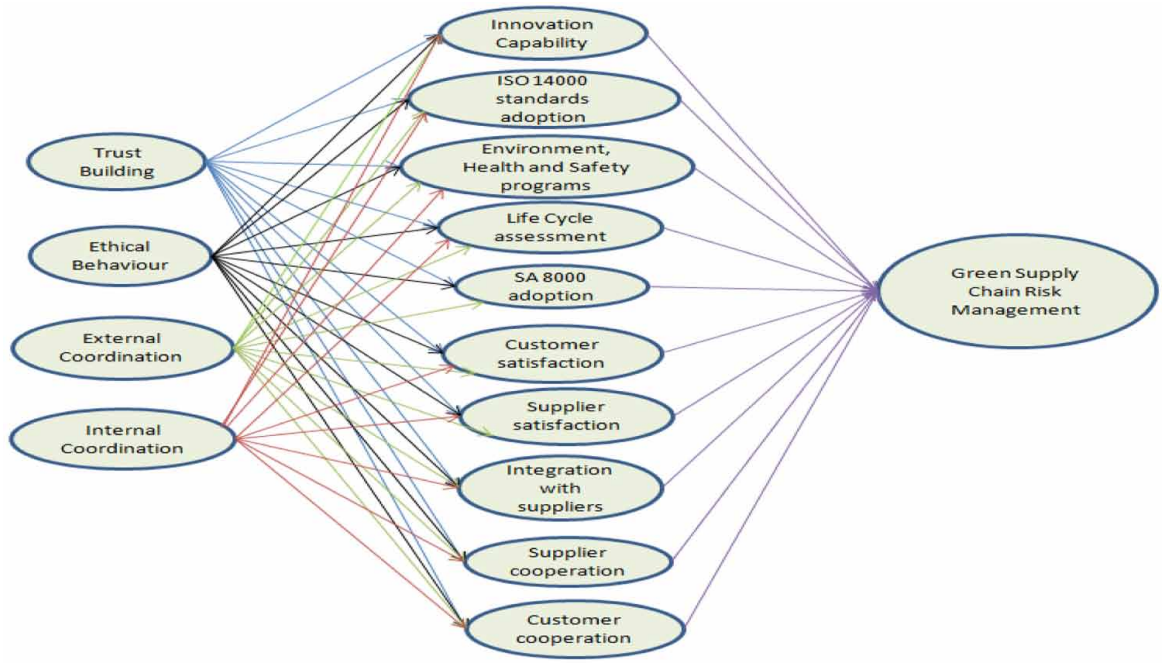


EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 12. Findings from MICMAC analysis

Purpose	Element No.	Elements	Dependence Power (X)	Driving Power (Y)	Sector
Innovative Green Procurement Practices	C1	Innovation capability	13	11	Linkage
	C2	ISO 14000 standards adoption	14	10	Linkage
	C3	Environment, Health and Safety programs	14	10	Linkage
	C4	Life Cycle assessment	14	8	Linkage
	C5	SA 8000 adoption	15	10	Linkage
	C6	Customer satisfaction	15	11	Linkage
	C7	Supplier satisfaction	15	10	Linkage
	C8	Green supply chain risk management	15	7	Dependent
Collaboration	C9	Trust building	2	15	Driving
	C10	Ethical Behaviour	2	15	Driving
	C11	Integration with suppliers	10	11	Linkage
Cooperation	C12	Support and cooperation of suppliers and sub-suppliers	14	11	Linkage
	C13	Customer cooperation for environmental objectives	14	10	Linkage
Coordination	C14	External coordination between buying and supplying organizations	4	13	Driving
	C15	Internal coordination among different departments of buyer organization	4	13	Driving

Figure 4. Conceptual model



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

the contextual relationships among all elements. The ISM resulted into development of a hierarchy of fifteen elements achieving seven different levels. The TISM diagraph shows the direct links and transitive links which will be useful for decision makers. We found that SA 8000 adoption; Customer satisfaction; Supplier satisfaction and Green supply chain risk management achieved the top level whereas Trust building and Ethical Behaviour achieved bottom level. Supply chain practitioners must aim at removing the bottlenecks at the bottom level for successful innovative green procurement programs.

We also focused on conducting the MICMAC analysis to understand the driving power and dependence power of all elements. It was found that four elements are actually acting as drivers such as Trust building, Ethical behaviour, External coordination and Internal coordination. From MICMAC analysis ten linkage variables emerged and finally we found that green supply chain risk management is the dependent variable. We have also drawn the conceptual model based on MICMAC analysis which will be useful for future empirical research. The findings corroborate with previous studies such as Dubey et al., (2013); Muduli et al., (2013) and Foerstl et al.2013. The findings as well support Resource Dependence theory and we can infer that Collaboration and Coordination is indeed very critical to drive the green procurement programs successfully and manage resources which ultimately results in mitigating the supply risks in the network.

Managerial Implications

The interesting part of this study is that we have considered all the soft dimensions which have so far lacked attention and focus from the supply chain researchers. The findings show that Coordination and Collaboration are basically the driving factors whereas Cooperation acts as a linkage factor. Therefore, supply chain practitioners must focus in improving these areas to achieve superior green procurement performance and ultimately manage green supply chain risks. Firms may focus on cross functional team building and regular review of activities to ensure that green procurement program is receiving full cooperation and support from suppliers and customers.

Unique Contributions, Limitations, and Future Research Directions

The current study is unique in terms of scope and coverage and attempted to bridge the gaps between practice and theory. Limitation in this study include small sample size (five experts opinion) used to develop the VAXO matrix. The limitations can be eliminated in future studies by involving larger sample size for data collection and statistically validate the model using structural equation modelling.

REFERENCES

Anvuur, A. M., & Kumaraswamy, M. M. (2008). Better collaboration through cooperation. *Collaborative relationships in construction: developing frameworks and networks*, 107-128.

Applequist, G. E., Pekny, J. F., & Reklaitis, G. V. (2000). Risk and uncertainty in managing chemical manufacturing supply chains. *Computers & Chemical Engineering*, *24*(9), 2211–2222. doi:10.1016/S0098-1354(00)00585-8

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Attaran, M., & Attaran, S. (2007). Collaborative supply chain management: The most promising practice for building efficient and sustainable supply chains. *Business Process Management Journal*, *13*(3), 390–404. doi:10.1108/14637150710752308

Attri, R., Dev, N., & Sharma, V. (2013). Interpretive structural modelling (ISM) approach: An overview. *Research Journal of Management Sciences*, *2*(2), 3–8.

Ayres, R., Ferrer, G., & Van Leynseele, T. (1997). Eco-efficiency, asset recovery and remanufacturing. *European Management Journal*, *15*(5), 557–574. doi:10.1016/S0263-2373(97)00035-2

Bag, S. (2016a). Contextual relationship among 3 Cs' and Innovative Green Procurement practices using ISM and its validation using MICMAC analysis. *International Journal of Applied Logistics*, *6*(2), 33–50. doi:10.4018/IJAL.2016070102

Bag, S. (2016b). Green Strategy, Supplier Relationship building and Supply Chain Performance: Total Interpretive Structural Modeling approach. *International Journal of Procurement Management*, *9*(4), 398–426. doi:10.1504/IJPM.2016.077702

Bag, S. (2016c). Flexible procurement systems is key to supply chain sustainability. *Journal of Transport and Supply Chain Management*, *10*(1), 1–9. doi:10.4102/jtscm.v10i1.213

Bag, S., & Anand, N. (2014a). Modeling Soft Dimensions of FMS and Their Interrelationship Using ISM and MICMAC Analysis. *Prabandhan: Indian Journal of Management*, *7*(10), 43–54. doi:10.17010/pijom/2014/v7i10/59252

Bag, S., & Anand, N. (2014b). Modeling Green Supply Chain Management framework using ISM and MICMAC analysis. *African Journal of Business Management*, *8*(22), 1053–1065.

Bag, S., & Anand, N. (2016). The importance of innovation leadership in cultivating Sustainable Supply Chain Management and enhancing Organization Performance. *International Journal of Process Management and Benchmarking*, *6*(4), 469–490. doi:10.1504/IJPMB.2016.079673

Bag, S., & Gupta, S. (2017). Antecedents of Sustainable Innovation in Supplier Networks: A South African Experience. *Global Journal of Flexible Systems Management*, *18*(3), 231–250. doi:10.100740171-017-0158-4

Bowen, F. E., Cousins, P. D., Lamming, R. C., & Farukt, A. C. (2001). The role of supply management capabilities in green supply. *Production and Operations Management*, *10*(2), 174–189. doi:10.1111/j.1937-5956.2001.tb00077.x

Buvik, A. (2001). The industrial purchasing research framework: A comparison of theoretical perspectives from micro economics, marketing and organization science. *Journal of Business and Industrial Marketing*, *16*(6), 439–450. doi:10.1108/EUM0000000006019

Calantone, R. J., Cavusgil, S. T., & Zhao, Y. (2002). Learning orientation, firm innovation capability, and firm performance. *Industrial Marketing Management*, *31*(6), 515–524. doi:10.1016/S0019-8501(01)00203-6

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Carr, A. S., Kaynak, H., & Muthusamy, S. (2008). The cross-functional coordination between operations, marketing, purchasing and engineering and the impact on performance. *International Journal of Manufacturing Technology and Management*, *13*(1), 55–77. doi:10.1504/IJMTM.2008.015973

Carter, C. R., & Carter, J. R. (1998). Interorganizational Determinants of Environmental Purchasing: Initial Evidence from the Consumer Products Industries. *Decision Sciences*, *29*(3), 659–684. doi:10.1111/j.1540-5915.1998.tb01358.x

Carter, C. R., Ellram, L. M., & Ready, K. J. (1998). Environmental purchasing: Benchmarking our German counterparts. *The Journal of Supply Chain Management*, *34*(4), 28.

Carter, C. R., & Rogers, D. S. (2008). A framework of sustainable supply chain management: Moving toward new theory. *International Journal of Physical Distribution & Logistics Management*, *38*(5), 360–387. doi:10.1108/09600030810882816

Chan, H. K., Chiou, T. Y., & Lettice, F. (2012). Research framework for analyzing the relationship between greening of suppliers and green innovation on firms' performance. *International Journal of Applied Logistics*, *3*(3), 22–36. doi:10.4018/jal.2012070103

Chan, R. Y., & Lau, L. B. (2002). Explaining green purchasing behavior: A cross-cultural study on American and Chinese consumers. *Journal of International Consumer Marketing*, *14*(2-3), 9–40. doi:10.1300/J046v14n02_02

Charter, M., & Gray, C. (2008). Remanufacturing and product design. *International Journal of Product Development*, *6*(3-4), 375–392. doi:10.1504/IJPD.2008.020406

Chen, C. C. (2005). Incorporating green purchasing into the frame of ISO 14000. *Journal of Cleaner Production*, *13*(9), 927–933. doi:10.1016/j.jclepro.2004.04.005

Chen, Y. S. (2010). The drivers of green brand equity: Green brand image, green satisfaction, and green trust. *Journal of Business Ethics*, *93*(2), 307–319. doi:10.100710551-009-0223-9

Cooper, M. C., & Ellram, L. M. (1993). Characteristics of supply chain management and the implications for purchasing and logistics strategy. *International Journal of Logistics Management*, *4*(2), 13–24. doi:10.1108/09574099310804957

Darnall, N., Jolley, G. J., & Handfield, R. (2008). Environmental management systems and green supply chain management: Complements for sustainability? *Business Strategy and the Environment*, *17*(1), 30–45. doi:10.1002/bse.557

Dubey, R., & Bag, S. (2014). Antecedents of Green Manufacturing Practices: A Journey towards Manufacturing. *Smart Manufacturing Innovation and Transformation: Interconnection and Intelligence: Interconnection and Intelligence*, 333.

Dubey, R., Bag, S., & Ali, S. S. (2014a). Green supply chain practices and its impact on organisational performance: An insight from Indian rubber industry. *International Journal of Logistics Systems and Management*, *19*(1), 20–42. doi:10.1504/IJLSM.2014.064029

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Dubey, R., Bag, S., Ali, S. S., & Venkatesh, V. G. (2013). Green purchasing is key to superior performance: An empirical study. *International Journal of Procurement Management*, *6*(2), 187–210. doi:10.1504/IJPM.2013.052469

Dubey, R., Gunasekaran, A., Singh, S., & Singh, T. (2015). Building theory of sustainable manufacturing using total interpretive structural modelling. *International Journal of Systems Science: Operations & Logistics*, *2*(4), 231–247.

Dubey, R., & Singh, T. (2015). Understanding complex relationship among JIT, lean behaviour, TQM and their antecedents using interpretive structural modelling and fuzzy MICMAC analysis. *The TQM Journal*, *27*(1), 42–62. doi:10.1108/TQM-09-2013-0108

Dubey, R., Singh, T., Ali, S. S., & Tiwari, S. (2014b). Contextual relationship among antecedents of truck freight using interpretive structural modelling and its validation using MICMAC analysis. *International Journal of Logistics Systems and Management*, *20*(1), 42–58. doi:10.1504/IJLSM.2015.065963

Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review*, *14*(4), 532–550.

Eisenhardt, K. M., & Graebner, M. E. (2007). Theory building from cases: Opportunities and challenges. *Academy of Management Journal*, *50*(1), 25–32. doi:10.5465/AMJ.2007.24160888

Eltayeb, T. K., Zailani, S., & Ramayah, T. (2011). Green supply chain initiatives among certified companies in Malaysia and environmental sustainability: Investigating the outcomes. *Resources, Conservation and Recycling*, *55*(5), 495–506. doi:10.1016/j.resconrec.2010.09.003

Foerstl, K., Hartmann, E., Wynstra, F., & Moser, R. (2013). Cross-functional integration and functional coordination in purchasing and supply management: Antecedents and effects on purchasing and firm performance. *International Journal of Operations & Production Management*, *33*(6), 689–721. doi:10.1108/IJOPM-09-2011-0349

Green, K., Morton, B., & New, S. (1996). Purchasing and environmental management: Interactions, policies and opportunities. *Business Strategy and the Environment*, *5*(3), 188–197. doi:10.1002/(SICI)1099-0836(199609)5:3<188::AID-BSE60>3.0.CO;2-P

Green, K., Morton, B., & New, S. (1998). Green purchasing and supply policies: Do they improve companies' environmental performance? *Supply Chain Management*, *3*(2), 89–95. doi:10.1108/13598549810215405

Green, K. W. Jr, Zelbst, P. J., Bhadauria, V. S., & Meacham, J. (2012). Do environmental collaboration and monitoring enhance organizational performance? *Industrial Management & Data Systems*, *112*(2), 186–205. doi:10.1108/02635571211204254

Gunasekaran, A., & Spalanzani, A. (2012). Sustainability of manufacturing and services: Investigations for research and applications. *International Journal of Production Economics*, *140*(1), 35–47. doi:10.1016/j.ijpe.2011.05.011

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Hamner, B., & del Rosario, T. (1998). Green purchasing: A channel for improving the environmental performance of SMEs. *Globalisation and the Environment Perspectives from OECD and Dynamic Non-Member Economies: Perspectives from OECD and Dynamic Non-Member Economies*, 75.

Hietajärvi, A. M., & Karvonen, I. (2016). Management of Risks in Export Networks: The Role of Collaboration. *International Journal of Applied Logistics*, *6*(1), 47–63. doi:10.4018/IJAL.2016010104

Hoegl, M., Weinkauf, K., & Gemuenden, H. G. (2004). Interteam coordination, project commitment, and teamwork in multiteam R&D projects: A longitudinal study. *Organization Science*, *15*(1), 38–55. doi:10.1287/orsc.1030.0053

Jüttner, U., Peck, H., & Christopher, M. (2003). Supply chain risk management: Outlining an agenda for future research. *International Journal of Logistics: Research and Applications*, *6*(4), 197–210. doi:10.1080/1367556031000162701 6

Kaiser, B., Eagan, P. D., & Shaner, H. (2001). Solutions to health care waste: Life-cycle thinking and" green" purchasing. *Environmental Health Perspectives*, *109*(3), 205–207. doi:10.1289/ehp.01109205

Kerzner, H. R. (2013). *Project management: A systems approach to planning, scheduling, and controlling*. John Wiley & Sons.

Kleindorfer, P. R., & Saad, G. H. (2005). Managing disruption risks in supply chains. *Production and Operations Management*, *14*(1), 53–68. doi:10.1111/j.1937-5956.2005.tb00009.x

Large, R. O., & Thomsen, C. G. (2011). Drivers of green supply management performance: Evidence from Germany. *Journal of Purchasing and Supply Management*, *17*(3), 176–184. doi:10.1016/j.pursup.2011.04.006

Lawson, B., & Samson, D. (2001). Developing innovation capability in organisations: A dynamic capabilities approach. *International Journal of Innovation Management*, *5*(03), 377–400. doi:10.1142/S1363919601000427

Leblebichi, H., Salancik, G., Copay, A., & King, T. (1991). Institutional change and the transformation of inter organizational fields: An organizational history of the U.S. radio broadcasting industry. *Administrative Science Quarterly*, *36*, 33–363.

Lee, H. L. (2002). Aligning supply chain strategies with product uncertainties. *California Management Review*, *44*(3), 105–119. doi:10.2307/41166135

Liao, S. H., Fei, W. C., & Chen, C. C. (2007). Knowledge sharing, absorptive capacity, and innovation capability: An empirical study of Taiwan's knowledge-intensive industries. *Journal of Information Science*, *33*(3), 340–359. doi:10.1177/0165551506070739

Lin, H. F. (2007). Knowledge sharing and firm innovation capability: An empirical study. *International Journal of Manpower*, *28*(3/4), 315–332. doi:10.1108/01437720710755272

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Luthra, S., Kumar, V., Kumar, S., & Haleem, A. (2011). Barriers to implement green supply chain management in automobile industry using interpretive structural modeling technique: An Indian perspective. *Journal of Industrial Engineering and Management*, *4*(2), 231–257. doi:10.3926/jiem.2011.v4n2.p231-257

Mahama, H. (2006). Management control systems, cooperation and performance in strategic supply relationships: A survey in the mines. *Management Accounting Research*, *17*(3), 315–339. doi:10.1016/j.mar.2006.03.002

Mandal, A., & Deshmukh, S. G. (1994). Vendor selection using interpretive structural modelling (ISM). *International Journal of Operations & Production Management*, *14*(6), 52–59. doi:10.1108/01443579410062086

Min, H., & Galle, W. P. (1997). Green purchasing strategies: Trends and implications. *International Journal of Purchasing and Materials Management*, *33*(2), 10–17. doi:10.1111/j.1745-493X.1997.tb00026.x

Min, H., & Galle, W. P. (2001). Green purchasing practices of US firms. *International Journal of Operations & Production Management*, *21*(9), 1222–1238. doi:10.1108/EUM0000000005923

Muduli, K., Govindan, K., Barve, A., Kannan, D., & Geng, Y. (2013). Role of behavioural factors in green supply chain management implementation in Indian mining industries. *Resources, Conservation and Recycling*, *76*, 50–60. doi:10.1016/j.resconrec.2013.03.006

NSF. (2010). Accessed from http://www.nsf.gov/statistics/seind12/c6/c6s5.htm

Pfohl, H. C., Gallus, P., & Thomas, D. (2011). Interpretive structural modeling of supply chain risks. *International Journal of Physical Distribution & Logistics Management*, *41*(9), 839–859. doi:10.1108/09600031111175816

Pinto, M. B., & Pinto, J. K. (1990). Project team communication and cross-functional cooperation in new program development. *Journal of Product Innovation Management*, *7*(3), 200–212. doi:10.1016/0737-6782(90)90004-X

Rahbar, E., & Abdul Wahid, N. (2011). Investigation of green marketing tools' effect on consumers' purchase behavior. *Business Strategy Series*, *12*(2), 73–83. doi:10.1108/17515631111114877

Rao, P., & Holt, D. (2005). Do green supply chains lead to competitiveness and economic performance? *International Journal of Operations & Production Management*, *25*(9), 898–916. doi:10.1108/01443570510613956

Roberts, S. (2003). Supply chain specific? Understanding the patchy success of ethical sourcing initiatives. *Journal of Business Ethics*, *44*(2), 159–170. doi:10.1023/A:1023395631811

Ryoo, S. Y., & Koo, C. (2013). Green practices-IS alignment and environmental performance: The mediating effects of coordination. *Information Systems Frontiers*, *15*(5), 799–814. doi:10.100710796-013-9422-0

Sarkis, J. (2012). A boundaries and flows perspective of green supply chain management. *Supply Chain Management*, *17*(2), 202–216. doi:10.1108/13598541211212924

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Sarkis, J., Zhu, Q., & Lai, K. (2011). An organizational theoretic review of green supply chain management literature'. *International Journal of Production Economics*, *130*(1), 1–15. doi:10.1016/j.ijpe.2010.11.010

Seuring, S. A. (2008). Assessing the rigor of case study research in supply chain management. *Supply Chain Management*, *13*(2), 128–137. doi:10.1108/13598540810860967

Shahabadkar, P. (2012). Deployment of Interpretive Structural Modelling Methodology in Supply Chain Management–An overview. *International Journal of Industrial Engineering & Production Research*, *23*(3), 195–205.

Simpson, D. F., & Power, D. J. (2005). Use the supply relationship to develop lean and green suppliers. *Supply Chain Management*, *10*(1), 60–68. doi:10.1108/13598540510578388

Singh, M. D., Shankar, R., Narain, R., & Agarwal, A. (2003). An interpretive structural modeling of knowledge management in engineering industries. *Journal of Advances in Management Research*, *1*(1), 28–40. doi:10.1108/97279810380000356

Srivastava, S. K. (2007). Green supply-chain management: A state-of-the-art literature review. *International Journal of Management Reviews*, *9*(1), 53–80. doi:10.1111/j.1468-2370.2007.00202.x

Stock, J. R., & Boyer, S. L. (2009). Developing a consensus definition of supply chain management: A qualitative study. *International Journal of Physical Distribution & Logistics Management*, *39*(8), 690–711. doi:10.1108/09600030910996323

Subramoniam, R., Huisingh, D., & Chinnam, R. B. (2009). Remanufacturing for the automotive aftermarket-strategic factors: Literature review and future research needs. *Journal of Cleaner Production*, *17*(13), 1163–1174. doi:10.1016/j.jclepro.2009.03.004

Sushil. (2012). Interpreting the interpretive structural model. *Global Journal of Flexible Systems Management*, *13*(2), 87–106.

Swami, S., & Shah, J. (2013). Channel coordination in green supply chain management. *The Journal of the Operational Research Society*, *64*(3), 336–351. doi:10.1057/jors.2012.44

Tjosvold, D. (1988). Cooperative and competitive interdependence collaboration between departments to serve customers. *Group & Organization Management*, *13*(3), 274–289.

Vachon, S. (2007). Green supply chain practices and the selection of environmental technologies. *International Journal of Production Research*, *45*(18-19), 4357–4379. doi:10.1080/00207540701440303

Vachon, S., & Klassen, R. D. (2006). Extending green practices across the supply chain: The impact of upstream and downstream integration. *International Journal of Operations & Production Management*, *26*(7), 795–821. doi:10.1108/01443570610672248

Varnäs, A., Balfors, B., & Faith-Ell, C. (2009). Environmental consideration in procurement of construction contracts: Current practice, problems and opportunities in green procurement in the Swedish construction industry. *Journal of Cleaner Production*, *17*(13), 1214–1222. doi:10.1016/j.jclepro.2009.04.001

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Wagner, S. M., & Bode, C. (2008). An empirical examination of supply chain performance along several dimensions of risk. *Journal of Business Logistics*, *29*(1), 307–325. doi:10.1002/j.2158-1592.2008.tb00081.x

Walker, H., Di Sisto, L., & McBain, D. (2008). Drivers and barriers to environmental supply chain management practices: Lessons from the public and private sectors. *Journal of Purchasing and Supply Management*, *14*(1), 69–85. doi:10.1016/j.pursup.2008.01.007

Walton, S. V., Handfield, R. B., & Melnyk, S. A. (1998). The green supply chain: Integrating suppliers into environmental management processes. *The Journal of Supply Chain Management*, *34*(1), 2–11.

Yang, W., & Zhang, Y. (2012). Research on factors of green purchasing practices of Chinese. *Journal of Business Management and Economics*, *3*(5), 222–231.

Yen, Y. X., & Yen, S. Y. (2012). Top-management's role in adopting green purchasing standards in high-tech industrial firms. *Journal of Business Research*, *65*(7), 951–959. doi:10.1016/j.jbusres.2011.05.002

Young, W., Hwang, K., McDonald, S., & Oates, C. J. (2010). Sustainable consumption: Green consumer behaviour when purchasing products. *Sustainable Development*, *18*(1), 20–31.

Zhu, Q., & Geng, Y. (2006). Green purchasing in Chinese large and medium-sized state-owned enterprises. *Greening the Supply Chain*, 173-187.

Zhu, Q., & Sarkis, J. (2006). An inter-sectoral comparison of green supply chain management in China: Drivers and practices. *Journal of Cleaner Production*, *14*(5), 472–486. doi:10.1016/j.jclepro.2005.01.003

Zhu, Q., & Sarkis, J. (2007). The moderating effects of institutional pressures on emergent green supply chain practices and performance. *International Journal of Production Research*, *45*(18-19), 4333–4355. doi:10.1080/00207540701440345

Zhu, Q., Sarkis, J., & Geng, Y. (2005). Green supply chain management in China: Pressures, practices and performance. *International Journal of Operations & Production Management*, *25*(5), 449–468. doi:10.1108/01443570510593148

Zhu, Q., Sarkis, J., & Lai, K. H. (2008). Green supply chain management implications for "closing the loop". *Transportation Research Part E, Logistics and Transportation Review*, *44*(1), 1–18. doi:10.1016/j.tre.2006.06.003

Zhu, Q., Sarkis, J., & Lai, K. H. (2012). Examining the effects of green supply chain management practices and their mediations on performance improvements. *International Journal of Production Research*, *50*(5), 1377–1394. doi:10.1080/00207543.2011.571937

Zhu, Q., Sarkis, J., Lai, K. H., & Geng, Y. (2008). The role of organizational size in the adoption of green supply chain management practices in China. *Corporate Social Responsibility and Environmental Management*, *15*(6), 322–337. doi:10.1002/csr.173

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

ADDITIONAL READING

Crespin-Mazet, F., & Dontenwill, E. (2012). Sustainable procurement: Building legitimacy in the supply network. *Journal of Purchasing and Supply Management*, *18*(4), 207–217. doi:10.1016/j.pursup.2012.01.002

Dubey, R., & Gunasekaran, A., Sushil, & Singh, T. (2015). Building theory of sustainable manufacturing using total interpretive structural modelling. *International Journal of Systems Science: Operations & Logistics*, *2*(4), 231–247.

Dubey, R., Gunasekaran, A., Papadopoulos, T., Childe, S. J., Shibin, K. T., & Wamba, S. F. (2017). Sustainable supply chain management: Framework and further research directions. *Journal of Cleaner Production*, *142*, 1119–1130. doi:10.1016/j.jclepro.2016.03.117

Kane, G. (2013). *Building a Sustainable Supply Chain*. ASIN: B01K932O0Q. Greenleaf Publishing

Mansi, M., & Pandey, R. (2016). Impact of demographic characteristics of procurement professionals on sustainable procurement practices: Evidence from Australia. *Journal of Purchasing and Supply Management*, *22*(1), 31–40. doi:10.1016/j.pursup.2015.06.001

Meehan, J., & Bryde, D. (2011). Sustainable procurement practice. *Business Strategy and the Environment*, *20*(2), 94–106. doi:10.1002/bse.678

Schneider, L., & Wallenburg, C. M. (2012). Implementing sustainable sourcing—Does purchasing need to change? *Journal of Purchasing and Supply Management*, *18*(4), 243–257. doi:10.1016/j.pursup.2012.03.002

Sushil. (2005). Interpretive matrix: a tool to aid interpretation of management and social research. *Global Journal of Flexible Systems Management, 6*(2), 27-30.

KEY TERMS AND DEFINITIONS

Green Supply Chain Risk Management: Companies adopting green supply chain programs face multiple challenges because of the dynamic nature of business environment, which exposes them to a series of risks and threats. The problems are aggravated by changes in customer demand patterns, supply crisis for environmentally friendly material, and competitor activities. Therefore, companies must develop appropriate strategies to reduce such uncertainties and mitigate risks. Companies focusing on good internal coordination, external coordination, and collaboration relationships may better manage the supply risks.

Innovative Green Procurement (IGP): IGP involves integrating the social, environmental, and economic perspectives in the supply network. IGP includes both the hard dimensions and soft dimensions. However, existing literature shows that less focus has been given to studying the unique IGP soft dimensions such as collaboration, cooperation, and coordination. These soft dimensions significantly influence the success of IGP and therefore must be considered while making any green procurement programs. IGP leads to development of innovative capability within the supply network and reduces supply chain risks.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Interpretive Structural Modelling (ISM): Interpretive structural modeling (ISM) is a method that transforms indistinct and inadequately articulated mental models of systems into visible, well-defined models helpful for many fields of research. The method is based on group or individual decision making and decides whether and how elements are related in the system. Interpretive structural modeling interprets the links in terms of the contextual relationship and the direction of the relationship for each pair of elements. This becomes the starting point of articulating the structure of any ill-defined system. At the final stage, it interprets the nodes of the diagraph in terms of the definition of respective elements so that a clear picture can be portrayed in terms of the relationships among the elements.

This research was previously published in Contemporary Approaches and Strategies for Applied Logistics edited by Lincoln C. Wood, pages 201-230, copyright year 2018 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 72
Green Retailing: A New Paradigm in Supply Chain Management

Arnab Adhikari
Indian Institute of Management Calcutta, India

Indranil Biswas
Indian Institute of Management Lucknow, India

Balram Avittathur
Indian Institute of Management Calcutta, India

ABSTRACT

Sustainable development with ecological protection has gained global significance across society because of continuing environmental degradation. It causes green supply-chain management to be an area of interest among researchers and practitioners. Existing literature related to green supply chain indicates that most of the scholarly works have been limited to the manufacturing context and retailing has not been paid enough attention. It signifies that integrating green policies into retail sector is a new potential area of research from academicians' and practitioners' point of view. This chapter discusses about the drivers, barriers, different dimensions, issues, existing environmental practices and policies adopted by leading retailers, future research avenues, different green polices adopted by various organizations and government bodies in the area of retailing. Thus it facilitates researchers, industry practitioners, policy makers to find the existing works, new research opportunities as well as to improve practices and policies.

INTRODUCTION

Over the last three decades, sustainable development with ecological protection has gained the global significance due to a number of factors like global warming, resource depletion, water pollution, carbon emission, soil erosion and so on. Previously, the environment has been highly affected by the firms' profit maximization objective without considering the environmental concerns and government's negligence about environmental policy. The world has experienced dire consequences of these myopic measures

DOI: 10.4018/978-1-5225-7915-1.ch072

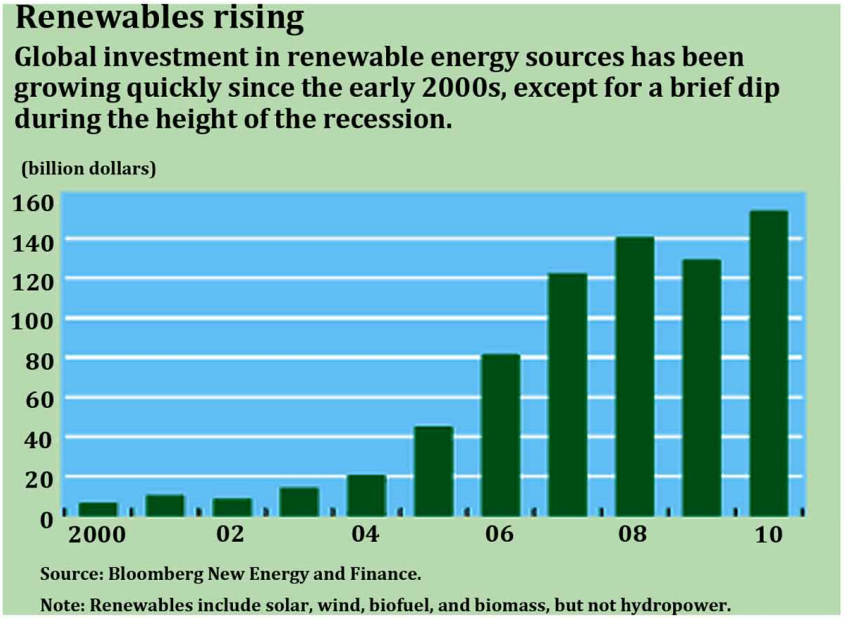
Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

several times. 'Bhopal disaster,' one of world's largest chemical industrial accidents in 1984, took around 5200 lives (Bhopal Gas Tragedy Information report). This tragic incident occurred due to the chemical gas leak from a pesticide plant in Bhopal managed by Union Carbide India Limited. The explosion at the Chernobyl nuclear power plant of former USSR in 1986 brought life threatening challenges to the civilization (IAEA report, 2006). The release of radioactive material from a nuclear reactor jeopardized the livelihood. In 2010, Oil spill in the Gulf of Mexico caused extensive damage to wildlife habitats (Gulf Oil Spill report). These catastrophes impel governments, organizations, different official bodies to pay attention in designing a suitable policy taking both economic development and environmental sustainability into account. An example of increasing level of green activities is presented in Figure 1 which depicts the growth of the global investment in renewable energy sources over the years (Eyraud & Clements, 2012).

Different nations and organizations have employed various policy measures to combat with environmental challenges. Several countries have adopted 'carbon trading' scheme to reduce emission. i.e. A regulatory mechanism where firms or countries buy and sell carbon permits (Lazarowicz, 2009). The programmes like "Pollution Prevention Pays" (3P) 3M and "Waste Reduction Always Pays" (WRAP) initiated by 3M and DOW, respectively indicate that the firms have recognized the importance of environmental friendly practices (Segerson and Miceli, 1998). Problems like resource marginalization, toxic waste overflow, increasing pollution level have become matters of concern for all the players within and outside the boundary of the supply chain. These circumstances inevitably give rise to the idea of green supply chain management. It emerges from environmental science and supply chain management. Srivastava (2007) defines green supply chain management as 'integrating environmental thinking into supply-chain management, including product design, material sourcing and selection, manufacturing processes, delivery of the final product to the consumers as well as end-of-life management of the product

Figure 1. Growth of global investment in renewable energy sources



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

after its useful life.' The scope of green supply chain management ranges from green purchasing of raw material to the design and the sale of green final product. The design of a green supply chain management encompasses the product design incorporating the environmental issues related to the product safety, pollution prevention, minimization of resource depletion, and waste management. Green procurement demonstrates the importance of raw material suppliers' adherence to the sustainable policies. These policies can be voluntary or imposed by the regulatory measures. Green manufacturing relates to the usage of the pollution free proper resource which will cause a minimum level of pollution and thus producing the environment friendly products.

Existing literature related to green supply chain indicates that most of the scholarly works have been limited to the manufacturing context whereas retailing has not been paid enough attention (Lai et al., 2010). Jones et al. (2008) opine that large retailers can play an instrumental role in environmental development in a supply chain. Adoption of greening policies helps a retailer to attract more environment-conscious end customers. Green retailing can be defined as an approach toward managing any retail business by incorporating sustainability focused practices and environmentally friendly processes. According to Juliet Norton (2010), green practices facilitates retailers to attract more customers as well as exploring new markets. Wiese et al. (2012) Support Juliet Norton's claim and state that green retailing can be an important building block of the marketing programme to portray a better image in customer's perception. It signifies that integrating green policies into the retail sector is going to be a potential area of research from academicians' and practitioners' point of view.

From the 1990s, many researchers came with different concepts, constructs, and solution approaches to deal with these problems. The companies have started to show their interest to maintain ecological balance by taking the initiatives like green purchasing, ISO implementation, eco-friendly production etc. Cairncross (1993) have brought about the idea of co-existence of industrial development and environmental security. Owen (1993) and Gupta (1995) advocate the value of integrating the environmental concerns in the business strategy by reasoning about the resource saving, waste elimination, productivity improvement.

The ideas behind reverse logistics and related market uncertainty, product speculation, return deposition are developed by Jahre (1995), Fleischmann et al. (1997) and many others. Fleischmann et al. (1997) describe the re-usage of the products from operations research perspective. Waste management, disposal option, proper disposal location selection is another area where many authors have come with different modeling solutions. Authors like Haastrup et al. (1998), Richter and Weber (2001), and Bloemhof-Ruwaard et al. (1995) use analytical techniques to minimize the waste; Dunn and El-Halwagi (1993) propose a methodology of the optimal design for the reused product. Teunter and Vlachos (2002) worked in the area of disposal option for the remanufacturable items. Walton et al. (1998) have shown the integration of suppliers in the construction of the green supply chain management.

This chapter describes the drivers, barriers, different dimensions, issues, methodologies used by scholars, future research avenues in the area of green retailing. Also, it presents existing environmental practices and policies adopted by leading retailers across the world. Besides, it demonstrates the different policies adopted by various organizations and government bodies. It also discusses the challenges related to the incorporation of the environmental friendly policies in the retailing. In addition, it highlights the opportunities associated with the green policies and justifies it with the existing industry practices. Thus it facilitates researchers, industry practitioners, and decision makers to find the existing works and new research opportunities, as well as to improve appropriate green practices and policies.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The organization of this chapter is as follows: in Section 2, different aspects like drivers and functional aspects of green retailing are described. Section 3 discusses the prevalent industry practices in the context of green retailing. Section 4 deals with the greening policies adopted by large retailers. In section 5, the barriers that hinder the successful implementation of green policies along with associated opportunities are presented. The chapter concludes with discussing contributions and future research avenues.

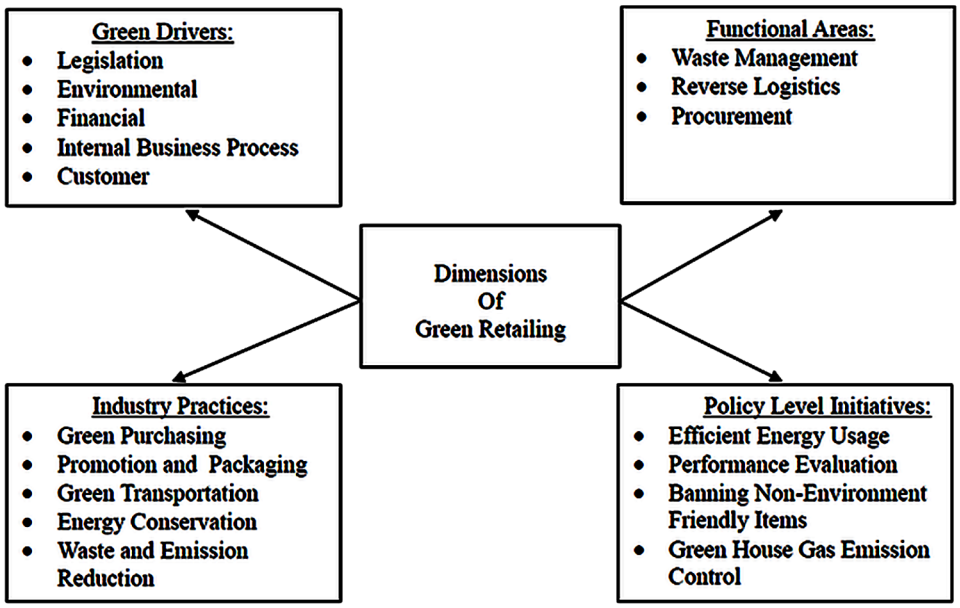
METHODOLOGY

The extant literature on green retailing can be broadly classified into four broad areas. The first set of articles concentrates on different drivers for adopting greening policies by various firms. Following the approach of Mann et al. (2010), the drivers of green retailing can be categorized into five classes related to legislation, environmental, financial, internal business process, and customer. The second area focuses on the functionality or operational sides of green measures like waste management, green procurement, and reverse logistics. The third strand of literature looks into the prevalent industry practices and internal firm-level policies for greening. The fourth set of literature investigates the impact of governmental (federal or local) policies and statutory body decisions on sustainability measures adopted by various firms. Based on this classification, here, we propose a conceptual framework to facilitate the scholars and industry practitioners' understanding about the green retailing, given below (also see Figure 2).

Green Retailing Drivers

The green retailing drivers describe the stimuli behind the firms' adoption of greening policies in their retail domain. These drivers pave the way of integrating green retailing through either voluntary approach

Figure 2. Conceptual framework of green retailing



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

or contractual agreement. In a similar fashion with Mann et al. (2010), the drivers of green retailing can be categorized into following ways, as presented in Table 1.

Legislation Driver

The legislation is one of the primary drivers of green policy adopted by different firms. It compels the firms to integrate the environmental policies into their business strategy and operations. Diverse factors like public opinion, government intervention, lobbying by interest groups are mostly responsible for the introduction of various green related legislations. They can be in the form of government laws (Fleischmann et al., 1997) or imposition of environment standards for production processes like carbon emission. European Union (EU) has already employed an emissions trading system to bring down the emission level (Lazarowicz, 2009). According to Georgiadis and Vlachos (2004), suitable environmental policies like usage of recycled products give firms the monetary incentive and thus an impetus to incorporate the green business strategy.

Environmental Driver

Reduction of non-renewable processes (Chan, 2007), control in the usage of toxic materials, goal to bring down the pollutants in emission are the most common environmental concerns those have led to environment related green drives. Also, associating with a partner who employs green practice helps a firm to improve its eco-friendly public image (Grant, 2007). Apart from these, opportunity to capture the new market plays a crucial role in adopting environment drives of green policies by a firm. For an example, Seventh Generation, a cleaning product provider has gained competitive advantage through their eco-friendly product design (Klonsky, 2010).

Financial Driver

Adoption of sustainable measures helps a firm to reduce cost, improve performance efficiency, and exercise better control over her process related activities. Several scholars like Hicks et al. (2004), Krikke et al. (1998), Ketzenberg et al. (2006), Goldsby and Closs (2000) demonstrate that reduction of energy cost, waste, holding cost, shortage cost, and penalty cost is possible by incorporating the green

Table 1. Classification of green retailing drivers

Drivers	Internal	Legislation	Fleischmann et al. (1997) Georgiadis and Vlachos (2004)
		Environmental	Chan (2007)
	External	Financial	Hicks et al. (2004), Krikke et al.(1998) Ketzenberg et al. (2006) Goldsby and Closs (2000)
		Internal Business Process	Mann et al. (2010) Hervani et al. (2005)
		Customer	Vermeulen and Ras (2006)

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

practice. Thus improved financial performance is one of the main drivers for adopting green practices. According to a survey conducted by Boston Consulting group in 2013, 37% of the executives inform that their respective companies have become profitable due to the value addition caused by integrating green policies in the respective practices (Vanderbilt report, 2013).

Internal Business Process Driver

It is very critical for any firm to consider the internal business process drivers or operational activities while adopting green practices. Quality, system responsiveness, production, and product recovery rate can be improved through green practices. Adoption of internal control mechanisms for green measures is mostly cost and profit driven (Hervani et al., 2005). In the context of the cost reduction through green policies, Matt Kistler, the senior vice president of at Wal-Mart, commented that "*If this was not financially viable, a company such as ours would not be doing it*" (Bhanoo, 2010). Also, incorporating green policies into the existing practices brings more operational efficiency. Canon has shown the improvement of its process efficiency through successful implementation of green practices (Canon report).

Customer Driver

Because of increasing social awareness, social media influence, increasing education rate, customers are these days well informed about the importance of environment friendliness. Their attitude towards the ecological protection has created a significant impact on the supply chain. In case of customer driver, several aspects such as product quality, delivery reliability, and economic benefits from the reusable product play very significant role in the design of the green supply chain. Vermeulen and Ras (2006) point out that marketing communication play a crucial role for the firm to create an environmental concern image in the eyes of a customer. The eco initiatives adopted by the organizations like eBay, Starbucks, Google are well accepted by the consumers (usanfranonlinen report).

Waste Management

The presence of hazardous waste brings down the quality of life and causes significant environmental degradation (Beamon, 1999). Minimizing any form of waste at each level of the supply chain i.e. from manufacturing to retailing is a prerequisite for designing a sustainable, environmental friendly supply chain. The issues related to waste management (Giannikos, 1998) can be categorized into two classes: (a) pollution prevention and (b) disposal management. Existing literature indicates that pollution prevention focuses on devising the strategy to restrict the pollution at the source at every stage of supply chain (Newman & Newman, 1995); disposal management deals with minimizing the cost related to waste (Richter & Dobos, 1999).

Pollution Prevention

Pollution prevention (P2) is a strategy to prevent the creation of waste rather than managing it after generation (Gupta, 1995). The term 'pollution prevention' is introduced by 3M Company in 1976 and often it is known as 'Source Reduction' (SR) strategy (Srivastava, 2007). As per Hart (1995), a green

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

product strategy is 'path dependent' on pollution prevention and emission reduction. It is evident that Reduction of emission increases the performance efficiency of firms and provides them with a cost advantage. In the context of manufacturing industry, Hanna and Rocky Newman (1995) show the integration of pollution prevention focus in product design. Hart and Ahuja (1996) empirically demonstrate that preventive measures to reduce pollution help firms to increase their profit level and significant gain is earned by the firms with the highest emission levels. They show that there exists a lagged relationship between preventive measures (emissions reduction) and financial performance (return-on-equity). The environmental profile of a company influences her reputation as well as market value (Barth & McNichols, 1994; White, 1995).

Disposal Management

In the context of an urban waste management system, Haastrup et al. (1998) design a decision support system, to identify the appropriate disposal locations. Giannakos (1998) develops a multi-objective model to determine the transportation network and the disposal locations. In the context of the reverse logistics supply chain, Teunter and Vlachos (2002) analyze the importance of a disposal option for remanufacturable items. Often, legal regulations force firms to set up facilities for collecting hazardous waste, and thus force companies to act green (Kotzab et al., 2011). These services, a part of disposal management, create immediate additional costs to the firms though in the long run has positive it has positive effects on the economic and ecological bottom line. However, this positive correlation is contested among the scholars. Nakao et al. (2007) argue that there exists a positive relation between the financial and ecological sustainability. Clemens and Papadakis (2008) doubt such relation and Williander (2007) argue that this relationship cannot be established.

Green Reverse Logistics

According to Dowlatshahi (2000), reverse logistics is highly influenced by the environmental concerns, whether be it packaging regulation or consumer choice, Exploration of related literature reveals that there are a significant number of works focusing on assessment of existing environment friendly practices (Lenox et al., 2000; Scherpereel et al., 2001). In the context of reverse logistics and related network design, scholarly works demonstrate the design of network that will comprise the facility locations for product recovery, reuse, and recycle and identification of the appropriate transportation links to minimize the incurred cost (Fleischmann et al., 1997; Krikke et al., 1998). Flapper et al. (2005) conduct an extensive study on reverse logistics network of different industries comprising pharmaceuticals, electronics, breweries, photocopiers, automobiles, and so on.

As per Tibben-Lembke (2002), remanufacturing, reuse, suitable logistics network design can bring higher profitability to the firms. Hvozda (2015) comments that small businesses need to partner among its industry so that they can develop a global system of recovery; partnership brings more efficiency to the entire closed loop supply chain. Rechargeable Battery Recycling Corporation (RBRC) is one such an industry-funded recycling system; the company has collected more than 100 million pounds of batteries over its two decade long existence (Hvozda, 2015). The business of refurbished products is predicted to grow in the coming days (Hagerty and Glader, 2011). A recent survey suggests that the market for refurbished electronic items is expected to double in only a few years' time (Cummings, 2015). Online

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

retailers like Amazon, eBay, and Overstock have dedicated web-sections for selling refurbished devices. National retailers like Best Buy and GameStop are following the same trend. Hazen et al. (2011) use 'diffusion of innovation' and 'resource-advantage' theories to analyze consumer reactions to firms that implement green reverse logistics practices. Their empirical research shows that an adoption of such policies leads to increased customer loyalty toward the organization and it, in turn, leads to higher willingness to pay more for such firm's products. Next subsection describes the topics on green procurement in the context of the retail industry.

Green Procurement

Green procurement encompasses the topic of how a retailer can build a cooperative strategy with a supplier to integrate the greening policy in the upstream activities. It can be either voluntary or regulatory compliance. Johnson (1998) discusses the ecofriendly procurement strategies in case of reverse logistics value management. With the help of empirical study, Min and Galle (2001) investigates the environmental friendly purchasing strategies of US firms. A significant number of scholarly works describe how a retailer should employ the appropriate supplier evaluation criteria like ISO 14000, EFP evolution and many others for procurement to check whether the vendor is maintaining the environmental friendly practice in his production process (Walton et al., 1998; Kumar et al., 2012). All these studies suggest that it is desirable to encourage the suppliers for being environmentally responsible. Christiansen et al. (2003) present a six step green sourcing model where the authors have given stress on building an environmental conscious supplier base and appropriate green sourcing strategy. Kumar et al. (2012) show that the example of green sourcing strategy of Coca Cola and Apple. Apple made an agreement to those suppliers who are in compliance with the company's environmental policy and standard. Coca Cola has improved in the reduction of wastage of their inputs like water and energy. Walton et al. (1998) provide a summarized version of the supplier evaluation criteria as presented in Table 2.

INDUSTRY PRACTICES

This section represents the existing environmental friendly practices adopted by retailers. The investigation into the current practices of the retail industry indicates that leading retailers focus on mainly six issues for greening (Evans and Denney, 2009). They are presented in Table 3. These six aspects are discussed below in detail.

Table 2. Supplier evaluation criteria

Top Ten Environmental Supplier Evaluation Criteria			
1	Public disclosure of environmental record	6	ISO 14000 certification
2	Second-tier supplier EFP evaluation	7	Reverse logistics program
3	Hazardous waste management	8	EFP in product packaging
4	Toxic waste pollution management	9	ODS management
5	On EPA 17 hazardous material list for product labeling	10	Hazardous air emission management

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 3. Prevalent industry practices

Industry Practice	Policy Adopting Firm (Indicative List)	Scholarly Article
Green purchasing	Aeon, Carrefour	Duff (2007)
Promotion of green products and green packaging	Wal-Mart	Wilson (2008)
Green facility location design	IKEA	Field (2008)
Green Transportation	Tesco	Thompson (2007)
Energy conservation	Sears Holding Corporation Mark & Spencer	Piel (2009)
Waste and emission reduction	Coca Cola	Stribling (2007)

Green Purchasing

In the context of green purchasing, it is observed that firms like Aeon and Carrefour have designed assessment criteria to develop environmentally responsible supplier base. Home Depot Canada gives stress on promoting the eco-friendly product to the consumers by launching exchange programme. Wal-Mart has established a partnership with manufacturers like GE, Royal Philips, and Osram Sylvania as well as suppliers to tackle the environmental issues. For selecting the supplier, Fujitsu Japan considers the environmental friendliness of the raw material suppliers' process. In a similar fashion, According to the 'green plan' announced by Panasonic in 2010, there is an emphasis on selecting the partners who involve in the reduction of the environmental impacts (Panasonic report). Early adoption of green products like organic foods is attributed to the 'universalism values' of the consumers (Schwartz, 1992). In a mall-intercept based study, Thøgersen and Zhou (2012) investigate the motivating factors for early adoption of organic food in China. They find that the influence of social norms in the context of adopting green products is less. Consumers' purchasing pattern is strongly linked to the customers' beliefs about product's healthiness, taste, and environmental friendliness.

Green Product and Packaging

Mark and Spencer has become the first retailer of United Kingdom to become 'carbon neutral'; the retailer has aimed to increase its sales of organic food and drink by 2012 (Smithers, 2012). On the basis of strategic capabilities like pollution prevention, product stewardship, and sustainable development of a retailing firm, Lai et al. (2010) present three dimensions of green retailing:

1. Internal improvement based green retailing,
2. External coordination based green retailing, and
3. Supportive development based green retailing.

Focused promotional strategy for green products also results in better awareness among the end customers. Phau and Ong (2007) show that consumers respond positively to product-related promotions compared to cause-related promotions. Consumers also perceive any environmental claims to be credible if the same is attributed to the green brands than to the neutral brand. They adopt a survey based

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

mechanism to investigate consumers' response toward different environmental claims embedded in promotional messages. As per a consumer survey conducted in 2012, Procter and Gamble is the leading brand in green packaging (begreenpackaging report). The use of plant fiber trays in their operation is widely accepted. Tesco has shown a phenomenal performance in the reduction of carbon emission and in the removal of plastic packaging (Lai et al., 2010).

Green Facility Location

Organizations like IKEA have deviated from the standardized model for setting up the facility location and have taken the local environmental concerns into account for store design. By applying an evolutionary multi-objective algorithm, Harris et al. (2009) show that trade-off between environmental impact and cost impact of opening new stores/ depots would help human decision makers to choose facility location. In the context of carpet reuse, Louwers et al. (1999) suggest that it is possible to have economically viable logistics networks with due consideration for environmental factors; their model differs from conventional facility location allocation models on two accounts:

1. The design of reuse systems is a free choice of the locations of the preprocessing centers, and
2. Inclusion of depreciation costs.

The world's largest office products company Staples along with the City of Miami and MK Real Estate Group has designed Miami's first Leadership in Energy and Environmental Design (LEED) registered green retail building to achieve a sustainable living standard (Staples annual report). As per the report released by McGraw Hill Corporation in 2013, 65% of the retail owners have adopted extensive green approaches in their daily operational and maintenance activities (cdrecycler report).

Green Transportation

From the green transportation perspective, Tesco is giving more stress on shifting from railways and road transport to the water shipment. Edwards et al. (2009) compare the carbon footprints of conventional and online retailing of non-food items from a "last mile" perspective. Neither home delivery nor regular shopping habit has an absolute carbon footprint advantage. Through the analysis of various "last mile" scenarios, they show that the home delivery operation is likely to generate less carbon-di-oxide (CO_2) than the conventional shopping trip to brick and mortar store. A123 systems, Tesla Motors, Venture Vehicles are the leading transport companies who employ green technology in the respective transport design (Kanellos, 2008). Dell has shown the selection of proper transportation mode for the product delivery which can vary from "truck to rail, air to sea" (Dell report).

Energy Conservation

Sears Holding Corporation has designed the energy efficient rooftop units to conserve the energy. Large retailers are adopting measures for energy conservation. Marks & Spencer aims to make their UK operations carbon neutral by employing diverse strategies, such as a commitment to reduce energy use and to use green energy (Smithers, 2012). Since 2003, the firm has reduced carbon emissions by 30% per square foot in their UK stores and plans to reduce it by a further 25% (Thompson, 2007). The firm has

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

also opened 'eco stores'. Target's store and Fontana store use solar panels and skylights, respectively to reduce the use of electricity (Lai et al., 2010). In 2010, Walmart has put emphasis on energy efficiency based supplier selection and has successfully reduced 17.4 metric ton greenhouse gas emission by the end of 2014 (Walmart report, 2015).

Waste and Emission Reduction

As per the existing scholarly works, several factors like legal regulations, community group pressure, external stakeholders' influence, competitive advantage (Lai et al., 2010; Kotzab et al., 2011) propel the environmental concerns in the domain of retailing. On the other hand, high cost of disposal of hazardous materials, environmentally friendly materials and packaging, and fulfilling the requirements of customer organizations for environmentally friendly operations and processes, insufficient awareness of the importance of environmental protection among the consumers can be obstacle the way of implementation of greening policy (Wang et al., 2013). In order to successfully integrate the environmental friendly concerns in the supply chain practice, several recommendations like identification of waste reduction opportunities, government financial support for green initiatives, awareness of the importance of green operations and willingness to lead green initiatives in suppliers and retailers, awareness of consumers have been suggested in the existing scholarly works (Lai et al., 2010; Kotzab et al., 2011; Wang et al., 2013). To reduce the carbon emission along with waste, Timberland has introduced a special programme named 'Climate Strategy' in 2009 (Timberland report, 2009). Here Timberland has developed a cooperative plan with its partners to reduce climate impact due to the carbon emission in its footwear value chain.

POLICY LEVEL DECISIONS

In this section, we describe the different government level initiatives adopted to incorporate environment friendly regulatory measures into the existing retail practices. In United Kingdom, a Waste and Resources Action Programme with a budget of 8 million euro have been launched to facilitate the retailers reducing their production, storage and transportation costs and companies like Argos, Asda, Tesco, Co-op group, and Marks & Spencer have applied for it (Centre for Retail Research, 2007). In 2004 Tesco, as a part of greening policy adoption measure, re-launched its "Healthy Living Club" program; the program makes the customers aware of general health, weight loss and green and other organic products (Jones et al., 2005). European Union has implemented a set of regulations using EU packaging directive to minimize the waste material using '2007 regulations' and to promote energy conservation and reusability of packaging with the help of legislation 'essential requirements'. EU has also introduced Renewable Energy Directive (RED) programme in 2009 to enhance the usage of nonrenewable electricity sources (Moïsé and Steenblik, 2011). Recycling activities are encouraged among retailers with the help of WEEE directive and regulations. Tesco establishes an objective to reduce its carbon footprint (Lai et al., 2010). Metro Group has been organizing 'energy savings week' for motivating employees to lessen energy savings (Tang, 2012). In France, a general framework law named 'Grenelle 1' has been implemented to establish the government's environmental policies. Retailers' responsibility to inform the consumers about their ecofriendly policies is specified in 'Grenelle 2', the extension of the 'Grenelle 1' (Moïsé & Steenblik, 2011). To promote green procurement, Swiss Federal Procurement Commission (BKB) has devised a supplier selection policy where they include assessment of suppliers' environment friendly approach as

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

a criterion (BBL report). In Australia, South Australian government has introduced a scheme called The Retailer Energy Efficiency Scheme (REES) to engage energy retail giants for helping households and small business houses for the efficient usage of energy as well as reduction of the Greenhouse Gas emission. In New Zeland, programs like Envirostep and Carbonzero are launched to evaluate the environmental performance and greenhouse gas emission, respectively (Sustainability report, 2015). Canadian government have taken many initiatives like establishing multi-stakeholder National Packaging Task Force to devise appropriate policy measures for bringing down the environmental impact related to packaging, banning single-use plastic shopping bags, replacing plastic bags with biodegradable ones, launching a reusable bag pilot project in Ontario and so on(Green scape report, 2012). In the USA, environmental protection agency (EPA) has introduced Greenscapes programme to designed cost-efficient and environmentally friendly solutions for the preservation of natural resources, waste prevention, and pollution reduction(Green scape report, 2012). EPA has launched Renewable Transport Fuel Obligation Programme (RTFO) and National Renewable Fuel Standard Program (RFS programme) and transportation sector to increase the use of different bio fuels namely renewable biofuel, advanced biofuel, cellulosic biofuel, and biomass based biofuel instead of fossil fuels (Moïsé & Steenblik, 2011). Indian government's action plan related to the devising the appropriate regulatory measures help to increase the concern about green policies among retailers. They are also envisioning it as a tool of competitive advantage. For example, Re-feel a cartridge manufacturer has shown the way to enhance the customer base in both economic and environmental friendly way (Datar & Laghate, 2011).

BARRIERS AND BENEFITS

There are several factors that can hinder the successful implementation of greening strategies in the retail sector. According to Hazen et al. (2012), consumers attitude towards the products manufactured in green reverse logistics production process does not bring the optimistic picture to the retailers. Often, customers perceive these products to be inferior in terms of quality. Often stakeholders of the organizations show disinterest in incorporating the greening policies in the existing practices to get rid of the extra cost. It leaves a negative impact on all supply chain agents including retailers. Many a firms maintains a susceptible stance to the success and the long run effect of greening policies. In 2009, large Oil companies have opposed the US government's renewable 'green oil' initiative. In this context, Rex W. Tillerson, the chief executive of Exxon Mobil, said that "We don't oppose alternative energy sources and the development of those. But to hang the future of the country's energy on those alternatives alone belies reality of their size and scale" (Mouawad, 2009). From small retailers' perspective, lack of detailed information about the green practices adopted by the retail giants and absence of benchmark policy act as impediments for integrating ecofriendly approaches in their existing practices. Proper Implementation of environmental regulatory measures is another critical issue regarding this matter. Often, it is observed that strict legal action is not taken against the firms causing environmental pollutions.

The adoption of green policies in the retail sector has brought success to many organizations. The inclusion of environmental management system leads to improvement of financial performance, energy efficiency, waste reduction in case of many companies like Sainsbury, Calgary, Target, Walmart, Staples and many others (Greening retail report, 2006).1 In case of Sainsbury, electric usage is reduced by 12% that leads to the savings of $17000 per store. In a similar line, Calgary group has experienced savings of $57000 per year through reducing the electricity consumption and improving the energy efficiency.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Target has brought down its water usage by 7%. Walmart's fuel efficiency has increased from 6.5 gallons to 13 gallons per gallon. Staples achieves a saving of $4.5 million through the trashless packaging. Many other organizations like Kesko, Wholesale club emphasize on educating employees about the ecofriendly policies and reduction of natural resource usage through special programmes.

CONCLUSION

In this book chapter, at first we have demonstrated the background of green retailing along with its importance. Then we have presented a conceptual framework depicting the drivers, dimensions, industry practices, and government policy level initiatives. Next we have described each of the things mentioned above in detail. For drivers, we have identified that legislation, financial, environmental, internal, and customer driver act as most important stimuli for the green retailing domain. Then, we have described how green measures influence waste management, procurement, and reverse logistics. Next, we have provided a detailed representation of green practices adopted by several industrial organizations in different areas like procurement, packaging, designing the facility location, transportation, energy conservation, and waste reduction. Further, we delve into the government policies that facilitate the integration of environment friendly measures into the practices through regulations, initiatives, and new ventures. Next we demonstrate the challenges and opportunities associated with the green retailing with the help of real life examples. From future research avenue perspective, analytical modeling techniques employed to solve the problems in the domains like reverse logistics, transportation, waste minimization and facility location design can be an area of interest for both scholars and practitioners point of view. Country or organization specific empirical studies on the disposal management, supplier evaluation, and waste reduction can be useful for both academia and industry practices. Approaches regarding modification and proper implementation of the existing environmental friendly policy measures can be other opportunities for government officials.

The nature earth has been highly affected by many a myopic measures of human civilization. If these activities cannot be curbed down, extinction of flora and fauna will be endangered in near future. It may happen that the integration of the greening activities in existing practices will not be successful for some retailers. But we can hope that this green movement in retail industry will bring desirable sustainability of the system and a safe future to the human civilization.

REFERENCES

Barth, M. E., & McNichols, M. F. (1994). Estimation and market valuation of environmental liabilities relating to superfund sites. *Journal of Accounting Research*, 177-209. Retrieved from http:// www.bbl.admin.ch/bkb

Beamon, B. M. (1999). Designing the green supply chain. *Logistics information management, 12*(4), 332-342.

Bhanoo, S. N. (2010, June 11) Products that are Earth-and-Profit Friendly. *New York Times.* Retrieved from http://www.nytimes.com

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Bhopal Gas Tragedy Information. (n. d.). *Bhopal.* Retrieved from http://www.bhopal.com/

Bloemhof-Ruwaard, J. M., Van Beek, P., Hordijk, L., & Van Wassenhove, L. N. (1995). Interactions between operational research and environmental management. *European Journal of Operational Research*, *85*(2), 229–243. doi:10.1016/0377-2217(94)00294-M

Cairncross, F. (1993). *Costing the earth: the challenge for governments, the opportunities for business.* Harvard Business School Press.

Centre for Retail Research. (2007). Retail Ethics and Green Retailing 2007: More Than Plastic Bags? Nottingham: United Kingdom.

Chan, H. K. (2007). A pro-active and collaborative approach to reverse logistics—a case study. *Production Planning and Control*, *18*(4), 350–360. doi:10.1080/09537280701318736

Christiansen, T., Berry, W. L., Bruun, P., & Ward, P. (2003). A mapping of competitive priorities, manufacturing practices, and operational performance in groups of Danish manufacturing companies. *International Journal of Operations & Production Management*, *23*(10), 1163–1183. doi:10.1108/01443570310496616

Clemens, B., & Papadakis, M. (2008). Environmental management and strategy in the face of regulatory intensity: Radioactive contamination in the US steel industry. *Business Strategy and the Environment*, *17*(8), 480–492. doi:10.1002/bse.573

Companies with Best Practice in Environmental Sustainability. (n. d.). *University of San Francisco,* CA, USA. Retrieved from http://www.usanfranonline.com/resources/supply-chain-management/three-companies-with-best-practices-in-environmental-sustainability/

Consumer Survey Shows Whole Food Market and P&G Are Leading Green Brands. (2012, November 6). *Be Green Packaging.* Retrieved from https://begreenpackaging.wordpress.com/tag/proctor-and-gamble

Cummings, T. (2015, March 18). Why your next phone might be a refurb. *Tech Spot*. Retrieved from http://www.techspot.com/

Datar, S., & Laghate, K. (2011, January 4) Green Business: A view of Retail Sector in India. Retrieved from http://www.ecoinitiative.in/retail-sector-green-biz.pdf

Dowlatshahi, S. (2000). Developing a theory of reverse logistics. *Interfaces*, *30*(3), 143–155. doi:10.1287/inte.30.3.143.11670

Dunn, R. F., & El- Halwagi, M. M. (1993). Optimal recycle/reuse policies for minimizing the wastes of pulp and paper plants. *Journal of Environmental Science & Health Part A*, *28*(1), 217–234.

Edwards, J. B., McKinnon, A. C., & Cullinane, S. L. (2010). Comparative analysis of the carbon footprints of conventional and online retailing: A "last mile" perspective. *International Journal of Physical Distribution & Logistics Management*, *40*(1/2), 103–123. doi:10.1108/09600031011018055

Engaging the Retail Sector in Sustainability (2006, September) Greening Retail. Retrieved from http://greeningretail.ca/dotAsset/48752.pdf

Environmental Consequences of the Chernobyl Accident and Their Remediation: Twenty Years of Experience. (2006). *International Atomic Energy Agency.* Retrieved from http://www-pub.iaea.org/

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Evans, W., & Denney, M. (2009). Best Environmental Practices of Leading Retailers from Around the World. *Greening Retail*. Retrieved from http://www.greeningretail.ca/research

Eyraud, L., & Clements, B. (2012, June). Going Green. *Finance & Development*, *49*(2). Retrieved from http://www.imf.org/

Flapper, S. D., van Nunen, J., & van Wassenhove, L. N. (Eds.). (2006). *Managing closed-loop supply chains*. Springer Science & Business Media.

Georgiadis, P., & Vlachos, D. (2004). The effect of environmental parameters on product recovery. *European Journal of Operational Research*, *157*(2), 449–464. doi:10.1016/S0377-2217(03)00203-0

Giannakos, I. (1998). A multi objective programming model for locating treatment sites and routing hazardous wastes. *European Journal of Operational Research*, *104*(2), 333–342. doi:10.1016/S0377-2217(97)00188-4

Goldsby, T. J., & Closs, D. J. (2000). Using activity-based costing to reengineer the reverse logistics channel. *International Journal of Physical Distribution & Logistics Management*, *30*(6), 500–514. doi:10.1108/09600030010372621

Grant, J. (2007). *The Green Marketing manifesto.* John Wiley & Sons, Ltd.

Green Packaging and Shipping (n. d.). *Dell*. Retrieved from http://www.dell.com/learn/us/en/uscorp1/corp-comm/earth-transportation-logistics

Greenhouse Gas Reduction and Energy Conservation. (n. d.). *Canon*. Retrieved from http://www.canon.com/environment/produce/co2.html

GreenScapes. (2012, November 28). *US Environmental Protection Agency*. Retrieved from http://www.epa.gov/epawaste/conserve/tools/greenscapes/index.htm

Gulf Oil Spill. (n. d.). Retrieved from http://ocean.si.edu/gulf-oil-spill

Gupta, M. C. (1995). Environmental management and its impact on the operations function. *International Journal of Operations & Production Management*, *15*(8), 34–51. doi:10.1108/01443579510094071

Haastrup, P., Maniezzo, V., Mattarelli, M., Rinaldi, F. M., Mendes, I., & Paruccini, M. (1998). A decision support system for urban waste management. *European Journal of Operational Research*, *109*(2), 330–341. doi:10.1016/S0377-2217(98)00061-7

Hagerty, J. R., & Glader, P. (2011, January 24). From Trash Heap to Store Shelf. *The Wall Street Journal*. Retrieved from http://www.wsj.com/

Hanna, M. D., & Rocky Newman, W. (1995). Operations and environment: An expanded focus for TQM. *International Journal of Quality & Reliability Management*, *12*(5), 38–53. doi:10.1108/02656719510089984

Harris, I., Mumford, C., & Naim, M. (2009, May). The multi-objective uncapacitated facility location problem for green logistics. *Proceedings of the IEEE Congress on Evolutionary Computation CEC '09* (pp. 2732-2739). IEEE. 10.1109/CEC.2009.4983285

Hart, S. (1995). A natural-resource-based view of the firm. *Academy of Management Review*, *20*, 986–1014.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Hart, S. L., & Ahuja, G. (1996). Does it pay to be green? An empirical examination of the relationship between emission reduction and firm performance. *Business Strategy and the Environment*, *5*(1), 30–37. doi:10.1002/(SICI)1099-0836(199603)5:1<30::AID-BSE38>3.0.CO;2-Q

Hazen, B. T., Cegielski, C., & Hanna, J. B. (2011). Diffusion of green supply chain management: Examining perceived quality of green reverse logistics. *The International Journal of Logistics Management*, *22*(3), 373–389. doi:10.1108/09574091111181372

Hazen, B. T., Wu, Y., Cegielski, C. G., Jones-Farmer, L. A., & Hall, D. J. (2012). Consumer reactions to the adoption of green reverse logistics. *International Review of Retail, Distribution and Consumer Research*, *22*(4), 417–434. doi:10.1080/09593969.2012.690777

Hervani, A. A., Helms, M. M., & Sarkis, J. (2005). Performance measurement for green supply chain management. *Benchmarking: An International Journal*, *12*(4), 330–353. doi:10.1108/14635770510609015

Hicks, C., Heidrich, O., McGovern, T., & Donnelly, T. (2004). A functional model of supply chains and waste. *International Journal of Production Economics*, *89*(2), 165–174. doi:10.1016/S0925-5273(03)00045-8

Hvozda, N. (2015, January 7). The Tyranny of Distance: Reconciling Extended Producer Responsibility with Global Transportation. *Triple Pundit*. Retrieved from: http://www.triplepundit.com/

Jahre, M. (1995). Household waste collection as a reverse channel: A theoretical perspective. *International Journal of Physical Distribution & Logistics Management*, *25*(2), 39–55. doi:10.1108/09600039510757666

Johnson, P. F. (1998). Managing value in reverse logistics systems. *Transportation Research Part E, Logistics and Transportation Review*, *34*(3), 217–227. doi:10.1016/S1366-5545(98)00016-7

Jones, P., Comfort, D., & Hillier, D. (2005). Corporate social responsibility and the UK's top ten retailers. *International Journal of Retail & Distribution Management*, *33*(12), 882–892. doi:10.1108/09590550510634611

Juliet Norton, I. (2010). Interview with Gareth Kane, author of The Three Secrets of Green Business. *Strategic Direction*, *26*(8), 37–39. doi:10.1108/02580541011055733

Kanellos, M. (2008, April 21) Companies to watch in Green Tech: Transportation. Retrieved from http://www.cnet.com/news/companies-to-watch-in-green-tech-transportation/

Ketzenberg, M. E., Laan, E., & Teunter, R. H. (2006). Value of information in closed loop supply chains. *Production and Operations Management*, *15*(3), 393–406. doi:10.1111/j.1937-5956.2006.tb00253.x

Klonsky, E. (2010, December 10) How to Bring an Eco-friendly Product to Market. Retrieved from http://www.inc.com/

Kotzab, H., Munch, H. M., de Faultrier, B., & Teller, C. (2011). Environmental retail supply chains: When global Goliaths become environmental Davids. *International Journal of Retail & Distribution Management*, *39*(9), 658–681. doi:10.1108/09590551111159332

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Krikke, H. R., Van Harten, A., & Schuur, P. C. (1998). On a medium term product recovery and disposal strategy for durable assembly products. *International Journal of Production Research*, *36*(1), 111–140. doi:10.1080/002075498193967

Kumar, S., Teichman, S., & Timpernagel, T. (2012). A green supply chain is a requirement for profitability. *International Journal of Production Research*, *50*(5), 1278–1296. doi:10.1080/00207543.2011.571924

Lai, K. H., Cheng, T. C. E., & Tang, A. K. (2010). Green retailing: Factors for success. *California Management Review*, *52*(2), 6–31. doi:10.1525/cmr.2010.52.2.6

Lazarowicz, M. (2009). *Global carbon trading: A framework for reducing emissions*. TSO.

Lenox, M., King, A., & Ehrenfeld, J. (2000). An assessment of design-for-environment practices in leading US electronics firms. *Interfaces*, *30*(3), 83–94. doi:10.1287/inte.30.3.83.11669

Louwers, D., Kip, B. J., Peters, E., Souren, F., & Flapper, S. D. P. (1999). A facility location allocation model for reusing carpet materials. *Computers & Industrial Engineering*, *36*(4), 855–869. doi:10.1016/S0360-8352(99)00168-0

Mann, H., Kumar, U., Kumar, V., & Mann, I. J. S. (2010). Drivers of sustainable supply chain management. *IUP Journal of Operations Management*, *9*(4), 52.

Min, H., & Galle, W. P. (2001). Green purchasing practices of US firms. *International Journal of Operations & Production Management*, *21*(9), 1222–1238. doi:10.1108/EUM0000000005923

Moïsé, E., & Steenblik, R. (2011). *Trade-Related Measures Based on Processes and Production Methods in the Context of Climate-Change Mitigation (No. 2011/4)*. OECD Publishing. doi:10.1787/18166881

More Companies reporting Profitability from Environmentally Friendly Practices (2013, February 21). Retrieved from http://www.vanderbilt.edu/

Mouawad, J. (2009, April 7) Oil Giants Loath to Follow Obama's Green Lead. Retrieved from http://www.nytimes.com/

Nakao, Y., Amano, A., Matsumura, K., Genba, K., & Nakano, M. (2007). Relationship between environmental performance and financial performance: An empirical analysis of Japanese corporations. *Business Strategy and the Environment*, *16*(2), 106–118. doi:10.1002/bse.476

Owen, J. V. (1993). Environmentally conscious manufacturing. *Manufacturing Engineering*, *111*(4), 8.

Phau, I., & Ong, D. (2007). An investigation of the effects of environmental claims in promotional messages for clothing brands. *Marketing Intelligence & Planning*, *25*(7), 772–788. doi:10.1108/02634500710834214

GreenProcurement. (n. d.). *Panasonic*. Retrieved fromhttp://www.panasonic.com/global/corporate/management/procurement/green.html

Fleischmann, M., Bloemhof-Ruwaard, J. M., Dekker, R., van der Laan, E., van Nunen, J. A. E. E., & Van Wassenhove, L. N. (1997). Quantitative models for reverse logistics: A review. *European Journal of Operational Research*, *103*(1), 1–17. doi:10.1016/S0377-2217(97)00230-0

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Richter, K., & Weber, J. (2001). The reverse Wagner/Whitin model with variable manufacturing and remanufacturing cost. *International Journal of Production Economics*, *71*(1), 447–456.

Scherpereel, C., Van Koppen, C. S. A., & Heering, G. B. F. (2001). Selecting environmental performance indicators. *Greener Management International*, *2001*(33), 97–115. doi:10.9774/GLEAF.3062.2001.sp.00010

Schwartz, S. H. (1992). In M. P. Zanna (Ed.), *Universals in the content and structure of values: Theoretical advances and empirical tests in 20 countries* (pp. 1–65). San Diego, CA: Academic Press.

Segerson, K., & Miceli, T. J. (1998). Voluntary environmental agreements: Good or bad news for environmental protection? *Journal of Environmental Economics and Management*, *36*(2), 109–130. doi:10.1006/jeem.1998.1040

Smithers, R. (2012, June 7). M&S becomes carbon neutral. *The Guardian*. Retrieved from http://www.theguardian.com/

Srivastava, S. K. (2007). Green supply-chain management: A state-of-the-art literature review. *International Journal of Management Reviews*, *9*(1), 53–80. doi:10.1111/j.1468-2370.2007.00202.x

Staples Annual Report. (2014). *Staples*. Retrieved from http://investor.staples.com/

Study shows Growth in Green Building Among Retail and Hospitality Sectors. (2013, September 23). *CD Recycler.com.* Retrieved from http://www.cdrecycler.com/McGraw-Hill-WM-study-green-building-growth.aspx

Sustainability (2015, January 12). Business in New Zealand. Retrieved from http://www.business.govt.nz/laws-and-regulations/the-environment/sustainability

Tang, K. Y. (2012). *Green retailing: construct measurement and its antecedent-adoption-performance relationships* [Unpublished Doctoral dissertation]. The Hong Kong Polytechnic University, Hong Kong.

Teunter, R. H., & Vlachos, D. (2002). On the necessity of a disposal option for returned items that can be remanufactured. *International Journal of Production Economics*, *75*(3), 257–266. doi:10.1016/S0925-5273(01)00096-2

Thøgersen, J., & Zhou, Y. (2012). Chinese consumers' adoption of a 'green' innovation–The case of organic food. *Journal of Marketing Management*, *28*(3-4), 313–333. doi:10.1080/0267257X.2012.658834

Thompson, B. (2007). Green retail: Retailer strategies for surviving the sustainability storm. *Journal of Retail & Leisure Property*, *6*(4), 281–286. doi:10.1057/palgrave.rlp.5100079

Tibben-Lembke, R. S. (2002). Life after death: Reverse logistics and the product life cycle. *International Journal of Physical Distribution & Logistics Management*, *32*(3), 223–244. doi:10.1108/09600030210426548

Timberland Climate Strategy. (2009). Retrieved from http://community.timberland.com/

Vermeulen, W. J., & Ras, P. J. (2006). The challenge of greening global product chains: Meeting both ends. *Sustainable Development*, *14*(4), 245–256. doi:10.1002d.270

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Walmart Cuts 17.4M Metric Tons of GHGs from Global Supply Chain (2015, April 27). Retrieved from http://www.environmentalleader.com/

Walton, S. V., Handfield, R. B., & Melnyk, S. A. (1998). The green supply chain: Integrating suppliers into environmental management processes. *International Journal of Purchasing and Materials Management*, *34*(1), 2–11. doi:10.1111/j.1745-493X.1998.tb00042.x

Wang, C., Li, X., & Mao, Z. (2013). Green retailing practices: An exploratory comparison between Chinese and British retailers. *Journal of General Management*, *39*(2).

White, M. A. (1995). *Does it Pay to be "green"?: Corporate Environment Responsibility and Shareholder Value*. McIntire School of Commerce.

Wiese, A., Kellner, J., Lietke, B., Toporowski, W., & Zielke, S. (2012). Sustainability in retailing-a summative content analysis. *International Journal of Retail & Distribution Management*, *40*(4), 318–335. doi:10.1108/09590551211211792

Williander, M. (2007). Absorptive capacity and interpretation system's impact when 'going green': An empirical study of ford, Volvo cars and Toyota. *Business Strategy and the Environment*, *16*(3), 202–213. doi:10.1002/bse.479

Wilson, M. (2008). The Power of Green. *Chain Store Age*, *84*(6), 12.

KEY TERMS AND DEFINITIONS

Energy Conservation: Energy conservation refers to reduction in the amount of energy consumption for either a process or a system through rational usage, reducing the requirement of energy intensive services.

Green Packaging: Green packaging or sustainable packaging uses environmentally-sensitive manufacturing methods and recyclable and biodegradable materials for the purpose of product packaging, so that the package has low impact on the environment and the packaging process consumes minimum energy.

Green Procurement: Green procurement refers to the spending and investment policy adopted by a firm toward purchase of environmentally friendly products as well as services, selection of vendors and the setting of required environmental criteria.

Green Promotion: Green Promotion refers to the specific type of advertising that focuses on the promotion of sustainable policies, environmentally friendly operations, green packaging and environmental measures adopted by a firm.

Green Retailing: Green Retailing is an approach toward managing any retail business by incorporating sustainability focused practices and environmentally friendly processes.

Green Supply Chain: Green Supply Chain Management integrates eco-friendly aspects into conventional supply-chain management practices, in order to make the every activity of the value chain: designing, procurement, processes, final product delivery, and end-of-life product management, to become environmentally conducive.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Green Transportation: Green Transportation or Sustainable Transportation comprises of those modes of transportation that do not depend on diminishing natural resources like fossil fuels. These transportation modes rely on renewable energy sources. They also have very low impact on the environment as these modes produce minimal or no greenhouse gas emission.

Reverse Logistics: Reverse Logistics is defined as the flow of used or unwanted or surplus materials, goods (semi-finished or final), and equipment back to the manufacturer through her logistics chains or retailers for the purpose of recycling and reuse, or disposal or both.

Waste Management: Waste management includes generation, minimization, removal, transportation, and treatment of waste. It also looks into the aspects of recycling, reuse and disposal of residual parts of used products.

This research was previously published in the Handbook of Research on Strategic Supply Chain Management in the Retail Industry edited by Narasimha Kamath and Swapnil Saurav, pages 290-307, copyright year 2016 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Section 7
Critical Issues and Challenges

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 73
A Review on Green Trust and Environmental Quality Awareness Affect Towards Environmental Attitude

Trianna Rosli
University Technology of Malaysia, Malaysia

Fauziah Sh. Ahmad
University Technology of Malaysia, Malaysia

ABSTRACT

There are literally thousands of the global warming and pollution issues affecting the living resources, habitats and residents of an ecosystem. The question is, do the issues affects consumers' environmental attitude? Although environmental awareness is gaining more ground among consumers, it is still not clear how this influence their cognitive thinking and consequently their action. The findings on this issue are still equivocal. There are also arguments that most consumers expect others to solve environmental issues which seems to be more of future concerns while they seek immediate gratification or short term personal satisfaction. To date, marketers are still struggling to convince consumers towards eco-products. Furthermore, green halo effect and greenwashing continues distorting buyers and caused them to be more skeptical. This chapter intends to consolidate the literature on green trust factors and environmental quality awareness and assess how these could stimulate environmental attitude.

INTRODUCTION

During the past decades, researchers from multidisciplinary areas relating to environmental studies recognized the importance knowledge and practices that can lead to more responsible ecological decisions and sustenance of environment. While advance nations have been more action oriented towards green and reported to take more initiatives to control and manage environmental issues (Otman, 2011), the developing nations including Malaysia are building up their stronger perceptions on the importance

DOI: 10.4018/978-1-5225-7915-1.ch073

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

to go green. Slowly it builds concerted effort to provide solutions to protect, develop and sustain the environment. The government as well as other responsible parties have been increasingly educating and undertaking the responsibility to enhance the nation's capacity in dealing with the environment issues. The consumption issues of natural resources such as water, energy as well as the protection of natural habitats and endangered species are making it more important for all individuals to practice green in their daily life. However, the national effort may not necessarily translated into a better green perceptions of customers.

However, in a different perspective, it is believed that conscious customers are socially performing daily decision making to minimize the impact of environmental burden and some voluntarily join the green movements to highlight the importance of being green. They even called themselves as 'green people' or more fashionably known as 'pro-environmentalist' (Ottman, 2011). Often, these environmentalist are not leaving the responsibility of environmental issues entirely on the government and businesses (Thøgersen, Jørgensen, & Sandager, 2012).

The environmental movement has extended into organization's practice that determines environmental performance. This includes higher environment standards to innovate and stimulate technology performance that affects companies' efficiency (Peng & Lin, 2009). The implementation of environmental regulations and development of environmental technology (improvement) are one of the critical factors in the organizations towards environmental performance. However, many firms are not capable of undertaking the green marketing strategies and integrating the green concept within all aspects of marketing routine (Ottman, 2011). The implementation of environment performance in the organization has proven such environment oriented practice can support customers to become greener practical within the company. It may not reflects individual's practice-related activities such as practicing product recycling at home or using the green product in the daily routine (Grimmer & Bingham, 2013).

Generally, people who are aware of the environmental problems tend to possess the environmental attitude, and it will translate into supporting or encouraging environment movements. Several research findings support that individuals who possess the environmental awareness have the tendency to perform the environmental behavior (Boztepe, 2012). Unfortunately, the past results seemed to be inconsistent. No matter how severe is the environmental degradation issues and people are expected to monitor lifestyles ethically, yet, there is an indication of poor green practice. People may take the environment for granted, as well as to some, leave for the others to solve the issue (Carrington, Neville, & Whitwell, 2010) because bio-gradable or green products may often cost more money and efforts (Markkula and Moisander, 2011). Customers are likely to seek personal gain (self-fulfillment) and satisfaction rather than a future outcome (Oliver, 2014). Furthermore, the reality in Malaysia shows the presence of a green idea in individual perspective but it is still limited (Goh & Wahid, 2014; Mei, Ling, & Piew, 2012; Ramli, 2009; Sinnappan et, 2011).

Based on Boztepe (2012), people behavior has a complex spectrum of habit, personality, and lifestyle. Hence, the attitude problem is rooted in customers' deep confusion on the green idea. Therefore, marketers are still struggling to change people behavior to be greener as well as to convince them on green consumption. Furthermore, it is difficult to overstate the effectiveness of the green initiatives and marketing strategy due to many possible constraints to make people going green.

The famous green constraints are known as green halo effect and greenwashing that are distorting the reality of green products. These restrictions are escalating the misconception and skeptical towards eco-label, claims, and advertising. Time to time, it has become a serious challenge for marketers to create a solid marketing strategy that will 'move' people towards being green.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Past literature has been discussed about people awareness and trust. However, the results still remain inconclusive to influence environmental attitude. Many initiatives by government bodies present the eco-labelling and advertisement, yet, how much people trust the green claims to actually persuading them to practice green in their daily activities? Although Malaysia has Environmental Performance Index to monitor how significant the performance of country's environment, but what are the perceptions of customers towards our environmental quality or development? How well the customers aware of the environmental issues and to what extend they will go about it? It is thus crucial to consolidate the literature on green trust and environmental quality awareness to bridge environmental attitude gap. Furthermore, an adaptation of the Theory of Reason Action; Three Paradigm Model as well as Trust-Based Situation Awareness Model would explain the potential relationship of the proposed constructs.

GREEN TRUST

Trust has numerous background from diverse disciplines including sociology, psychology, and economics. In psychology, trust "compromises the intention to accept the vulnerability based on positive expectations of the intentions or behavior of another" (Rousseau, Sitkin, Burt, & Camerer, 1998, p. 395).Two criteria in the definition, the first criteria relates to 'positive expectancy' from another individual. It explains the individual's belief towards another person will act in a manner that is responsible and integrity. The second criteria is related to 'accepting the vulnerability' where people will accept it with an open heart (willingly accept) of whatever outcomes.

Early researchers discussed the trust antecedent in the Commitment-Trust Theory where it is conceptualizing trust "as an existing when one party has confidence in an exchange partner's reliability and integrity" (Morgan and Hunt, 1994, p. 5). The definition is similar to another early study that claimed: "trust is defined as a willingness to rely on an exchange partner in whom one has confidence" (Moorman, Deshpande, and Zaltman, 1993, p. 82). Furthermore, it is suggested that positive trust could influence the relationship between partners. For instance, when a customer has high competence trust towards a service provider, it is presumed that the customer holds a high-performance expectation of the provider in the subsequence relationship exchange (Singh & Sirdeshmukh, 2000).

The popular example of green constraints are called a greenwashing and green halo. These terms are considered as marketing strategy or tactics to make customers feel safe in a placebo way.. The modern western 'greenwash' term started in the early 1970s when Earth Day began on April 22, 1970; the US government encouraged companies to advertise themselves as being friendly to the environment. During that green period, western public utilities spent 300 million dollars to portray themselves as a green company. A New York writer, Jay Westervelt who created the first term of greenwashing in 1986, wrote about environmental issues essay concerning hotel industry's practice of placing placards in each room promoting reuse of towels to 'save the environment.' Westervelt (1986) said, in most cases, no significant effort had contributed to reducing energy wastage, and companies claimed that they were green but demonstrated nonexistence cost reduction due to this practice. Therefore, the greenwash term used to describe the practice of businesses over claiming the environmental products or practice that cannot be validated. Hence, the false claims are broad misleading marketing tactics by dishonest companies which often result in suspicion about green claims (Parguel, Benoît-Moreau, & Larceneux, 2011; Self, Self, & Bell-Haynes, 2010).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Green products are associated with the direct impact on the environment in every phase of the product's life-cycle, and this also serves vague promises that guaranteed by the profit-making companies. The exaggeration of the environmental value of their products will rise the suspicions which make customers distrust and hesitate to buy. Thus, such greenwash claims can damage and lead to confusion, skeptical as well as uncertainty towards the green products (Obermiller, Spangenberg, & MacLachlan, 2005; Tahir Albayrak et, 2011, Pomering and Johnson, 2009). As a result, it will potentially destroy the green market in the future (Kalafatis, Pollard, East, & Tsogas, 1999; Peattie, 1999; Polonsky & Rosenberger, 2001).

Another example of marketing strategy is called the Green Halo tactic; it is a cognitive bias that most companies influence their customers' feelings and thought about the characters of the products. For example, organization claim is to saving the world by driving a Prius, selling the organic beauty products and safe product made by bio-ingredients. This halo effects seems to give false feelings or thoughts of consumers that they are doing good for the society. Edward Thorndike who is a psychologist that named Halo Effect term which refers to a person who being perceived as having a halo when he or she influenced by products claims or branding. The University of Toronto shows that when people spend money on eco-friendly products, believe they earned 'moral credit' for saving the world.

Turnbull (2000) define the green consumer confusion as a 'customer failure' to develop a correct interpretation of green product's preference during their purchase decision process (Turnbull, Leek, & Ying, 2000). Therefore, the confusion and mistrust arise when companies fail to develop a real situation or give a misleading interpretation of a various aspect of their products during information decision making (Peattie, 1999; Turnbull et al., 2000). As a result, consumer's misunderstanding creates a confusion of the green market when the products are too similar, complex, ambiguous or too much of information of the products (Y.-S. Chen, 2007, 2009; Y.-S. Chen & Chang, 2012b; Mitchell & Papavassiliou, 1999; Turnbull et al., 2000). Hence, this will raise people suspicions and undermine their trust and eventually, this will stop them to purchase or consume green products again. (Singh & Sirdeshmukh, 2000). Even worse, they will tell their friends and influence them not to try or buy green products.

Therefore, an interesting extension study by Chen (2009) has developed antecedent in sustainability research, and coined the Green Trust term. This precursor serves customer's 'willingly to depends' on green products characteristic, attributes as well as advertising. Trust defines the trustworthy or an act of willingness to rely on products, service or brand based on beliefs or expectation resulting in its credibility, benevolence, and ability to its environmental performance (Schurr & Ozanne, 1985).

Adapt by Chen (2010); there are four items proposed as below:

1. Green product's environmental reputation is reliable.
2. Green product's performance is dependable.
3. Green product have assurance towards environment protection.
4. Green product's environmental claims are trustworthy.

ENVIRONMENTAL QUALITY AWARENESS

According to Han, Hsu, Lee, & Sheu (2011), environmental awareness is a positive attitude towards eco-friendly activities and encourages people to engage more frequently in ecological behaviors in their everyday life. Chen (2010) defines an individual with environmentally awareness has the environmen-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

tally concerned attitude that can be described as the perception of self and the extent to which a person identifies him/herself to be an essential part of the environmental setting. Past result shows that the environmental quality issues have brought up the idea of being more exposed to efficiency and favorable attitude (Simmons & Widmar, 1990).

For many years, environmental awareness has received significant attention and extensive coverage of studies among academicians and practitioners (Bran, Radulescu, & Ioan, 2011; Grimmer & Bingham, 2013; Peng & Lin, 2009). According to philosophy science study, self-awareness is an effort "to describe consciousness in clear terms that develop awareness of the qualia drawn up by other networks" (Ferrari & Sternberg, 1998, p. 6). A person with environmental awareness practices energy saving, recycling, and efficiently consuming bio-gradable products; they are the individuals who acknowledge the importance of environment protection (Ottman, 2011).

There were extensive coverage studies on environmental awareness (Bran, Radulescu, & Ioan, 2011; Grimmer & Bingham, 2013; Peng & Lin, 2009). The environmental awareness can be associated with business success by communicating various products' ecology credibility and impact towards social and environment. Although, the early models were based on the linear progression of environmental awareness that hypothesized to influence pro-environmental behavior, yet, it was claimed that environmental awareness does not promote sustainable lifestyle efficiently (Hobson, 2001).

Unfortunately, in the case of Malaysia, there is discrepancy between individual's stated and actual behaviour. The commitment does not necessarily translated into pro-environmental behavior (Mat Said, Ahmadun, Hj. Paim, & Masud, 2003). Behavioral researchers argues that individual hardly change their behavior when their lifestyle is rooted deep in a social context (Jackson, 2005). Another study supported that awareness about a green product does not affect the purchasing green product decision (Suki, 2013). Hence, the question is, why environmental awareness is still not enough to influence environmental attitude?

In 2009, the introduction of Environmental Performance Index had become a favorite indicator which numerically marking the environmental performance of states policies and provides a ranking of the whole countries. Even so, EPI cannot provide feedback on the level of customers' sensitivity (Carrington et al., 2010). To date, there is no inclusive evidence on the study of environmental quality awareness (EQA) in Malaysia.

Environmental Quality Awareness defines as an acknowledgment the quality of environmental towards Human Health, Ecosystem Vitality and Socioeconomic Sustainability of the country (Trianna R, 2017). EQA investigates customers' awareness towards environmental quality and seeing to what extent the customers will receive a response in their lifestyle regarding human health, ecosystem vitality and socioeconomic sustainability of the country (Trianna R, 2017). It postulates to support the attitude/behavior gap issues, as well as structuring the solutions for the current ecological concerns in Malaysia. By considering this, the researcher proposed the environmental awareness quality could contribute towards the sustainability area of knowledge (Trianna, 2017). EQA will deliver four question items:

1. I am aware environmental burden can affect my health and ecosystem vitality.
2. I know that air and water quality may affect my health and ecosystem vitality.
3. I believe that water sanitation system is important to maintain a good health.
4. I am aware that open fire, transportation, and industrial hazardous waste can affect my health and ecosystem vitality.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

ENVIRONMENTAL ATTITUDE

Historically, people are worried about their health because the fear of losing the ability to sustain healthy life environment and they felt the environment has diluted by many unethical actions (J. Ottman, 2011). In social psychology research, the customer's attitudes have been continuously used to predict energy conservation and ecologically informed purchase which specifically focused on the relationship between environment attitudes as well as environmentally related behavior (Ajzen, 1991; Ajzen & Sexton, 1999).

Environment attitude refers to the individual's value judgment and it taps the person's cognitive assessment to participate in environmental-supportive behavior (Lee, 2008; Sinnappan et, 2011) in instances such as to ride public transport, recycling, or to get environmental products. However, supported by Carrington's study shown that most of the people expect others to solve on the environment issues (Carrington, Neville, & Whitwell, 2010). Furthermore, the deceiving cases about organizations that are trying to compete by claiming things that untrue. Therefore, it has been formed as customers' constraint to rely on and depends on green product's claims.

Many green attitudes constraints that evolved with people trust and awareness have restricted to influence them to behave environmentally. People are driven by the curiosity and added precaution to protect their health, and some of them are skeptical with the reputations of product manufacturers towards social and environment responsibility (Ottman, 2011).

Adding to this, customers are overwhelming with complex information on green products (Moisander, 2007). The increasing skeptical and confusion towards green claims would negatively influence green consumption (Y.-S. Chen, 2009; Y.-S. Chen & Chang, 2012a, 2012b, 2013; Walsh & Mitchell, 2010) as well as outperform the ability to act in a green way.

Hence, it is best to study the environmental quality awareness influence towards environmental attitude. The researcher will access Environmental Attitude antecedent as to gain the understanding about individual's belief. The proposed variable items are adapted from Sinnapan et al. (2011);

1. It is essential to promote green living in Malaysia.
2. I strongly agree Malaysia needs more environmental protection.
3. It is important to raise environmental awareness among Malaysia people.

THEORIES AND MODEL

As proposed by Theory of Reasoned Action (TRA), 'evaluation of outcome' constitutes the attitude of a person which lead to the behavior, by this mean, people must be observant to the consequence (Azjen, 2011). TRA theory suggests 'beliefs' are the novels that play the first role in human behavior (Figure 1). In another word, these beliefs guide the human behavior by three kinds of considerations, the first belief is about the consequences of the behavior, which is called behavioral beliefs. Then, a normative belief that defines as beliefs about the normative expectations of others. Followed by control beliefs, which constitutes the beliefs about factors that may facilitate that performance of the behavior (Ajzen, 2002). The theory delivers in-depth information on three salient beliefs are behavioral beliefs, normative beliefs and as well as control beliefs. These three salient beliefs that people who hold onto which considered principal determinants of individual's intention and action (Ajzen & Sexton, 1999).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

According to this underpinning theory from Icek Ajzen, behavioral beliefs is predicted to influence attitudes towards the behavior, normative beliefs constitute the underlying determinants of subjective norm, and lastly, control beliefs provides the foundation perceptions of behavior control.

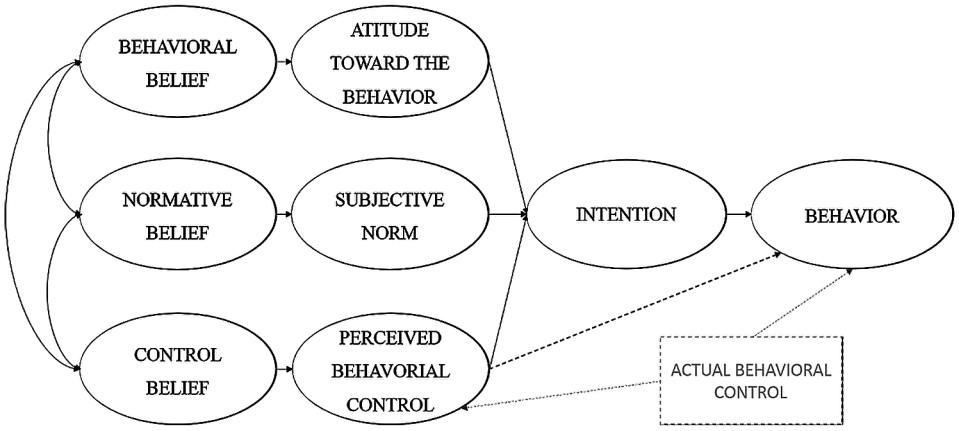
Meanwhile, Sterling's of Three Paradigm model (2009) also explains that the individual must have the ethical sensibility or consciousness through perception (seeing) and followed by the conception (understanding). Stephen Sterling (2009) suggested a critical understanding of pattern and the consequence will help a person to connect towards the subject. In the study of ecology learning, people need to have 'cognitive domain' (aware and understanding) and 'affective domain' (seeing, emotion, assumption, values), then people will have 'intentional domain' (doing or practical) in order to respond towards environmental issues. Correspond to futures expert Paul Raskin argues that "the shape of the global future rests with the reflexivity of human consciousness – the capacity to think critically about why we believe what we do – and then to think and act differently" (Raskin, 2008, p. 469). The Three paradigm model suggests that the people awareness is critical to shaping the people values and attitude.

Moreover, the addition of Environmental Performance Index (EPI) literature has shown that contents raw data (index) is insufficient which it does not play the part of taking account of customers' awareness or standpoint, nor it examines how well green practice as they exposed to the environmental performance (Alex de Shernin et, 2013). Hence, the theories and model support the relationship between green trust and environmental quality awareness towards the environmental attitude that will discuss further.

PROPOSED MODEL

In this chapter, the researcher proposed the Theory of Situation Awareness (SA) as a foundation for the model relationship. SA theory is a significant contributor to the "Quality of decision-making in complex, dynamically changing environments" (Aydoğan, Sharpanskykh, & Lo, 2014,p. 22). SA refers to knowing what is happening around oneself and generally, this theory is adapted in intelligent software agent and aviation organizations. The operational of SA model has been vigorously debated about two main

Figure 1. The theory of planned behavior. Organizational behavior and human decision processes.
Source: Ajzen (1975)



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

streams of the traditional information-processing approach of psychology versus ecological psychology. Based on Endsley (1995), the concept of situation awareness refers to the level of knowledge that an individual has of a situation and an operator's dynamic understanding of 'what is going on.'

A decision-making process developed by considering from what sources should be taken into the information fusion of making that particular decision. Therefore, an individual must be in somewhere to 'depend' on the information sources. Alas, the decision-making process may vary because the persons influenced by the source of information given and the degree of (un)certainty of information provided by this source. Hence, the person must determine to what extent of communicated or observed information contributes to the activation level to correspond or to decide (Aydoğan, Sharpanskykh, & Lo, 2014). Moreover, one of the major factors influencing both misuse and disuse is trust in automation (Parasuraman, Sheridan, & Wickens, 2008).

Therefore, this chapter adapted the model concept by R. Aydo˘gan et al. (2015) study which extended the SA theory in the study of an aircraft. This study integrated the interpersonal trust in the framework which previously SA Theory does not take it in the model range. The study suggested that the more person trusts the information source, the more it affects that person to make an assessment of the situation. Thereby, the ability examines of what kind information source should be taken into account and how well person aware of the situation is important in decision making.

The model noted that the choices or alternative would depend not only on the content of information but also on the trustworthiness of the information source is important to put into the consideration (Aydoğan et al., 2014). Thus, R. Aydo˘gan et al. (2015) proposed integrated model between SA which activated by communicated or observed information and the trust towards information sources affect decision maker's assessment of the situation.

R. Aydo˘gan et al. (2015) performed Endsley and Hoogendoorn's computational model of SA which manage to introduced agent-based situational awareness model incorporating trust to enable humanlike decision-making tools in the computational area. The finding proved that significant impact of trustworthiness of information sources had an effect on airline operation controller's situation awareness and implication on its decision-making.

Therefore, this chapter adapted Trust Based-Situation Awareness model by R. Aydo˘gan et al. (2015) that has extended the knowledge area by integrated the trust antecedent and stimulate in an airline's operation control domain case. This chapter aims to investigate the relationship between green trust and environmental quality awareness towards environmental attitude using the Trust Based-Situational Awareness model. Figure 2 shows a study by R. Aydo˘gan et al. (2015). Both are hypothesized that the independent variables are affecting the dependent variable (outcome).

Figure 3 showed the example of prior study and proposed green trust and environmental quality awareness towards environmental attitude. The first construct of green Trust discusses on the willingness of the people to depend on the marketing information sources, for instance, advertisements, eco-label, and claims. The second novel discusses the environmental quality awareness which explains about people's awareness is towards environmental quality to fit the environmental discipline study. Therefore, this chapter suggests that based on this adapted model, the integration of green trust and environmental quality awareness potentially affects environmental attitude. Therefore, it is postulated that when people trust towards information source and there is sufficient awareness towards environmental quality, it will lead them to have the environmental attitude.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 2. Airline operation control decision-making in complex sociotechnical systems
Source: Aydoğan, Sharpanskykh, and Lo (2014)

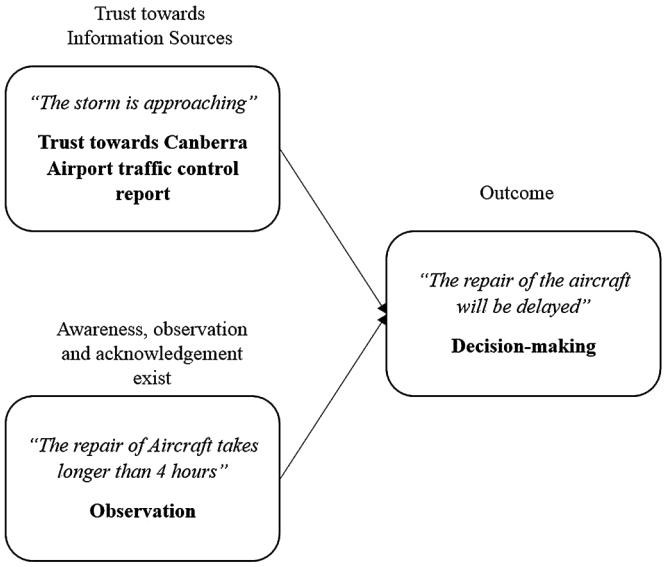
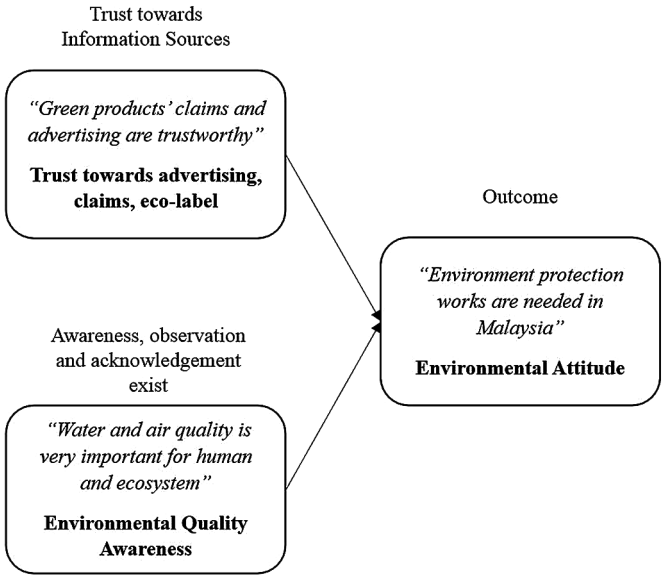


Figure 3. Green trust: environmental quality awareness towards environmental attitude



CONCLUSION

Overall, the chapter explains the opportunity to strengthen the relationship between green trust and environmental awareness towards environmental attitude for future research. Furthermore, a discussion of Trust Based-Situational Awareness model has extended the EQA framework that proposed by Trianna R (2017). Hence, the future research could test the Planned Behavior theory to provide a necessity

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

bridge between green trust, environmental quality awareness and environmental attitude relationship in the framework.

As supported by Chen et al., (2009, 2010, 2013) behavioral study, people must trust the green claims, eco-label, characteristics and attributes to make them purchase green products. Hence, no matter how well perspective or attitude towards environmental, if the people are skeptical or confuse about green products, they will not be interested in purchasing green products (Y.-S. Chen, 2009, 2013; Y.-S. Chen & Chang, 2013; Walsh & Mitchell, 2010). Chen et al. (2013) who is developed green trust novel has tested in Taiwan and environmental awareness (Zsóka, 2005; Dunlap, Liere, Mertig, & Jones, 2000; Kollmuss & Agyeman, 2002; Connolly & Shaw, 2006; Chen, 2010; Han, Hsu, Lee, & Sheu, 2011; Boztepe, 2012) has tested in many Western countries, hence, the study should not be generalized and presented as a whole customer's behavior.

The differences of background and multi-culture of Malaysian people contributed different findings as compare to Western countries. The interaction between behavior, organizational factor and personal factors described in triadic reciprocal determinism (Bandura, 1986) which has multicultural society dominated by Malay, Chinese and Indian. Thus, the personality behavior possibly will influence by culture as Schein stated that "one can view personality and character as the accumulation of cultural learning that an individual has experienced in the family, the peer group, the school, the community and the occupation. In this sense, culture is within us as people and yet constantly evolving as we join and create new groups that eventually creates new cultures" (Shein, 2004, p. 8). In addition, environmental quality awareness (EQA) provides another spectrum of scale has contributed towards the sustainability area of knowledge. This chapter proposed environmental quality awareness variable that is assumed the person will make more initiatives to control and manage environmental issues. Hence, the research hypothesizes that if individuals are aware of environmental quality; it will translate it to their environmental attitude by supporting as well as encouraging environment movements.

Dunlap (2000), suggested that to understand any specific environmentally significant behavior requires empirical analysis and the roles of environmentalist tendencies are different from behavior, the actor and the context. Furthermore, "environmental intent and environmental impact are two separate things, theories explaining environmentalism are necessarily insufficient for understanding how to change environmentally significant behaviors" (Dunlap, Liere, Mertig, & Jones, 2000, p. 9). As a conclusion, Green Trust and Environmental Quality Awareness are hypothesized to affect an environmental attitude that further study, especially in developing country like Malaysia. Therefore, by assessing proposed model will extend the understanding of people trust to influence environmental attitude and to what extent of awareness towards environment quality that could influence them to gain environmental attitude as well as change social and lifestyle.

REFERENCES

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179–211. doi:10.1016/0749-5978(91)90020-T

Ajzen, I., & Sexton, J. (1999). Depth of processing, belief congruence, and attitude-behavior correspondence. *Dual-process theories in social psychology*, 117-138.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Aydoğan, R., Sharpanskykh, A., & Lo, J. (2014). *A Trust-Based Situation Awareness Model.* Paper presented at the European Conference on Multi-Agent Systems.

Chen, Y.-S. (2007). The Driver of Green Innovation and Green Image – Green Core Competence. *Journal of Business Ethics*, *81*(3), 531–543. doi:10.100710551-007-9522-1

Chen, Y.-S. (2009). The Drivers of Green Brand Equity: Green Brand Image, Green Satisfaction, and Green Trust. *Journal of Business Ethics*, *93*(2), 307–319. doi:10.100710551-009-0223-9

Chen, Y. S. (2013). Towards green loyalty: Driving from green perceived value, green satisfaction, and green trust. *Sustainable Development*, *21*(5), 294–308. doi:10.1002d.500

Chen, Y.-S., & Chang, C.-H. (2012a). Enhance green purchase intentions: The roles of green perceived value, green perceived risk, and green trust. *Management Decision*, *50*(3), 502–520. doi:10.1108/00251741211216250

Chen, Y.-S., & Chang, C.-H. (2012b). Greenwash and Green Trust: The Mediation Effects of Green Consumer Confusion and Green Perceived Risk. *Journal of Business Ethics*, *114*(3), 489–500. doi:10.100710551-012-1360-0

Chen, Y.-S., & Chang, C.-H. (2013). Towards green trust: The influences of green perceived quality, green perceived risk, and green satisfaction. *Management Decision*, *51*(1), 63–82. doi:10.1108/00251741311291319

Dunlap, R., Liere, K., Mertig, A., & Jones, R. E. (2000). Measuring endorsement of the new ecological paradigm: A revised NEP scale. *The Journal of Social Issues*, *56*(3), 425–442. doi:10.1111/0022-4537.00176

Ferrari, M. D., & Sternberg, R. J. (1998). *Self-awareness: Its nature and development*. Guilford press.

Goh, Y.-N., & Wahid, N. A. (2014). A Review on Green Purchase Behaviour Trend of Malaysian Consumers. *Asian Social Science*, *11*(2), 103. doi:10.5539/ass.v11n2p103

Grimmer, M., & Bingham, T. (2013). Company environmental performance and consumer purchase intentions. *Journal of Business Research*, *66*(10), 1945–1953. doi:10.1016/j.jbusres.2013.02.017

Hobson, K. (2001). Sustainable lifestyles: rethinking barriers and behaviour change. *Exploring sustainable consumption: Environmental policy and the social sciences*, 191-209.

Jackson, T. (2005). *Motivating sustainable consumption: a review of evidence on consumer behaviour and behavioural change: a report to the Sustainable Development Research Network*. Centre for Environmental Strategy, University of Surrey.

Kalafatis, S. P., Pollard, M., East, R., & Tsogas, M. H. (1999). Green marketing and Ajzens theory of planned behaviour: A cross-market examination. *Journal of Consumer Marketing*, *16*(5), 441–460. doi:10.1108/07363769910289550

Lee, K. (2008). Opportunities for green marketing: Young consumers. *Marketing Intelligence & Planning*, *26*(6), 573–586. doi:10.1108/02634500810902839

Lee, K. (2009). Gender differences in Hong Kong adolescent consumers green purchasing behavior. *Journal of Consumer Marketing*, *26*(2), 87–96. doi:10.1108/07363760910940456

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Mat Said, A., & Ahmadun, F. l.-R., Hj. Paim, L., & Masud, J. (2003). Environmental concerns, knowledge and practices gap among Malaysian teachers. *International Journal of Sustainability in Higher Education*, *4*(4), 305–313. doi:10.1108/14676370310497534

Mei, O. J., Ling, K. C., & Piew, T. H. (2012). The antecedents of green purchase intention among Malaysian consumers. *Asian Social Science*, *8*(13), 246. doi:10.5539/ass.v8n13p246

Mitchell, V.-W., & Papavassiliou, V. (1999). Marketing causes and implications of consumer confusion. *Journal of Product and Brand Management*, *8*(4), 319–342. doi:10.1108/10610429910284300

Obermiller, C., Spangenberg, E., & MacLachlan, D. L. (2005). Ad skepticism: The consequences of disbelief. *Journal of Advertising*, *34*(3), 7–17. doi:10.1080/00913367.2005.10639199

Ottman, J. (2011). *The new rules of green marketing: Strategies, tools, and inspiration for sustainable branding*. Berrett-Koehler Publishers.

Ottman. (2011). *The New Rules of Green Marketing*. Academic Press.

Parasuraman, R., Sheridan, T. B., & Wickens, C. D. (2008). Situation awareness, mental workload, and trust in automation: Viable, empirically supported cognitive engineering constructs. *Journal of Cognitive Engineering and Decision Making*, *2*(2), 140–160. doi:10.1518/155534308X284417

Parguel, B., Benoît-Moreau, F., & Larceneux, F. (2011). How sustainability ratings might deter greenwashing: A closer look at ethical corporate communication. *Journal of Business Ethics*, *102*(1), 15–28. doi:10.100710551-011-0901-2

Peattie, K. (1999). Trappings versus substance in the greening of marketing planning. *Journal of Strategic Marketing*, *7*(2), 131–148. doi:10.1080/096525499346486

Polonsky, M. J., & Rosenberger, P. J. III. (2001). Reevaluating green marketing: A strategic approach. *Business Horizons*, *44*(5), 21–30. doi:10.1016/S0007-6813(01)80057-4

Ramli, N. (2009). *Awareness of Eco-label in Malaysia's Green Marketing Initiative*. Academic Press.

Rousseau, D. M., Sitkin, S. B., Burt, R. S., & Camerer, C. (1998). Not so different after all: A cross-discipline view of trust. *Academy of Management Review*, *23*(3), 393–404. doi:10.5465/AMR.1998.926617

Schurr, P. H., & Ozanne, J. L. (1985). Influences on exchange processes: Buyers preconceptions of a sellers trustworthiness and bargaining toughness. *The Journal of Consumer Research*, *11*(4), 939–953. doi:10.1086/209028

Self, R. M., Self, D. R., & Bell-Haynes, J. (2010). Marketing tourism in the Galapagos Islands: ecotourism or greenwashing?. *International Business & Economics Research Journal (IBER), 9*(6).

Shove, E., & Warde, A. (2002). Inconspicuous consumption: the sociology of consumption, lifestyles and the environment. *Sociological theory and the environment: classical foundations, contemporary insights, 230*, 51.

Singh, J., & Sirdeshmukh, D. (2000). Agency and trust mechanisms in consumer satisfaction and loyalty judgments. *Journal of the Academy of Marketing Science*, *28*(1), 150–167. doi:10.1177/0092070300281014

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Sinnappan. (2011). *Antecedents of Green Purchasing Behavior among Malaysian Consumers*. Academic Press.

Tahir Albayrak. (2011). *The Influence of Skepticism on Green Purchase Behavior*. Academic Press.

Trianna Rosli (2016). *Measuring Environmental Performance Awareness: A Qualitative Approach*. SOSHUM.

Turnbull, P. W., Leek, S., & Ying, G. (2000). Customer confusion: The mobile phone market. *Journal of Marketing Management*, *16*(1-3), 143–163. doi:10.1362/026725700785100523

Walsh, G., & Mitchell, V.-W. (2010). The effect of consumer confusion proneness on word of mouth, trust, and customer satisfaction. *European Journal of Marketing*, *44*(6), 838–859. doi:10.1108/03090561011032739

KEY TERMS AND DEFINITIONS

Eco-Label: A certification that provides the understanding of ecological benefits to the customers in the long run.

Environmental Attitude: An expression of psychological tendency between favor and un-favor towards things, situations, and people.

Environmental Performance Index: Global metrics for the environment that rank the countries' environmental performance of the human health protection and the protection of ecosystems.

Environmental Quality Awareness: Explains customers' awareness towards environmental quality that consists of three sustainable pillars which are environmental health, ecosystem vitality, and socio-economic sustainability.

Green Consumerism: Defined as the customers' purchasing habits towards environmentally friendly products and services.

Green People: Also called pro-environmentalists, these are people who belong to environment-society. These people are supporters of green or environmental movements whether political or ethical movements.

Green Products: Environmentally safe products that are safe, energy efficient and often have low maintenance requirements.

Green Purchasing Behavior: Spending on products that are beneficial to the environment.

Green Self-Efficacy: People's degree of involvement, effort and how long they will persist in facing the obstacles as well as aversive experiences.

Green Trust: Defined as the willingness to depend on a product or service based on the belief or expectation resulting from its credibility, benevolence, and ability about environmental performance.

This research was previously published in Driving Green Consumerism Through Strategic Sustainability Marketing edited by Farzana Quoquab, Ramayah Thurasamy, and Jihad Mohammad, pages 37-49, copyright year 2018 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 74
Sustainable Consumption and Green Marketing in Developing Countries:
Contemporary Perspective Using Nigeria and Kenya as Case Studies

Abiodun Elijah Obayelu
Federal University of Agriculture, Abeokuta, Nigeria

ABSTRACT

This chapter provides an insight into why Green Marketing (GM) and Sustainable Consumption (SC) of green products are subject of research and discussion in contemporary society. It analyzed the extent of GM in developing countries using cases of Nigeria and Kenya, factors influencing GM, the benefits of GM on the environment and firms, and the challenges. The study is both exploratory with the use of structured literature review of publications in peer reviewed academic journals on GM and SC, and empirical in nature. The findings on respondents rating of factors influencing green purchase behavior showed that concern for health and environment was considered as the most important in Nigeria, while in Kenya it was social awareness and value. For an effective GM and SC, government at all levels has a role of creating awareness to boost green knowledge through educative campaign programs and enforcing green agenda. Government can make regulations relating to GM and ensure SC by lowering the cost when compared to the conventional marketing

INTRODUCTION

Green, environmental and eco-marketing is fairly a new concept or philosophy in the modern marketing (Kassaye, 2001; Singh & Pandey, 2012) acting as a bridge connecting the corporate, environment and the consumers (Seth & Khan, 2015). The marketing concept emerged due to concerns over issues such as environmental degradation, global warming and the over-use of non-renewable resources (Hartmann

DOI: 10.4018/978-1-5225-7915-1.ch074

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

& Ibanez, 2006; Tanner & Kast, 2003). Green marketing (GM) is cognizant of making the world green (Shah, *et al.,* 2014) and is a part of the new marketing approaches, which do not just refocus, adjust or enhance existing marketing thinking and practice, but seek to challenge those approaches and provide a substantially different perspective (Ahmad, 2012). It provides the satisfaction consumer needs, wants, and desires in conjunction with the preservation and conservation of the natural environment (Sahu, 2012). GM is now part and parcel of the overall corporate strategy (Menon, 2013), an increasingly interesting research field, and a more viable and sustainable alternative to the conventional marketing (Singh, 2015). The society is becoming more concerned with the natural environment thereby making businesses begin to modify their behaviour as a response to the society's new concerns (Nandini, 2011). According to American Marketing Association (AMA, 2010), GM is the marketing of products that are presumed to be environmentally safe. As a golden rules of green marketing, the consumer must be aware of, and concerned about the issues that the firm's product attempts to address. It also educates the customers not only to let people know whatever the company is doing to protect the environment, but also a matter of letting them know why it matters; being genuine and transparent in green marketing campaign and reassure the buyers that the product performs the job and finally give the customers an opportunity to participate. Firms use GM in an attempt to address cost or profit related issues.

People are worried about sustainability-related issues than ever before by been more concerned about the environment (GIA, 2011). The perceived seriousness of environmental problems will therefore contribute to green purchasing behavior (Dagher & Itani, 2014). Influential customers want to do business with companies that have established their green credentials, so companies are launching hefty advertising and web campaigns, publishing extensively documented sustainability reports, cooperating with external sources to communicate transparently, and communicating their efforts internally (Choudhary & Gokarn, 2013). Marketers are now trying to use green marketing concept in developing their strategies to ensure sustainable development, thereby making GM to catch the attention of scholars and practitioners in developing countries. Marketing theory as applied to these issues remains relatively under-explored. Also, green marketing has been widely explored in developed nations of the world but appears to be at a distant dream in developing nation as studies on green marketing are conspicuously missing in the context of developing economies like India, Pakistan, Brazil, Russia, China and most Africa countries (Singh, 2015). The purpose of this study is to bridge this gap, and to advance our theoretical and empirical understanding of Sustainable consumption (SC) and GM in developing countries as a means of tackling problems associated with the impact of economic activity on the environment. This chapter therefore attempts to address the following objectives:

1. Provide a conceptual link between GM and SC;
2. Describes the status of green marketing in Nigeria and Kenya;
3. Assess respondents understanding and awareness of green products, and factors influencing GM in Kenya and Nigeria;
4. Explain reasons and strategies of using green marketing for sustainable development;
5. Analyze the basic challenges of green marketing in developing countries and
6. Suggest the possible ways of overcoming the challenges associated with green marketing and sustainable consumption.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

JUSTIFICATION OF THE PAPER

Many of the developing countries are more concerned with natural environment thereby making producers and marketer modify their behaviours in an endeavor to address the new concerns. Empirical evidences have shown that marketers are now incorporating green marketing strategies into many activities such as pricing (Kapelianis & Strachan, 1996); promotion (Davis, 1993); planning (McDaniel & Rylander, 1993); product and package design (Polonsky, *et al.,* 1997); distribution (Schlegelmilch & Robertson, 1995), retailing (Duff, 1990); customer segmentation (Balderjahn, 1988); strategic alliances (Stafford & Hartman, 1996); industrial marketing (Drumwright, 1994) and overall marketing strategy (Menon, 2013). Most green marketing literature is strongly based on the assumption that a consumer's environmental awareness is a pre-condition for green purchasing (Meyer, 2001). Public concerns over environmental deterioration in recent years have made marketers recognize the need, and value of green marketing. This chapter evaluates literature related to green marketing and sustainable consumption by digging deep into literature in this newly growing area, throw more light on the conceptual issues associated with green marketing and provide information on green consumer behavior. It also serves as a roadmap on how to organize green marketing effectively and sustainably, and intervention strategies undertaken by some developing countries to enhance green marketing and protection of consumers. The study is a tool for examining current practices in the green marketing arena, a guide for future practices that need comprehensive knowledge and direction and provide guidance for future researchers seeking to investigate corporate and market sustainable (green) development. Further, It will assist managerial audience looking for advice on how to launch or enhance green marketing efforts in Kenya, Nigeria of elsewhere, and contribute to the understanding of consumer motivations for purchasing green products. The findings will also contribute goal 12 of the new Sustainable Development Goals (SDGs) of ensuring sustainable consumption and production pattern by showing the status of the consumption of green products in the selected countries.

CONCEPTUALIZATION OF GREEN MARKETING AND SUSTAINABLE CONSUMPTION

Protection of environmental resources and developing social responsibility are very important for enterprises as well as customers and the government (Peattie & Peattie, 2009; Grinstien & Nisan, 2009). GM concept emerges from societal marketing (Kotler, 1999) introduced by the American Marketing Association (AMA) via a workshop on "Ecological Marketing" in 1975 (Zhu & Sarkis, 2015). Proceedings of the workshop resulted in one of the first books on green marketing entitled "Ecological Marketing" (Henion & Kinnear, 1976). The concept however became prominent in the late 1980s and early 1990s ((Laheri, 2014) as a result of valuable concerns for people and a healthy environment (Dodds, 2007). It is the primary segment of social marketing, because it covers the protection and preservation of the values necessary for survival, existence and development of man as a human being, reflecting the practical support for the implementation of the philosophy of sustainable development of mankind (Srinivasa, 2014).

The evolution of green marketing has three phases (Peattie, 2001). The first phase in 1980s was termed "Ecological" green marketing, and during this period all marketing activities were concerned at solving and providing remedies for environmental problems (Lee, 2008). The second phase in 1990s was termed "Environmental" green marketing and the focus shifted to clean technology that involved

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

designing of innovative new products, which take care of pollution and waste issues. GM in this phase was closely tied to issues of industrial ecology and environmental sustainability such as extended producers' liability, life-cycle analysis, material use and resource flows, and eco-efficiency (Singh & Pandey, 2012). The third phase is the "Sustainable" green marketing which marked a more radical approach to markets and marketing to meet the full environmental costs of production and consumption and create a sustainable economy. GM is rapidly growing, and is expected to get bigger in the years to come (Dangelico & Pujari, 2010).

In terms of definition, there is no universal definition of green marketing and its dimensions. For instance, GM has been described as an organization's efforts of designing, promoting, pricing and distributing products that will not harm the environment (Pride & Ferrell, 1993). While many people believe that green marketing refers solely to the promotion or advertising of products with environmental characteristics, especially in his buying decision (Panahi *et al.,* 2014). To Polonsky (2007), green marketing is a broader concept that can be applied to consumer goods and industrial goods and services. GM is view as strategies to promote products by employing environmental claims either about their attributes or about the systems, policies and processes of the firms that manufacture or sell them. It is also referred to as an initiative which primarily advocates sustainable development by incorporating activities such as product modification, change in production process, packaging, promotion and advertising (Polonsky, 2007) which Laheri (2014) referred to as green marketing strategies. All the activities are designed to generate and facilitate any exchange intended to satisfy human needs or wants, such that the satisfaction of these needs and wants occurs, with minimal detrimental impact on the natural environment (Sarkar, 2012; Laheri, 2014).

Further, GM is the adoption of environmentally friendly strategies that promote resource conservation in every stage of the value chain (Iweana, 2014). It is a marketing response to the design, production, packaging, use and disposal of product (Oyewole, 2011; Lampe & Gazda, 1995). Neeraja *et al.,* (2014) described green marketing to include all the marketing activities of the firm, starting from conceiving the product idea to the actual sale of the product, which are designed with the objective to either create a positive impact or reduce the negative impact of its products on the environment. GM is the process of selling products and/or services based on their environmental benefits or the marketing of products that are presumed to be environmentally safe (Meso & Wario, 2014). It is a holistic marketing concept where in the production, marketing, consumption and disposable of product and services happen in a manner that is less deterimental to the environment with growing awareness about the implication of global warming, non biodegradable solid waste, harmful impact of pollution etc (Katiyar & Katiyar, 2014). This study however considered GM as the process or art of creating awareness among consumers using competitive pricing, promotion and distribution strategies; which can be referred to as green marketing mix to facilitate uptake of products and services intended to satisfy human needs or wants with minimal detrimental impact on the natural environment.

GM is an emerging marketing strategy that includes a wide variety of tasks and activities like fair-trade practices, product modification, production process and packaging that are eco-friendly (Mishra & Sharma, 2008). GM includes greening products as well as greening firms and green products are those that are originally grown, recyclable, reusable and bio-degradable; products with natural ingredients; products containing recycled contents, non-toxic chemical products content under approved chemicals that do not harm and pollute the environment, products that will not be tested on animals and have eco-friendly packaging (Rath, 2013; Neeraja Rani *et al.,* 2014).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

GM has three key components (Polonsky, 1994): (i) it is a subset of marketing; (ii) it evaluates both positive and negative activities; and (iii) it examines a range of environmental issues. A common element within the definition is the explicit inclusion of environmental awareness in marketing management. GM is an integration of environmental issues into corporate marketing strategy, especially the 4P's, and green consumerism (Zhu & Sarkis, 2015).

Sustainable development (SD) on the other hands is the form of development which aims at sustainable consumption (SC) and sustainable economic growth and tries to protect the environment. We can therefore say that sustainable consumption (SC) is a part of sustainable development (SD) and a prerequisite in the world-wide struggle against sustainability challenges such as climate change, famine or environmental pollution (Lorek & Fuchs, 2013). While SD is the maintenance of long-term economic, social and environmental capital, SC becomes the way of life (Saxena & Khandelwal, 2010).

SD can be conceptually broken into three constituent parts: environmental sustainability, economic sustainability and socio-political sustainability. Realizing the importance of people's concern for a healthy environment to live and preferring environmental friendly products and services to consume, marketers these days are trying to capitalize on the same to ensure sustainable growth and using these concepts in designing their strategies. Green marketing focuses on all marketing activities while protecting the environment. On the other hand sustainable development demands that the future generations inherit the natural environment in the same state or better as inherited by the previous generations. This calls for the protection and improvement of the environment. Therefore, sustainable development is a dependent variable of green marketing and other factors (Kinoti, 2011) (See Figure 1 for more details).

Based on Kinoti (2011) framework, certain differences can be drawn between GM and the conventional marketing (See Table 1).

METHODOLOGY

The study looks at SC and GM in developing countries where it is believe that both consumers and firms are becoming more and more conscious about the environment and also becoming socially responsible. The study is built on other past studies such as Olsen *et al.,* (2014) model on GM, Kotler, (2011) essay on GM and Kinoti (2011) framework of Green Marketing. In order to analyse consumer perceptions of

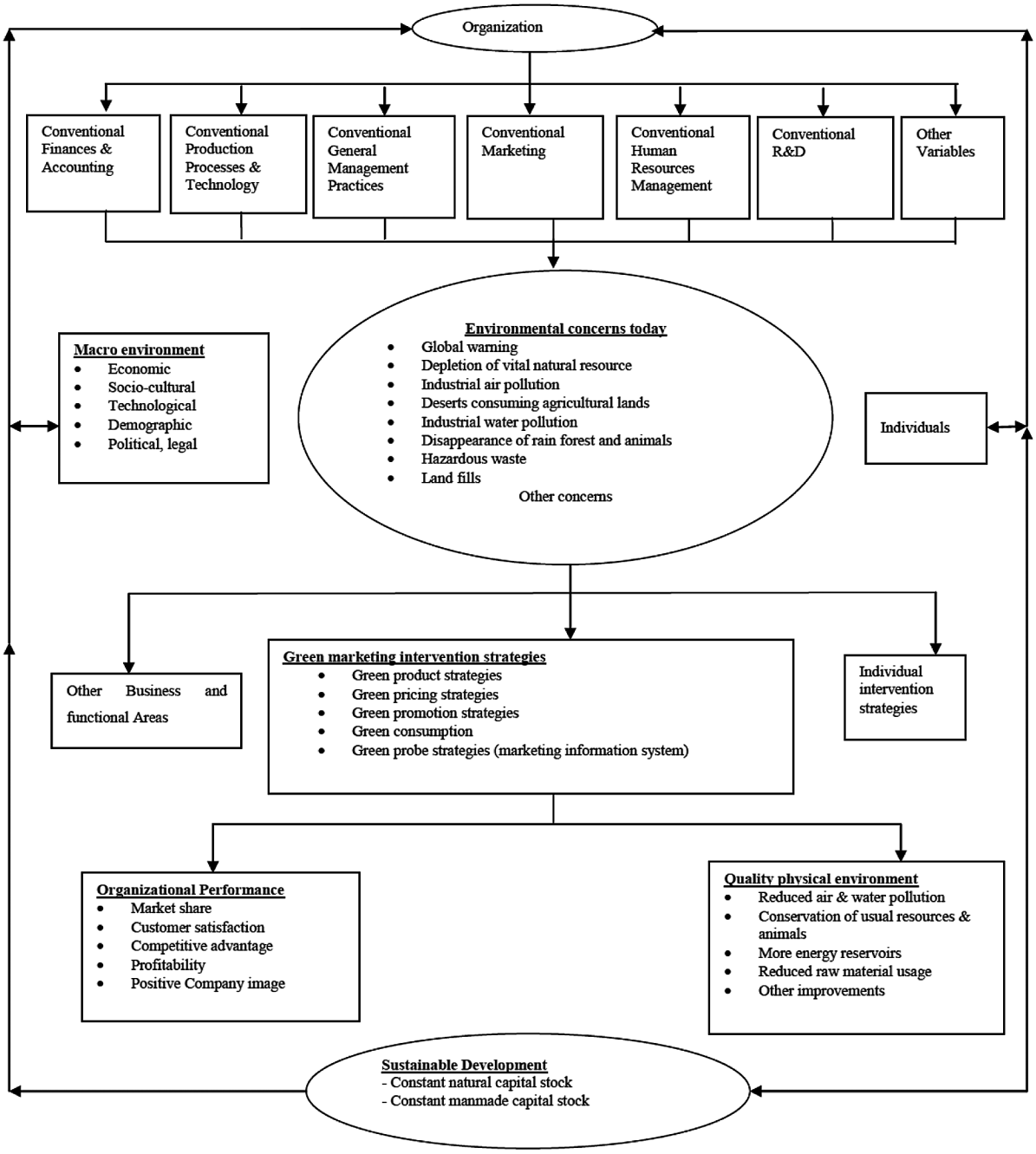
Table 1. Traditional/conventional marketing versus green marketing

Indicators	Traditional/Conventional Marketing	Green Marketing
Goals	Customer satisfaction (as customers)	Customer satisfaction (as humans)
	Accomplish traditional goals	Accomplish sustainable goals Eco-system compatibility
Decision making	Fragmented thinking	Integrated thinking
	Short term orientation	Long-term orientation
Ecological responsibility	Organization alone responsibility	Mutually responsibility
	No underpaid ecological costs	Full accounting of ecological cost
Focus	Tangible goods	Products as services

Source: Gosh (2010)

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 1. Conceptual framework of green marketing intervention strategies and sustainable development
Source: Kinoti, (2011).



green products which Chris (2010) observed as unclear in many countries, this study complements findings from literature by conducting a pilot survey in Kenya and Nigeria, using the University students, making it both exploratory and empirical in nature. The study used a structured literature review of publications in peer reviewed academic journals on green marketing and sustainable consumption. By

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

structured literature we mean a systematic, explicit, and reproducible design for identifying, evaluating, and interpreting the existing body of recorded documents (Fink, 2013). The study employed case studies of Nigeria and Kenya by conducting a pilot survey of 50 selected University students each in Nigeria and Kenya using a convenient sampling technique. Some of the students in the selected institutions which were: the Federal University of Agriculture, Abeokuta, Ogun State in Nigeria and Jomo Kenyatta University of Agriculture and Technology, Kenya were interviewed in order to obtain some relevant information about their awareness and factors influencing their purchasing decision for green products. The University students were used as case study because their views on the subject on green products are believed to reveal the true status of green products in the two countries. Students are believed to be more up to date, and use more of green products. Information collected was analyzed using the simple descriptive statistics such as frequency table and a five points likert scale.

RESULTS AND DISCUSSION OF MAJOR FINDINGS

Reasons for Using Green Marketing and Strategies to Ensure Sustainable Consumption

While going green may be in fashion, it is still unclear to some people why firms are making these changes. Green purchasing behaviour can help achieve a sustainable environment (Dagher & Itani, 2014). As organizations are facing limited natural resources, they have to develop new or alternative ways of satisfying these unlimited wants using GM which make use of the limited resources, while satisfying individual and industrial consumers wants, as well as achieving the organization's objectives without causing any harm to the environment (Orange, 2010). GM strives to ensure that production, consumption and even disposal of products in a manner that is less harmful to the environment (Mohanasudaram, 2012). Everyone wants to create and establish sustainable businesses than ever before and GM has become the mainstream as consumers want something that can impact their lives and therefore want to take corrective measures to embrace sustainability effectively. Consumers patronize the products and their aims are to make sure the contribution is supporting sustainable environment and contribution the guiding of the climate change (Hartmann & Apaolaza-Ibáñez, 2006). Green marketing helps a business to become socially responsible, provide better products and improve working conditions (Seth & Khan, 2015). The importance of going green is to save the environment by reducing the hazardous wastage, sewage, deforestation and air pollution in order to preserve and conserve the limited resources for the future generation (Kinoti, 2011). Green products are less harmful to the environment, consume natural resources less, and help in saving time, money and effort (Hartmann & Ibanez, 2006; Papista & Krystallis, 2012). While GM helps at satisfying the needs and desires of the customers, it also keep the company responsible in maintaining long term social and environmental gains (Szuster 2008; Yildirim 2014). It gives alternative picture on different food consumption patterns and lifestyle and energy mixes that could close the gap between ecological footprint and biocapacity. All areas of our economy are affected by green marketing (Zulfiqar & Shafaat, 2015), GM leads not only to protection of the environment, but it also develops job opportunities and new market (Yazdanifard & Mercy, 2011).

According to Afande (2012), GM ensures sustained long term growth along with profitability; helps in accessing the new market and enjoying competitive advantage; assist companies to market their products and services keeping the environment aspects in mind. We can therefore conclude that GM helps at: (i)

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

changing people's consciousness to ecological-friendly lifestyle and consumption (ii) engage consumers in sustainable consumption through convincing examples. GM also helps to reduce waste by using raw materials and energy-saving products, thereby making marketing of green products a profitable venture that leads to a sustainable long-term growth (Ottman 1997; Gupta & Agarwal, 2012). Competitive advantage can also be enjoyed by the companies that are first to deploy their environmental innovation. There is also an increase in brand loyalty leading to increase in market share by the company beyond healthier and more fulfilled lives offered to consumers with a reduction in air and water pollution, and depletion of natural resources through green products (Olsen, 2014).

The Strategies of Green Marketing

There exists a substantial gap or disconnect between the stated pro-environmental beliefs and actual consumption behaviors of ostensibly green consumers (Davari & Strutton, 2014). To close this gap by green marketers requires green marketing mix strategies. GM strategies refer to product modification, changes to production process, and improvements in packaging with intent of reducing the detrimental impact on the environment (Laheri, 2014). To achieve that, green marketer uses the green marketing mix strategies which include developing green-based products, green logistics, green promotion, green pricing and green consumption. The strategies include; adoption of eco-marketing orientation as a business philosophy, government intervention, undertaking life-cycle analysis and teaming up for success (Ottman, 1999; Willum, 1998). While some companies employ the 4 Ps (product, price, promotion, and place) of marketing mix, some others have 7 Ps of marketing mix. Green marketing manipulates the four elements of the marketing mix to sell products and services offering superior environmental benefits in the form of reduced waste, increased energy efficiency, and/or decreased release of toxic emissions (Singh & Pandey, 2012).

- **Product:** The ecological objectives in planning products are to reduce resource consumption and pollution and to increase conservation of scarce resources. This strategy has not been well utilized in Nigeria with a lot of pollution and prevalent high level of destruction of scarce resources such as forest resources.
- **Price:** Price is a critical and important factor of green marketing mix. Most consumers are only prepared to pay additional value if there is a perception of extra product value. This value may be improved by performance, function, design, visual appeal, or taste. Green marketing should take all these facts into consideration while charging a premium price. In our two case study countries, the prices of green products are identified to be very high and many people are not willing to pay for the premium price
- **Promotion:** There are three types of green advertising: adverts that address a relationship between a product/service and the biophysical environment; those that promote a green lifestyle by highlighting a product or service; and adverts that present a corporate image of environmental responsibility. Most promotion strategy by green marketers in our case study areas is the one that promote a green lifestyle by highlighting a product or service
- **Place:** The choice of where and when to make a product available will have significant impact on the customers. Very few customers are ready to go out of their way to buy green products in the study areas. This implies that green products have to be positioned in places where it can attract consumers' attention.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The Status of Green Marketing and Some Intervention Strategies in Nigeria and Kenya

Government of any nation wants to protect consumers and the environment. This protection has significant green marketing and sustainability implications. Government regulations relating to environmental marketing are designed to protect consumers in several ways which includes: reduction of production of harmful goods or products; modification of consumer or industry use; and ensure that all type of consumers has the ability to evaluate the environmental composition of goods (NeerajaRani *et al.,* 2014). Literature on the extent of adoption, drivers and influence of green marketing initiatives in Kenya and Nigeria, and case studies are few. The followings are some of our major findings on the two countries.

A Case of Nigeria

A recent study on green marketing by Karatu and Mat (2015) observed that in spite of global awareness towards the environment and green marketing, evidences in Nigeria revealed that only 5% of the population is engaged in green purchase behavior (Olamiyu, 2012; Karatu & Mat, 2015). Table 2 showed that about 42% of respondents in Nigeria still do not know what green products are compared to their counterparts in Kenya. The finding is in line with that of National Bureau of Statistics (NBS) which found that Nigerians have poor knowledge of green marketing and low purchasing power, with over 61.2% of the population living on less than a dollar (Abraham-Ajayi, 2013). It also corroborates the result of the findings of Jacob and Jolly (2012); Scott and Vigar-Ellis (2014) who observed that green marketing concept is not popular in developing countries. Consumer conceptions of what is green are

Table 2. Respondents understanding of 'green products'

Perception About Green Products	Nigeria		Kenya	
	Frequency*	Percentage	Frequency*	Percentage
Green colored products	40	80	21	42
Natural/organic products	48	98	49	98
Recycled/recyclable products such as shoes	21	42	42	84
Bio-degradable products	22	44	43	86
Vegetarian products	20	40	15	30
Fresh products	40	80	21	42
Herbal products	35	70	40	80
Healthy products	50	100	50	100
Good quality products	20	40	27	54
Highly priced products	45	90	43	86
Products made from wood such as note book from bamboo, desk from wood etc	17	34	32	64
Energy saving products such as solar calculator, bulbs etc	30	60	46	92

Source: Survey, 2015.
Note: * Multiple responses.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

generally inconsistent, and do not correspond with the prevailing views on sustainability. Findings from this study show that, inadequate green knowledge among the sampled respondents (Tables 2 and 3), lack of government control, high price of green product and distrust towards green products (Table 4) are some of the reasons while green marketing/products is not gaining popularity in Nigeria. This indicates that many respondents are yet to know what is green or not green. Therefore, their failure to adopt green behaviours can be ascribed to knowledge deficit which can be corrected by informational campaigns.

Rettie *et al.,* (2012) shows how consumer perceptions of the extent to which behaviours are normal or not normal can be identified and used in the design of sustainability marketing strategies. Products such as cans, tins, cellophane etc are disposed by consumers in Nigeria with little or no efforts at recycling them thereby contributing to environmental degradation (Gbadeyan & Omolekan, 2015). We found that even though green marketing builds customers loyalty and brand recognition, many manufacturers in Nigeria are still of the opinion that customer may not be willing to pay high price for environmental friendly products if they go into such business.

The most important factors affecting purchase decision of green products in Nigeria is concern for health and environment, followed by social awareness and value, and the absence of marketing as the third important factor (Table 4). Green products are always more expensive than the regular ones and Nigerians, being a mass-oriented market, always go for lowest prices. Despite these challenges of green marketing in Nigeria, Ahmad (2014) observed that if green marketing is properly exploited in Nigeria through provision of enabling environment and structure for eco-friendly products, it can serve as a solution to the vulnerable and volatile environmental situation.

Other findings also revealed that there is no well known record of consumerist movements or activists presently in Nigeria (Ogechukwu, 2013). But in the early 1970s due to industrialization and mass production of goods, coupled with increased education and sophistication of the buyers/consumers, there were

Table 3. Awareness by the respondents of the presence of 'green products in the market

Green Products	Nigeria		Kenya	
	*Frequency	Percentage	*Frequency	Percentage
Don't know	21	42	5	10
Notebook case made from bamboo	0	0	30	60
Recycled shoes	29	58	48	96
Less energy consumption mobile phone	0	0	27	54
Wooden desk	50	100	47	94
Pure soap powder	35	70	15	30
Herbal products	25	50	33	66
Paper bag made from 100% natural latex	7	14	21	42
Organic products	27	54	43	86
Carbon credits	0	0	0	0
Recycled water	0	0	21	42
Solar-powered calculator	0	0	40	80
Solar bulbs, solar fan etc	30	60	49	98

Note: * Multiple responses.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 4. Factors affecting green marketing

	Factors	Responses From Sample in Nigeria					Responses From Sample in Kenya				
		VI	I	U	NI	LI	VI	I	U	NI	LI
Factor 1: Concern for Health and Environment											
1	Awareness of green product like fuel efficient vehicles should be spread	50	0	0	0	0	50	0	0	0	0
2	Concerned about me and my family's health	50	0	0	0	0	50	0	0	0	0
3	The uses of green product can save the earth	9	13	21	10	7	7	21	11	7	4
4	Consumption of green products will positively affect the environment	27	13	8	2	0	9	18	19	1	3
5	When I have a choice between two equal products, I always purchase the one which is less harmful to other people and the environment	20	8	16	5	1	27	14	9	0	0
6	I am concerned about my environment	16	9	17	5	3	21	16	7	5	1
Factor Mean Score		**4.27**					**4.23**				
Factor 2: Eco-Buying Attitude											
1	I make every effort to buy paper products made from recycled paper	3	2	11	18	16	14	2	12	12	10
2	I use a low-phosphate detergent (or soap) for my laundry	11	15	13	7	4	16	18	9	3	4
3	I have convinced members of my family or friends not to buy some products which are harmful to the environment	15	20	10	3	2	17	20	5	3	5
4	I try only to buy products that can be recycled	1	1	10	8	30	5	17	13	7	8
5	I promote environmental awareness by working in different social campaign	0	0	48	1	1	9	10	20	7	4
Factor Mean Score		**2.66**					**3.34**				
Factor 3: Social Responsibility											
1	To save energy, I use public transport as much as possible	0	0	0	5	45	5	6	11	17	11
2	I buy energy efficient household appliances	43	7	0	0	0	48	2	0	0	0
3	I have switched products for ecological reasons	2	3	13	12	20	7	21	13	5	3
Factor Mean Score		**2.75**					**3.64**				
Factor 4: Eco-Certification											
5	I look for eco friendly certification while buying any product	3	7	8	11	21	13	20	11	5	1
6	Quality is the only criteria when I look green product	7	10	12	10	11	12	12	9	10	7
Factor Mean Score		**2.52**					**3.51**				
Factor 5: Social Awareness and Value											
1	I get value for money while buying Green Product	14	20	10	3	3	37	11	1	1	0
2	There are campaigns to provide awareness of saving environment	18	15	7	7	3	31	18	1	0	0

continued on following page

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 4. Continued

Factors		Responses From Sample in Nigeria					Responses From Sample in Kenya				
		VI	I	U	NI	LI	VI	I	U	NI	LI
3	Nowadays people are more environment friendly than ever	32	6	6	6	0	45	5	0	0	0
Factor Mean Score		**3.94**					**4.73**				
Factor 6: Lifestyle											
1	It is prestigious to buy green products	12	11	7	12	8	3	12	6	18	11
2	Green products are high quality products	5	10	19	10	6	12	17	10	6	5
Factor Mean Score		**3.05**					**3.03**				
Factor 7: Absence of Marketing											
1	The green products are not well promoted in the market	19	21	3	2	5	7	5	6	21	11
2	The green products are not available at affordable prices	18	20	2	5	5	11	10	12	10	7
Factor Mean Score		**3.88**					**2.84**				
Factor 8: Promotion											
1	I look for good offers to buy green products	13	17	10	7	3	9	10	7	11	13
2	I look for variety while buying eco-friendly products	5	10	16	13	6	8	8	10	7	17
Factor Mean Score		**3.25**					**2.74**				
Factor 9: Brand Consciousness											
1	I am not brand conscious for eco friendly products	14	10	11	5	10	13	11	8	15	3
Factor Mean Score		**3.26**					**3.32**				
Factor 10: Indifferent Attitude											
1	I usually purchase the lowest priced product, regardless of its impact on society	20	21	3	2	4	11	15	10	4	10
2	Since one person cannot have any effect upon pollution and natural resource problems, it doesn't make any difference what I do	13	12	5	12	8	10	9	3	12	16
Factor Mean Score		**3.61**					**2.88**				
Factor 11: Packaging											
1	Packaging attracts me to buy green products	10	21	7	7	5	17	20	4	5	3
Factor Mean Score		**3.48**					**2.88**				
Factor 12: Trust and Government Regulation											
1	I have very strong trust in green product been sold	2	1	2	10	35	20	15	5	7	3
2	I purchase because of strong government control and implementation	5	7	3	17	18	16	13	8	6	7
Factor Mean Score		**1.93**					**3.67**				

Source: Field survey, 2015.

Note: 5 = very important (VI) 4= important (1), 3 = Undecided (U), 2 = not important NI), 1= not very important/ least important (LI), Total number of respondents in each category, Mean score (MS) =summation of rating point ×number of observation divide by Total number of respondents in each category

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

greater demand for quality products and the need to be informed in the country. Many of the consumers complained to the consumer protection unit, a section established in the Federal Ministry of Trade to take care of the problems of the consumers from the activities of most business organizations. There were journalistic exposures, especially in the print and electronic medium where newspaper and magazines have dedicated consumer rights page sections (Ogechukwu, 2013). The electronic media also dedicated airtime towards exposing the deficiencies in business practices and in the products. The Federal Radio Corporation of Nigeria, the Nigeria Television Authority, the African Independent Television and Ray Power were in the vanguard of the exposures. There were also new laws by the legislature and a growing numbers of pressure groups in most commercial cities such as: Aba in Abia State, Lagos, Onitsha in Anambra State, Ibadan in Oyo State, Kaduna and Kano. These pressure groups put more restraints on marketers and producers with conditions that marketers have to clear their plans with the company's legal, public-relations, public affairs, and the consumer affairs department before sales of green products.

The Case of Kenya

Kenya like other countries in the world has been implementing sustainable development and embracing eco-friendly technologies. In order to enhance efficiency in the use of natural resources and energy, the industrial sector has embraced cleaner production technologies through technical assistance by the Kenya National Cleaner Production Centre (National Environment Management Authority, 2012). As an evidence, this study revealed in Tables 2 and 3 show that respondents in Kenya have more understanding of green products than their Nigerian counterparts. This may not be unconnected with the influence of pressure groups, wider media coverage and more stringent legislation which are considered to be major factors that led to the increase in environmental behaviors (Aitken, 2006; Melillo, *et al.,* 2006). Table 4 shows that social awareness and value is the most important factor influencing green marketing in Kenya, followed concern for health and environment, and social responsibility respectively.

The Consumers Federation of Kenya (Cofek) is Kenya's independent, self-funded, multi-sectoral, non-political and apex non-profit Federation committed to consumer protection, education, research, consultancy, litigation, anti-counterfeits campaign and business rating on consumerism and customer-care issues. The green revolution in Europe, where Kenya sells most of her floricultural products, is putting immense pressure on the Kenyan firms to conform or lose out. Consumers are aware of the global pattern of labor rights, occupational safety and health and environmental abuses and have pressed on for sustainable cultivation of flowers (Meso & Wario, 2014).

Studies on green marketing from literature reviewed in Kenya include a study by Kiongera (2003) who surveyed green marketing practices in Bamburi cement in Kenya; Obuya (2003) who carried out a survey of the extent to which manufacturing firms in Nairobi practice green marketing; Kalama (2007) undertook a study on the green marketing practices by Kenya Petroleum refineries; Odhiambo (2008) surveyed the extent to which floricultural firms in Kenya practice green marketing; and Thiong'O (2009) undertook an investigation of green marketing practices among pharmaceutical firms in Kenya. Thiong'O (2009) observed that green marketing concept has not been fully embraced by the pharmaceutical industry due to lack of information although companies are trying to put in place several measures on green product, green pricing, green promotion and green distribution. The ongoing activities of the firm according to Thiong'O (2009) include: conserving energy, water and material resources in production to avoid wastages and improve efficiency, product production that meet the legal specifications, product production that do not harm animals and humans. Afande (2012) examined the relative influence of

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

drivers for adoption of green marketing in Kenya tea firms and a similar study in 2015 to analyze the extent of adoption of green marketing practices by Kenya tea firms and found that regulations, customer pressure, expected business benefits positively influence adoption and corporate social responsibility positively influences adoption of green marketing by the Kenya tea firms. Meso and Wario (2014) in their study on the determinants of the adoption of green marketing strategies in Kenya's floriculture industry established that both stakeholder pressure and regulatory pressure have a significant influence on the adoption of green marketing strategies.

Challenges of GM, and Factors Influencing Adoption of Green Products in Developing Countries

The need for sustainable marketing practices is a new challenge for marketing scholars (Kotler, 2011). There is still generally lack of standard or public consensus about what constitutes "green". As a result of this, consumers in most developing countries like Pakistan, Nigeria, Kenya no longer trust green products claims (Ali *et al.,* 2011). Establishment of credibility through a comprehensive plan is a major challenge of effective green marketing in developing countries. Companies are often reluctant to promote their attributes, and consumers are often skeptical about claims (Newton & Harte, 1997; Iweama, 2014). In a recent study on green marketing in Nigeria, lack of appropriate strategies for effective application of green marketing is observed as a major challenge (Gbadeyan & Omolekan, 2015). Green marketing strategies are expensive and difficult to implement in the short-run and the benefits to the environment are intangible, indirect or insignificant to consumers, difficult to measure and quantify (Kinoti, 2011). Other challenges facing green marketing in developing countries are however include: lack of government incentives, financial costs of altering processes, products and waste management (Thiong'O, 2009), lack of factual information about the green marketing concept to both the industry and to the consumers or the type of green marketing communications message to which consumers are exposed (Grimmer & Woolley, 2014). Cultural and institutional differences also affect green behaviour in Africa. An individual's consumption behaviour is a result of the individual culture value system developed over time as they socialize in a particular group which in turn is influenced by regional sub-cultures and familial values (Luna & Gupta 2001; Brosekhan & Velayutham, 2008). Cultural norms, and values relating to the environment and society lead to different patterns of green consumer behaviour (Peattie, 1995) while cconsumers attitudes on the government's role, and their personal norm towards environment have also been reported as having significant effect to their attitude toward green product (Tan & Lau, 2010).

In countries like India for example, the initial cost of green products is still considered as been high and consumers are price sensitive, many people are still less aware about "Eco-Mark" green washing or green sheen coupled with lack of standardization are still big challenges confronting green marketing (Govind, 2014).

Green purchase behavior in many developing countries is hampered by factors such factors like the consumer characteristics (gender, income, age, etc.), green product price, absence of environmental consciousness, situational factors and additional monetary incentives (Drozdenko *et al.,* 2011). Studies (Brecard *et al.,* 2009; Jansson *et al.,* 2009; Quah and Tan, 2010) revealed that high-income and well-educated individuals are willing to pay more for green products than the low-income and less educated. This shows that the levels of education and income have significant positive effect on the adoption of green products. Pricing the green product is also very important (Ewing, 2009). Eco-friendly products are more expensive than standard products because of the high manufacturing costs (Green & Peloza,

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

2011; Olson, 2013). In addition to these, the quantity of green messages, product type, and their source credibility influence the extent to which new green products change brand attitude (Olsen *et al.,* 2014).

CONCLUSION AND RECOMMENDATIONS

Green marketing is a part of corporate social responsibility, with focus on the environmental responsibility. Green marketing has the potential to contribute to the establishment of more sustainable form of society even though it is still at infancy stage in developing countries when compared with developed countries. In recent time, the concept is gaining ground in developing countries as one of the key business strategies of the future and a viable solution to address environmental problems (such as pollution, acid precipitation, threat to earth ozone layer, accumulation of greenhouse gasses, agricultural land consumed by deserts, vital habitual resources which are fastly depleted), improvement of organizational performance, better physical environment which will eventually lead to sustainable development. Using green marketing goes with some potential challenges that must be overcome. These include the issue of uprightness and straightforwardness.

Consumers are looking for green products as the companies want to turn into green, but there is a need for sincerity of the green products. In order to ensure the confidence of the consumers without breaching any laws or standards of products and business practices, the marketers of the green products have a moral and more socially responsibility of being transparent in describing what they are actually doing for green marketing. Companies should also realize that their products can only be certified green by a third party using the popular Green Certifications. The use of self-certification by some companies will not be credible, a third party needs to be able to review and approve the certification processes.

Enough information regarding promotion of green products and their features appears not to have been done in Nigeria and Kenya. Consumers need information about a business to evaluate its claims and reputation. Therefore, green product marketing companies should promote awareness of their products' histories, including origin and manufacturing. Green marketing tools, such as eco-label, eco-brand and environmental advertisement, will make perception easier and increase awareness of attributes and characteristics of green products. Government can boost green knowledge through educative campaign programs and by enforcing green agenda. Consequently, enhanced knowledge on green products will correct the biased impression on green products. Government can also mandate the firms to become more responsible by encouraging the firms/marketers to change their environmental marketing activities but while doing that, there must be a strong policy to protect the consumers.

Limitations and Suggestions for Future Research

The results of this research are only limited to sample of the exploratory study of two universities (one in Nigeria and the second in Kenya). Subsequent studies should include a cross-section of the Nigeria and Kenya population. Future research can even go as far as embarking on regional comparisons or analyze the gap on green marketing and consumerism in developing and developed countries. The study on the social norms is also suggested to be included in future research to compare its impact on green products. Attention should be devoted to examining the effects of perceived consumer effectiveness on environmental attitudes, green purchase intention and green buying commitment. Investigation of psychographics will also be very important in African green consumerism studies.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

REFERENCES

Abraham-Ajayi, A. (2013). *Is Green marketing meant for the Nigerian market?* Retrieved July, 6, 2015 from http://demo.conceptplex.com.ng/index.php/2013-08-02-11-33-44/24-welcome-to-caritas-debates#.VaA80LXsV15

Afande, F. O. (2012). Drivers for adoption of green marketing by Kenya tea firms. *Scholarly Journal of Business Administration*, *2*(5), 90–100.

Afande, F. O. (2015). Extent of Adoption of Green Marketing Strategies by the Kenya Tea Firms. *Journal of Marketing and Consumer Research*, *11*(1), 132–153.

Ahad, A. Y. (2014). A synthesis of green marketing concept as a recipe for healthy environment in Nigeria. *International Journal of Business Management and Administration*, *3*(1), 1–8.

Aitken, L. (2006). Green works. *Campaign (UK)*, *28*, 26–27.

Akenji, L. (2014). Consumer scapegoatism and limits to green consumerism. *Journal of Cleaner Production*, *63*(15), 13–23. doi:10.1016/j.jclepro.2013.05.022

Ali, A., Khan, A. A., Ahmed, I., & Shahzad, W. (2011). Determinants of Pakistan Consumers' Green Purchase Behavior: Some Insights from a Developing Country. *International Journal of Business and Social Science*, *2*(3), 217–226.

Ali, A. J., & Wisniesk, J. M. (2010). Consumerism and ethical attitudes: An empirical study. *International Iournal of Islamic and Middle Eastern Finance and Management*, *3*(1), 36–44. doi:10.1108/17538391011033852

American Marketing Association. (2010). *Defining Green Marketing*. Retrieved July, 6, 2015 from http://dstevenwhite.com/2010/08/04/defining-green-marketing/

Balderjahn, I. (1988). Personality variables and environmental attitudes as predictors of ecologically responsible consumption patterns. *Journal of Business Research*, *17*(1), 51–56. doi:10.1016/0148-2963(88)90022-7

Boztepe, A. (2012). Green Marketing and Its Impact on Consumer Buying Behavior. *European Journal of Economic and Political Studies*, *5*(1), 5–21.

Brecard, D., Hlaimi, B., Lucas, S., Perraudeau, Y., & Salladarre, F. (2009). Determinants of demand for green products: An application to eco-label demand for fish in Europe. *Ecological Economics*, *69*(1), 115–125. doi:10.1016/j.ecolecon.2009.07.017

Brosekhan, A. A., and Velayutham, C. M. (2008). Consumer Buying Behaviour – A Literature Review. *IOSR Journal of Business and Management, 1*, 17-24.

Choudhary, P., & Gokarn, S. (2013). Green Marketing: A Means for Sustainable Development. *Journal of Arts*, *Science & Commerce*, *3*(3), 26–32.

Chris, E. (2010). What Green Means to Consumers and the Industry. Dealer Scope, 52(3), 26.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Dagher, G. K., & Itani, O. (2014). Factors influencing green purchasing behaviour: Empirical evidence from the Lebanese consumers. *Journal of Consumer Behaviour*, *13*(3), 188–195. doi:10.1002/cb.1482

Davari, A., & Strutton, D. (2014). Marketing mix strategies for closing the gap between green consumers' pro-environmental beliefs and behaviors. *Journal of Strategic Marketing*, *22*(7), 563–586. doi:10.1080/0965254X.2014.914059

Davis, J. J. (1993). Strategies for environmental advertising. *Journal of Consumer Marketing*, *10*(1), 19–36. doi:10.1108/07363769310039102

Dodds, J. (2007). *Green Marketing 101*. Retrieved online on the 1st April, 2015 at http://makemarketinghistory.blogspot.com/2007/05/%20green-marketing-101.html

Drozdenko, R., Jensen, M., & Coelho, D. (2011). Pricing of green products: Premiums paid, consumer characteristics and incentives. *International Journal of Business, Marketing, and Decision Sciences*, *4*(1), 106–116.

Drumwright, M. E. (1994). Socially Responsible Organizational Buying: Environmental Concern as a Noneconomic Buying Criterion. *Journal of Marketing*, *58*(July), 1–19. doi:10.2307/1252307

Duff, M. (1990). Springtime in marketing: Will supermarkets find gold in the "green" issue? Loblaw's, Wal-Mart, and others are betting they can. *Supermarket Business*, *45*(4), 15–45.

Ewing, J. (2009). Diamler: the dawning of the age of electric cars. *Bloomberg Business Week*. Retrieved October 30, 2015 from www.businessweek.com

Fink, A. (2013). *Conducting research literature reviews: from the Internet to paper*. New York: Sage Publications.

Gbadeyan, R. A., & Omolekan, O. J. (2015). Relevance of Green Marketing on Environmental Degradation: An Empirical Study of Consumers' of Green Products in Benin- City, Nigeria. *University of Mauritius Research Journal*, *21*(1), 1–23.

Gosh, M. (2010). Green marketing: A changing concept in changing time. *BVIMR Management Edge*, *4*(1), 82–92.

Govind, T. R. (2014). Green Marketing in India: Emerging Opportunities and Challenge. *Asian Journal of Management Sciences*, *02*(03), 111–115.

Green, T., & Peloza, J. (2011). How does corporate social responsibility create value fpr consumers? *Journal of Consumer Marketing*, *28*(1), 48–56. doi:10.1108/07363761111101949

Grimmer, M., & Woolley, M. (2014). Green marketing messages and consumers' purchase intentions: Promoting personal versus environmental benefits. *Journal of Marketing Communications*, *20*(4), 231–250. doi:10.1080/13527266.2012.684065

Grinsteian, A., & Nisan, U. (2009). Demarketing, minorities and marketing attachment. *Journal of Marketing*, *73*(2), 105–122. doi:10.1509/jmkg.73.2.105

Gupta, M., & Aggarwal, K. (2012). Concern about green marketing: legend or myth. *Journal of Research in Finance and Marketing*, *2*(9), 10-21.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Hartmann, P., & Ibanez, V. A. (2006). Green Advertising revisited. *International Journal of Advertising*, *28*(4), 715–739. doi:10.2501/S0265048709200837

Henion, K. E., & Kinnear, T. C. (1976). *Ecological Marketing*. Chicago: American Marketing Association.

Iweama, V. O. (2014). Implications of Green Marketing for a Developing Economy. *Journal of Pristine*, *9*(1), 1–12. Retrieved from http://www.globalacademicgroup.com/journals/pristine/IMPLICATIONS%20OF%20GREEN%20MARKETING.pdf

Jacob, C., & Jolly, J. (2012). Green Marketing: A Study of Consumers' Attitude towards Environment Friendly Products. *Canadian Center of Science and Education*, *8*(12), 117–126.

Jansson, J., Marell, A., & Nordlund, A. (2009). Elucidating green consumers: A cluster analytic approach on proenvironmental purchase and curtailment behaviors. *Journal of Euromarketing*, *18*(4), 245–267. doi:10.9768/0018.04.245

Kalama, E. (2007). *Green marketing practices by Kenya petroleum refineries. A study of the perception of management of oil companies in Kenya. Unpublished MBA project*. Kenya: University of Nairobi.

Kapelianis, D., & Strachan, S. (1996). The price premium of an environmentally friendly product. *South African Journal of Business Management*, *27*(4), 89–95.

Karatu, V. M. H., & Mat, K. N. (2015). Predictors of Green Purchase Intention in Nigeria: The Mediating Role of Environmental Consciousness. *American Journal of Economics*, *5*(2), 291–302.

Kassaye, W. W. (2001). Green dilemma. *Marketing Intelligence & Planning*, *19*(6), 444–455. doi:10.1108/EUM0000000006112

Katiyar, A., & Katiyar, N. (2014). Conceptual study on challenges and opportuinty of green marketing in developing countries. *International Journal of Management and Commerce Innovations*, *2*(1), 218–225.

Kinoti, M. W. (2011). Green marketing intervention strategies and sustainable development: A conceptual paper. *International Journal of Business and Social Science*, *2*(23), 263–273.

Kiongera, F. N. (2003). Green marketing practices in cement industry in Kenya. (Unpublished MBA). University of Nairobi, Kenya.

Kotler, P. (1999). *Marketing Management: The Millennium Edition*. New Delhi: Prentice Hall of India.

Kotler, P. (2011). Reinventing marketing to manage the environmental imperative. *Journal of Marketing*, *75*(4), 132–135. doi:10.1509/jmkg.75.4.132

Kotler, P., & Armstrong, G. (2010). *Principles of Marketing* (13th ed.). Prentice Hall.

Kumar, P. K., & Anand, B. (2013). Book Review: Green Marketing: Theory, Practice, and Strategies. *Indian Journal of Marketing*, *43*(1), 54–56. doi:10.17010/ijom/2013/v43/i1/34043

Laheri, V. K., Dangi, H., & Vohra, A. (2014). Green Marketing: Development of Construct and Its Evolution. *Asia-Pacific Journal of Management Research and Innovation*, *10*(2), 147–155.

Lee, K. (2008). Opportunities for green marketing: Young consumers. *Marketing Intelligence & Planning*, *26*(6), 573–586. doi:10.1108/02634500810902839

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Lorek, S., & Fuch, D. (2013). Strong Sustainable Consumption Governance - Precondition for a Degrowth Path? *Journal of Cleaner Production*, *38*, 36–43. doi:10.1016/j.jclepro.2011.08.008

Luna, D., & Gupta, S. F. (2001). An integrative framework for cross-cultural consumer behavior. *International Marketing Review*, *18*(1), 45–69. doi:10.1108/02651330110381998

McDaniel, S. W., & Rylander, D. H. (1993). Strategic green marketing. *Journal of Consumer Marketing*, *10*(3), 4–10. doi:10.1108/07363769310041929

Melillo, W., Miller, S., & Solman, G. (2006). Companies find it's not easy marketing green. *Brandweek*, *47*(8), 26–27.

Menon, A., & Menon, A. (2013). Enviropreneurial Marketing Strategy: The Emergence of Corporate Environmentalism as market strategy. *Journal of Marketing*, *61*(1), 51–67. doi:10.2307/1252189

Meso, M., & Wario. (2014). Determinants of the adoption of green marketing strategies in Kenya's floriculture industry. *The Strategic Journal of Business and Change Management, 2*(41), 775-790.

Meyer, A. (2001). What's in it for Customers: Successfully Marketing Green Clothes. *Business Strategy and the Environment*, *10*(5), 317–330. doi:10.1002/bse.302

Mishra, P., & Sharma, P. (2008). Green marketing: Challenges and opportunities for business. *Journal of Marketing Communications*, *8*(1), 35–41.

Mohanasundaram, V. (2012). Green Marketing: Challenges and Opportunities. *International Journal of Multidisciplinary Research*, *2*(4), 66–73.

Nandini, M.D (2011). A conceptual framework on green marketing: A tool for sustainable development. *International Journal for Sales and Marketing Management*, *1*(1), 1-16.

National Environment Management Authority. (2012). *Green Initiatives in Kenya. Published by*. Kenya: National Environment Management Authority.

NeerajaRani, A. K., Aravind, J., & Prasad. (2014). Green Marketing and Its Impact. *British Journal of Marketing Studies*, *2*(8), 45–48.

Newton, T., & Harte, G. (1997). Green business: Technicist kitsch? *Journal of Management Studies*, *34*(1), 75–98. doi:10.1111/1467-6486.00043

Obuya, E. N. (2003). A Survey of the Extent to Which Manufacturing Firms in Nairobi Practice Green Marketing. (Unpublished MBA). University of Nairobi, Kenya.

Odhiambo, S. A. (2008). A Survey of the Extent to Which Floricultural Firms in Kenya Practice Green Marketing. (Unpublished MBA). University of Nairobi, Kenya.

Ogechukwu, A. D. (2013). Consumerism the Shame of Marketing in Nigeria: Challenges to Corporate Practices. *Universal Journal of Management and Social Sciences*, *3*(3), 49–71.

Olamiyu, E. (2012). Preparing Nigerian Market for Green Products. *National Mirrow*, *29*(3).

Olsen, M. C., Slotegraaf, R. J., & Chandukala, S. R. (2014). Green Claims and Message Frames: How Green New Products Change Brand Attitude. *Journal of Marketing*, *78*(5), 119–137. doi:10.1509/jm.13.0387

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Orange, E. (2010). From eco-friendly to eco-intelligent. *The Futurist*, (September–October), 28–32.

Ottman, J. A. (1999). Achieving sustainability out of the box thinking regarding environmentally preferable products and services Greener marketing: a global perspective on green marketing practice. Green leaf Publishing Limited.

Panahi, M., Keivandarian, A., & Azizi, A. (2014). Investigating the Consumer Attitude toward Green Marketing. *European Journal of Business and Management*, *4*(11), 1–5.

Papista, E., & Krystallis, A. (2013). Investigating the Types of Value and Cost of Green Brands: Proposition of a Conceptual Framework. *Journal of Business Ethics*, *115*(1), 75–92. doi:10.100710551-012-1367-6

Peattie, K., & Crane, A. (2005). Green marketing: Legend, myth, farce or prophesy? *Qualitative Market Research*, *8*(4), 357–370. doi:10.1108/13522750510619733

Peattie, K. A., & Peattie, S. (2009). Social marketing: A pathway to consumption reduction. *Journal of Business Research*, *62*(2), 260–268. doi:10.1016/j.jbusres.2008.01.033

Polonsky, M. (1995). A stakeholder theory approach to designing environmental marketing strategy. *Journal of Business and Industrial Marketing*, *10*(3), 29–46. doi:10.1108/08858629510096201

Polonsky, M. J. (2007). An introduction to Green marketing. *Electronic Green Journal*, *1*(2), 1–10.

Polonsky, M. J., Carlson, L., Grove, S., & Kangun, N. (1997). International environmental marketing claims: Real changes or simple posturing? *International Marketing Review*, *14*(4), 218–232. doi:10.1108/02651339710173426

Pride, W., & Ferrel, O. (1993). Marketing. Academic Press.

Quah, S., & Tan, K. G. (2010). Consumer purchase decisions of organic food products: An ethnic analysis. *Journal of International Consumer Marketing*, *22*(1), 47–58. doi:10.1080/08961530902844949

Rath, R. C. (2013). An Impact of Green Marketing on Practices of Supply Chain Management in Asia: Emerging Economic Opportunities and Challenges. *Int. J. Sup. Chain Mgt.*, *2*(1), 78–86.

Rettie, R., Burchell, K., & Riley, D. (2012). Normalising green behaviours: A new approach to sustainability marketing. *Journal of Marketing Management*, *28*(3/4), 420–444. doi:10.1080/0267257X.2012.658840

Sahu, T. (2012). *Green Marketing: An Attitudinal and Behavioral Analysis of Consumers in Pune*. (Unpublished PhD Thesis). Symbiosis International University Pune.

Saleena, T. A., & Basheer, A. P. V. (2015). Green Marketing Initiatives: A Conceptual Study. *EPRA International Journal of Economic and Business Revie*, *3*(6), 181–187.

Sarkar, A. (2012). Green Marketing and Sustainable Development challenges and Opportunities. *International Journal of Marketing*, *Financial Services and Management Research*, *1*(9), 120–134.

Saxena, R., & Khandelwal, P. K. (2010). Can Green Marketing be used as a tool for Sustainable Growth? A Study Performed on Consumers in India- An Emerging Economy. *The International Journal of Environmental, Cultural*, *Economic and Sustainability*, *6*(2), 277–291.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Schlegelmilch, B. B., & Robertson, D. (1995). The influence of country and industry on ethical perceptions of senior executives in the US and Europe. *Journal of International Business Studies*, *26*(4), 852–881. doi:10.1057/palgrave.jibs.8490823

Scott, L., & Vigar-Ellis, D. (2014). Consumer understanding, perceptions and behaviours with regard to environmentally friendly packaging in a developing nation. *International Journal of Consumer Studies*, *38*(6), 642–649. doi:10.1111/ijcs.12136

Seth, S., & Khan, M. S. (2015). Green Marketing: Solving Dual Purpose of Marketing and Corporate Social Responsibility. *Management Studies and Economic Systems*, *1*(3), 181–188.

Shah, J. R., Abdullah, I. K., & Mohammad, T. I. (2014). Factors Affecting Green Marketing in Bangladesh. *Global Journal of Management and Business Research: E-Marketing*, *14*(1), 44–49.

Singh, E. R. (2015). Green marketing: A paradigm shift in the world of conventional marketing. *International Journal of Multidisciplinary Research and Development*, *2*(1), 268–270.

Singh, P. B., & Pandey, K. K. (2012). Green Marketing: Policies and practices for Sustainable Development. *Integral Review-. Journal of Management*, *5*(1), 22–30.

Srinivasa, R. O. (2014). Green Marketing and Its Impact on Sustainable Development. *International Journal of Innovative Technology & Adaptive Management*, *1*(5), 39–45.

Stafford, E. R., & Hartman, C. L. (1996). Green alliances: Strategic relations between businesses and environmental groups. *Business Horizons*, *2*(1), 50–59. doi:10.1016/S0007-6813(96)90023-3

Tan, B. C., & Lau, T. C. (2010). Attitude towards the Environment and Green Products: Consumers' Perspective. *Management Science and Engineering*, *4*(2), 27–39.

Tanner, C., & Kast, S. W. (2003). Promoting sustainable consumption: Determinant of green purchases by Swiss consumers. *Psychology and Marketing*, *20*(10), 883–902. doi:10.1002/mar.10101

Thiong'o, S. M. (2009). *An Investigation of Green Marketing Practices among Pharmaceutical Firms in Kenya. Unpublished MBA project*. Kenya: University of Nairobi.

UNEP. (2010). *ABC of SCP Clarifying concepts in sustainable consumption and production*. United Nations Environment Programme, 2010. Retrieved September 3, 2015 from https://sustainabledevelopment.un.org/content/documents/945ABC_ENGLISH.pdf

Willums, J. O. (1998). *The sustainable business challenge: A briefing for tomorrows business leaders*. Greenleaf publishing. doi:10.9774/GLEAF.978-1-909493-04-9_8

Yildirim, E. (2014). An Investigation on the Additional Cost of Green Products: The Willingness to Pay of University Students. *Journal of Sustainable Development Studies*, *7*(1), 132–146.

Zhu, Q., & Sarkis, J. (2015). *Green Marketing and Consumerism in China: Analyzing the Literature.* Working Paper WP1-2015.

Zulfiqar, Z., & Shafaat, M. (2015). Green Marketing: Environmental Concern and Customer Satisfaction. *European Journal of Business and Management*, *7*(1), 115–126.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

KEY TERMS AND DEFINITIONS

Brand: A name, term, sign, symbol, or design, or the combination of them, intended to identify the goods or services of one seller or group of sellers and to differentiate them from those of a competitor.

Consumer Attitudes: A composite of a consumer's beliefs, feelings, and behavioural intentions toward some object within the context of marketing (Ali and Wisniesk, 2010).

Consumer Purchasing Behavior: Final consumer behavior during the purchase. There are four types of purchase behavior: Complex purchase behavior, those purchasing behaviors that seek variety, purchasing behavior that seeks to reduce tensions after purchase and normal purchasing behavior (Kotler and Armstrong, 2010).

Consumer Social Responsibility (CSR): Decision making linked to environmental stewardship, ethical values, stringent compliance with legal requirements and respect for communities and the environment in totality (Seth and Khan, 2015).

Consumerism: A social movement seeking to augment the rights and powers of consumers in relation to sellers (Kotler, 1999).

Eco-Brand: A name, symbol or design of products that are harmless to the environment.

Eco-Efficiency: This is usually calculated as the economic value added by a firm in relation to its aggregated ecological impact.

Green Business: An enterprise that has minimal negative impact on the global or local environment, community, society, or economy.

Green Consumerism: The production, promotion, and preferential consumption of goods and services on the basis of their pro-environment claims (Akenji, 2014).

Green Consumers: Green consumer as one who avoids products that are likely to endanger the health of the consumer or others; cause significant damage to the environment during manufacture, use or disposal; consume a disproportionate amount of energy; cause unnecessary waste; use materials derived from threatened species or environments; involve unnecessary use of, or cruelty to animals; adversely affect other countries (Elkington, 1994; Boztepe, 2012).

Green Economy: This encompasses all activities or actions that help reduce carbon emissions into the atmosphere which is a major component of greenhouse gases that enhances global warming thus causing climate change (National Environment Management Authority, 2012).

Green Procurement: A process whereby organizations take into account environmental elements when procuring goods, services, works and utilities and achieve value for money on a whole life-cycle basis.

Green Product: A product that meets one of these criteria of possessing qualities that will protect the environment; replaced artificial ingredients with natural ingredients or products that are non toxic, energy and water-efficient, harmless to the environment, recyclable and biodegradable.

Socio-Efficiency: The relation between a firm's value added and its social impact.

Sustainable Consumption (SC): This shares a number of common features with and is closely linked to the terms sustainable production and sustainable development. SC is the use of goods and services that respond to basic needs and bring a better quality of life, while minimizing the use of natural resources, toxic materials and emissions of waste and pollutants over the life cycle, so as not to jeopardize the needs of future generations (UNEP, 2010).

This research was previously published in the Handbook of Research on Consumerism and Buying Behavior in Developing Nations edited by Ayantunji Gbadamosi, pages 429-451, copyright year 2016 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 75
Multi-Criteria Decision Making Techniques for Green Supply Chain Management: A Literature Review

Samet Güner
Sakarya University, Turkey

Halil İbrahim Cebeci
Sakarya University, Turkey

ABSTRACT

Due to increasing importance of environmental issues, green practices became an important part of supply chain management. Today, various multi-criteria decision making techniques (MCDM) have been utilized for incorporation of green efforts in supply chain practices effectively. The purpose of this paper is examining the existing application areas of MCDM techniques in green supply chain management (GSCM) literature. Three questions will be investigated in relation to this issue: 1) Which MCDM techniques were prevalently applied in GSCM literature? 2) Which MCDM techniques have been overlooked in GSCM literature? 3) What are the major application areas of MCDM techniques in GSCM practices? To this aim, literature is reviewed between the period of 2008 and the first half of 2016. In total, ninety eight journal articles were examined. Consequently, this paper represents a detailed picture of application areas of MCDM techniques in GSCM practices and can definitely give a blueprint to researches in solving multiple objective problems effectively in the area of GSCM.

INTRODUCTION

The classical economic system assumes that the limited resources of nature should be used to their maximum potential in order to meet the infinite requests and needs of human. Free market economy prompts companies to be profit oriented regardless of any environmental damage that might be caused (Roarty, 1997). This system, which puts the profit maximization as the unique aim for companies, was support-

DOI: 10.4018/978-1-5225-7915-1.ch075

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

ing the traditional supply chains which based on profit, efficiency and effectiveness until the twentieth century (Güner & Coşkun, 2010). However, this view has led to ignore the natural environment while maximizing the profit and inevitably cause global environmental problems.

Global environmental problems, like holes in the ozone layer and global warming, puts the future of the human race at risk and have shifted people's attention towards these problems and their causes. These problems have weakened the assumption of *"there is one and only one social responsibility of business – to use its resources and engage in activities designed to increase its profits so long as it stays within the rules of the game"* which was proposed by Friedman (1962) and led to search for new management approaches that brings the environmental concerns into corporate decision making processes.

Today, some developments such as increasing number and activity of governmental and non-governmental environmental organizations, imposing several sanctions by governments in favor of environmental protection and increasing number of international symposiums and congresses on environment, books and other scientific publications that address the environment, environmentalism and environmental problems shows the increasing attention to environmental issues.

Not only external factors such as governmental and non-governmental environmental organizations and academics, but also supply chain members force companies to be more environmental. Environmental crises lead customers to consider environmental effects of what they consume (Güner & Coşkun, 2010). Today, many researches demonstrated that customers are much more sensitive to environmental issues when compared with past years and customers feel personal responsibility for purchasing environmental friendly products (Kotler, 2004; Grant, 2007; Zaltman & Zaltman, 2008). Beside consumers, other companies in supply chains (suppliers, buyers etc.) force companies to be green. Today, environmental requirements are influencing the supplier selection and the supplier evaluation processes (Larsen, 2000). Also, industry leaders support their suppliers to be more environmental friendly (Lee, 2008) and set requirements for all their suppliers to comply with stricter environmental regulations (Ho, Shalishali, Tseng & Ang, 2009).

As a result of these improvements, the traditional approach, which hallows the profit and ignores the environmental issues, gives way to a more proactive green approach in businesses (Azzone & Bertele, 1994). In today's market conditions, economic and financial results alone are not sufficient and they need to be accompanied by ecological achievements (Lee, 2009). This means firms need to leave their traditional way of pure profit and benefit orient and shift to a new understanding that advocates business ethics, social responsibility and green management (Molina-Azorin, Claver-Cortes, Lopez-Gamero & Tari, 2009). Furthermore, many researchers proposed the green management as a competitive weapon for companies (Taylor, 1992; Porter & Van der Linde, 1995).

Briefly, market factors force companies to be more social responsible (Baron, 1995) and these environmental pressures significantly influence the strategic decisions of both large and small enterprises (Sarkis, 1998). Thus, environmental issues merit a more noteworthy investigation in supply chain decision making processes.

On the other side, most researchers suggest that going green may increase the cost burden and reduce the competitiveness of companies (Palmer, Oates & Portney, 1995). There is thus a tradeoff between economy and environmentalism. However, along with the increasing environmental sensitivity of the market, basic principles of environmentalism became an important part of business life and they must be adopted by companies as a part of profit maximization. At this point, operations research provides useful multi-criteria decision making (MCDM) techniques to practitioners for balancing the profit and the environmental concerns.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The purpose of this chapter is examining the existing application areas of MCDM techniques in GSCM literature. Furthermore, it aims to discover the potential application areas and potential benefits of MCDM techniques in GSCM strategies. Three questions will be investigated in relation to this issue:

1. Which MCDM techniques were prevalently applied in GSCM literature?,
2. Which MCDM techniques have been overlooked in GSCM literature?,
3. What are the major application areas of MCDM techniques in GSCM practices?

Thus, this chapter will provide a guidance for business practitioners and management scholars for effective use of MCDM methods in GSCM practices. In order to achieve this aim, the search was carried out using Google Scholar and Scopus search engines via ensuring a thorough check on journal articles that are accessible on the main databases. By this way, the majority of the GSCM related MCDM journals papers were reached. The following keywords were used during the search: "Green Supply Chain", "Green Supply Chain Management", "Reverse Logistics", "Multiple Criteria Decision Making" and "Multiple Objective Decision Making". Also, the well-known MCDM techniques and their acronyms were used in the research process. The research is limited between the periods of 2008 and the first half of 2016. Thus, in total, we reached 98 journal papers which are published in this timespan.

The remainder of this paper is organized as follows. In section 2, we give some basic principles of well-known MCDM techniques and their applications in GSCM strategies. Section 3 addressed the research findings. Summary and the conclusions are presented in the last section.

MCDM TECHNIQUES AND THEIR IMPLICATIONS TO GSCM

MCDM techniques include a wide range of methodology such as Analytical Hierarchy Process (AHP), Analytical Network Process (ANP), Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), Decision Making Trial and Evaluation Laboratory (DEMATEL), Data Envelopment Analysis (DEA), The Compromise Ranking Method (VIKOR), Goal Programming (GP), Elimination and Choice Expressing Reality (ELECTRE), Preference Ranking Organization Method for Enrichment Evaluation (PROMETHEE), Simple Multi-Attribute Ranking Technique (SMART), Measuring Attractiveness by a categorical Based Evaluation Technique (MACBETH) etc. In total, over 40 MCDM techniques were developed and used. While some of them are more popular and widely used (such as AHP, ANP, TOPSIS and DEA), some others are relatively new and have a limited application area yet (such as VIKOR, SMART, MACBETH).

These techniques are useful tools for analyzing complex problems due to their ability to evaluate different alternatives on various criteria for possible selection of the best alternative and they help decision makers to choose the best option according to their individual or group preferences where multiple conflicting criteria exist. Through their practical methodologies, these techniques have been used from trivial decisions such as car choice to complex strategic decisions such as foreign policies.

MCDM techniques have already been used in supply chains successfully in order to manage the conflicting objectives such as profit maximization, increasing customer service level and minimizing the supply chain risks. With the increasing importance of environmental issues in supply chain strategies, green criteria have added as a new parameter beside other conflicting objectives. MCDM techniques assess relationships among a number of decision and environmental factors (Sarkis, 1998) and

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

aid companies for balancing the other objectives and the environmental concerns. As Mardani, Jusoh, Nor, Khalifah, Zakwan & Valipour (2015) demonstrated that energy, environment and sustainability are first areas that have applied MCDM techniques and approaches. Today, a wide range of GSCM related decision making problems have been addressed by MCDM techniques. These decisions include green supplier selection, GSCM benchmarking strategies, green performance management, evaluation of green supplier development programs, determination of GSCM success factors etc.

Although AHP, ANP, TOPSIS, DEMATEL, DEA, VIKOR, GP, ELECTRE and PROMETHEE have been applied to GSCM practices, some others, such as SMART and MACBETH, have not been applied yet. In this section, the MCDM techniques that applied to GSCM practices are examined in detail.

Analytical Hierarchy Process (AHP)

AHP method was introduced by Saaty in early 1970s and it is used for determining the relative importance of attributes and the priority of a set of alternatives where multiple criteria are exist (Saaty, 1980; Darmawan, Putra & Wiguna, 2014). The primary advantage of the AHP approach is the relative ease which it handles multiple criteria and performs qualitative and quantitative data (Meade & Sarkis, 1998). With applying the AHP, decision-makers simplify a complex issue that is not structured, strategic and dynamic to be parts and arranges in a hierarchy (Darmawan et al., 2014).

Due to ease of use and interpretable nature, AHP is widely used in GSCM related topics such as supplier selection and evaluation, barrier and pressures analysis, performance evaluation, risk analysis and benchmarking. In most of the cases, AHP is used in GSCM practices directly by giving the alternative solutions, but sometimes it is combined with other techniques, such as PROMETHEE (Tsui & Wen, 2012) and TOPSIS (Wang & Chan, 2013, Yazdani, 2014, White, Wang & Li, 2015), to complete the decision making process. Also in some cases, AHP is combined with Fuzzy number theory to cope with the uncertainty and vagueness nature of problem (Hsu & Hu, 2008, Che, 2010, Mangla, Kumar & Barua, 2015a, Mangla, Kumar & Barua, 2015b, White, Wang & Li, 2015, Kannan et al., 2013).

Table 1 presents the application areas of AHP method in GSCM practices. As it can be observed from Table 1, supplier selection and evaluation is the major application area of AHP in GSCM practices. AHP is also applied in GSCM practices for evaluation of green performance and risk analysis. Furthermore, in some cases it is utilized for barrier analysis, benchmarking and order allocation.

Analytical Network Process (ANP)

ANP is another MCDM technique that was introduced by Saaty. ANP is the general form of the AHP which has been used in MCDM problems to release restrictions associated with hierarchical structure (Hsu & Hu, 2009, Hsu, Kuo & Chiou, 2014) and to present a non-linear network structure with possible interdependences and feedback (Lin, Madu, Kuei, Tsai & Wang, 2015). Instead of AHP's unidirectional hierarchical structure, ANP enables interrelationships among the decision levels and attributes in a more general form (Büyüközkan & Çifçi, 2012b).

Similar to AHP, ANP is also widely applied in GSCM problem areas, such as supplier selection and evaluation, green supplier development program evaluation, strategy selection and market analysis. In most cases, ANP is combined with other MCDM techniques (Tuzkaya et al., 2009, Büyüközkan & Çifçi, 2012a, Hsu et al., 2013, Kuo et al., 2015, Uygun & Dede, 2016, Kuo et al., 2010). To cope with the inherent fuzziness or uncertainty in judgment during the pairwise comparison process, and also to deal

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 1. Application of AHP in GSCM practices

Authors	Application Area	Description (Objectives) of Study
Nie, 2016	Performance Evaluation	Calculates an index with using AHP for evaluating the green performance of companies.
Yu & Hou, 2016	Supplier Selection and Evaluation	Uses modified multiplicative analytic hierarchy process (MMAHP) to determine the best alternative green supplier.
Boutkhoum, Hanine, Boukhriss, Agouti & Tikniouine, 2016	Implementation (Success Factors, Strategy Selection, Adoption or Benchmarking)	A combination of fuzzy AHP and fuzzy TOPSIS is presented for better understanding of sustainable strategies through the identification and evaluation of the most appropriate GSCM practices.
Mangla, Kumar & Barua, 2015a	Market Analysis (Risks, Barriers or Pressures)	Uses fuzzy AHP method to analyze the risks of implementation of GSCM practices.
Mangla, Kumar & Barua, 2015b	Market Analysis (Risks, Barriers or Pressures)	Combines the fuzzy AHP and interpretive ranking process (IRP) methods to create decision making model for evaluating risks associated with implementation of GSCM practices.
Sharma, Chandana & Bhardwaj, 2015	Performance Evaluation	Determines the key performance indicators for implementation of GSCM practices with factor analysis and AHP.
White, Wang & Li, 2015	Performance Evaluation	Uses a combination of fuzzy AHP (for determining weights) and fuzzy TOPSIS (for choosing the best alternative) for evaluating the green packaging performance.
Darmawan, Putra & Wiguna, 2014	Implementation (Success Factors, Strategy Selection, Adoption or Benchmarking)	AHP is used for analyzing the source of green wastes and calculating the green performance index to choose the best strategy for green productivity.
Govindan, Kaliyan, Kannan & Haq, 2014	Market Analysis (Risks, Barriers or Pressures)	Focuses on determining the GSCM implementation barriers based on procurement effectiveness. AHP is used for identifying the most important barriers.
Mathiyazhagan, Govindan & Noorul Haq, 2014	Market Analysis (Risks, Barriers or Pressures)	Determines the pressures on GSCM implementation and selects the most important ones with AHP.
Odeyale, 2014	Performance Evaluation	Evaluates the companies green performances with using AHP and weighing multiplication and additive model (WMAAM).
Yazdani, 2014	Supplier Selection and Evaluation	Presents a two-stage process (AHP + TOPSIS) to choose the right supplier with green criteria. Both stages include fuzzy numbers rather than crisp values.
Dey & Cheffi, 2013	Performance Evaluation	Uses an AHP based framework to evaluate and measure the environmental performance of manufacturing supply chains.
Hsueh & Yan, 2013	Supplier Selection and Evaluation	Combines four different methodologies, including AHP, to evaluate the green performances of public contractors.
Kannan, Khodaverdi, Olfat, Jafarian & Diabat, 2013	Supplier Selection and Evaluation	Presents an integrated approach of fuzzy AHP, Fuzzy TOPSIS and Multi-objective linear programming for selecting the best green supplier and calculate an appropriate order quantity.
Luthra, Grag & Haleem, 2013	Implementation (Success Factors, Strategy Selection, Adoption or Benchmarking)	Develops a mathematical model for choosing the appropriate greening strategy for supply chains with using AHP.
Shen, Muduli & Barve, 2013	Performance Evaluation	Determines the criteria that are related to effectiveness of GSC with using AHP and creates a guidance model for GSCM implementation.
Wang & Chan, 2013	Implementation (Success Factors, Strategy Selection, Adoption or Benchmarking)	Fuzzy TOPSIS is used for the evaluation of different green initiatives. AHP is used in first stage of the model for determining the criteria weights.
Peng, 2012	Supplier Selection and Evaluation	Combines the AHP and Grey Relational Analysis to choose the best green supplier combined with the green adjustment factor.

continued on following page

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 1. Continued

Authors	Application Area	Description (Objectives) of Study
Shaw, Shankar, Yadav & Thakur, 2012	Supplier Selection and Evaluation	Present a two-stage model to determine the best supplier and order quantity. Model includes fuzzy AHP method and linear programming approach.
Tsui & Wen, 2012	Supplier Selection and Evaluation	Develops a two-stage model for green supplier selection procedure. AHP is used to determine each criterion weights in the first stage and PROMETHEE is used to choose the best alternative in the second stage.
Wang, Chan, Yee & Diaz-Rainey, 2012	Market Analysis (Risks, Barriers or Pressures)	A fuzzy AHP is used to incorporate uncertain variables into the model for risk assessment of implementing green initiatives.
Liu & Wang, 2011	Performance Evaluation	Constructs a performance evaluation index system for evaluating GSC. AHP is used to calculate the factor weights for indexing system.
Che, 2010	Supplier Selection and Evaluation	Fuzzy AHP method is used to determine the factor weights and particle swarm optimization to determine optimal values for order quantity and supplier selection problem in GSCM.
Sarimento & Thomas, 2010	Implementation (Success Factors, Strategy Selection, Adoption or Benchmarking)	AHP is used to determine the improvement areas for benchmarking processes with the adoption of green initiatives.
Lee, Kang, Hsu & Hung, 2009	Supplier Selection and Evaluation	Fuzzy AHP method is used to evaluate and choose the best green suppliers.
Hsu & Hu, 2008	Implementation (Success Factors, Strategy Selection, Adoption or Benchmarking)	Examines the GSCM implementation approaches by factor analysis in Taiwanese electronic industry. Fuzzy AHP is used to prioritize the relative importance of a number of dimensions and approaches.
Kannan, Haq, Sasikumar & Arunnachalam, 2008	Supplier Selection and Evaluation	The interaction of green supplier selection criteria in automobile industry is analyzed with using a combination of Interpretive Structural Modelling and AHP.

with the discrete scale of relative importance, ANP method is combined with Grey System Theory (Dou et al., 2014) and Fuzzy Numbers (Büyüközkan & Çifçi, 2011, Büyüközkan & Çifçi, 2012a, Büyüközkan & Çifçi, 2012b, Tuzkaya et al., 2009, Lin et al., 2014, Kuo et al., 2015, Uygun & Dede, 2016).

The application areas of ANP method in GSCM practices are presented in Table 2. Supplier selection and evaluation is the major application area of ANP in GSCM practices. In addition, it is utilized for the evaluation of green supplier development programs, implementation of green practices, strategy selection and market analysis.

Technique for Order Preference by Similarity to Ideal Solution (TOPSIS)

TOPSIS is initially proposed by Chen and Hwang (1992) and it is a multiple criteria method to identify solutions from a finite set of alternatives (Büyüközkan & Çifçi, 2012a). The basic idea of TOPSIS is that the optimal alternative should have the shortest distance from the positive ideal solution and the longest distance from the negative ideal solution (Kuo et al., 2015). Because of including an unlimited range of criteria and performance attributes and allowing explicit trade-offs between attributes (Kannan et al., 2013), TOPSIS approach is a widely accepted method for ranking problems. In some cases, TOPSIS is

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 2. Application of ANP in GSCM practices

Authors	Application Area	Description (Objectives) of Study
Chung, Chao & Lou, 2016	Supplier Selection and Evaluation	Suggests a model that combines ANP and IPA (Importance–Performance Analysis) for selection of green suppliers in GSCs. ANP is used for selection process and IPA is used for performance evaluation.
Wu & Barnes, 2016	Supplier Selection and Evaluation	Presents a model for green supplier selection process by combining ANP and multi-objective programming (MOP) methodologies.
Uygun & Dede, 2016	Supplier Selection and Evaluation	Presents a three stage model to evaluate and choose the green suppliers. In this model, fuzzy DEMATEL is used to determine the cause-effect relations, fuzzy ANP is used for factor weighting and fuzzy TOPSIS is used for the selection process.
Lin, Madu, Kuei, Tsai & Wang, 2015	Supplier Selection and Evaluation	A combination of ANP and Triple Bottom Line (TBL) is used for green supplier selection decision for a Taiwanese Electronics Company.
Kuo, Hsu & Chen, 2015	Supplier Selection and Evaluation	Presents a mathematical model that includes fuzzy ANP and fuzzy TOPSIS methods for evaluating suppliers' carbon performances.
Dou, Zhu & Sarkis, 2014	Green Supplier Development Program Evaluation	Introduces a Grey ANP model to identify supplier development programs for improving suppliers' performance. Grey ANP is used for determining the involvement level of suppliers into green development programs.
Hsu, Kuo & Chiou, 2014	Supplier Selection and Evaluation	Presents a model for evaluating suppliers' carbon performances with using ANP and VIKOR. Initially criteria weights are determined by ANP and after that VIKOR is used for supplier selection process.
Lin, Tseng, Chiu & Wang, 2014	Implementation (Success Factors, Strategy Selection, Adoption or Benchmarking)	Proposes a hybrid approach, which includes applied interpretive structural modeling to build a hierarchical structure and uses the ANP to analyze the dependence relations. Researchers also applied the fuzzy set theory to determine linguistic preferences.
Theißen & Spinler, 2014	Supplier Selection and Evaluation	Introduces a decision support system that includes ANP model to identify the best suppliers based on their carbon management ability.
Felice, Petrillo & Cooper, 2013	Performance Evaluation	Suggests an integrated model for evaluating the greening performance of supply chains. Model does not only include some of the environmental indexes such as Environmental Performance Evaluation (EPA) and the Life Cycle Assessment (LCA) but also contains ANP method and Benefits, Opportunities, Costs and Risks (BOCR) analysis.
Büyüközkan & Çifçi, 2012a	Supplier Selection and Evaluation	Combines three different fuzzy MCDM methods (DEMATEL, ANP and TOPSIS) for green supplier selection process.
Büyüközkan & Çifçi, 2012b	Implementation (Success Factors, Strategy Selection, Adoption or Benchmarking)	Examines the components and elements of GSCM and suggests a GSCM evaluation framework. The identified components are integrated into a strategic assessment and evaluation using fuzzy ANP.
Cabral, Grilo & Cruz-Machado, 2012	Implementation (Success Factors, Strategy Selection, Adoption or Benchmarking)	Proposes an integrated model that includes Lean, Agile, Resilient and Green (LARG) paradigms with using ANP to support decision-making in choosing the most appropriate practices and KPIs to be implemented by companies.
Chen, Shih, Shyur & Wu, 2012	Implementation (Success Factors, Strategy Selection, Adoption or Benchmarking)	Proposes a model that associates the activities with greenness of design, purchasing, manufacturing, and marketing departments with using ANP.
Chen, Lin & Ting, 2012	Supplier Selection and Evaluation	Presents a mathematical model that includes ANP and liner programming (LP) for green purchasing process. ANP is used for green supplier selection and LP is used for order allocation.

continued on following page

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 2. Continued

Authors	Application Area	Description (Objectives) of Study
Mehrabi, Gharakhani, Jalalifar & Rahmati, 2012	Market Analysis (Risks, Barriers or Pressures)	Uses ANP method to determine critical barriers in implementation of GSCM.
Zhou, Ma, Li & Li, 2012	Supplier Selection and Evaluation	Presents a green supplier selection model based on ANP and radial basis function (RBF) neural network.
Büyüközkan & Çifçi, 2011	Supplier Selection and Evaluation	Proposes a model that cope with unclear and lack of information situation for green supplier selection process by using fuzzy ANP.
Kuo, Wang & Tien, 2010	Supplier Selection and Evaluation	Introduces a novel four-stage model for supplier selection. Delphi method is used for gathering data and Artificial Neural Network is utilized for predicting performance measures. ANP is used for determining factor weights and DEA is used for selection process.
Hsu & Hu, 2009	Supplier Selection and Evaluation	ANP method is used to incorporate the issue of hazardous substance management into green supplier selection process.
Tuzkaya, Ozgen, Ozgen & Tuzkaya, 2009	Supplier Selection and Evaluation	Presents a two-stage model to evaluate the suppliers green performances. Fuzzy ANP is used to calculate factor weights and Fuzzy PROMETHEE is used to select the best alternative.

integrated with other MCDM methods such as AHP (Wang & Chan, 2013, Yazdani, 2014, White, Wang & Li, 2015) or ANP (Büyüközkan & Çifçi, 2012a, Kuo et al., 2015, Uygun & Dede, 2016).

As shown in Table 3, TOPSIS has also been applied to GSCM problems. Similar to AHP and ANP, supplier selection and evaluation is the major application area of TOPSIS in GSCM practices. Additionally, it is used for performance evaluation and implementation.

Decision Making Trial and Evaluation Laboratory (DEMATEL)

DEMATEL is firstly developed by Science and Human Affairs Program of the Battelle Memorial Institute of Geneva between 1972 and 1976 and it is a comprehensive tool for building and analyzing a structural model involving causal relationships between complex factors (Hsu, Kuo, Chen & Hu, 2013). It can elevate the understanding of the issues, groups of interacted factors and provide a feasible solution by building a hierarchical relevant network system (Muduli & Barve, 2013). All factors fall into two categories in DEMATEL: cause and effect. This categorization results in a superior understanding of the system's parts and consequently discovering solutions to obviate issues of convoluted systems (Govindan, Khodaverdi & Vafadarnikjoo, 2015).

In some cases, DEMATEL's cause effect structure requires integration of soft techniques such as fuzzy sets theory (Büyüközkan & Çifçi, 2012a; Govindan et al., 2015; Lin, 2013; Mavi et al., 2013; Pishdar et al., 2014; Uygun & Dede, 2016) and Grey System theory (Fu et al., 2012). Also, some researchers demonstrated that collaboration of pairwise comparison techniques like AHP and ANP is very useful for GSCM practices (Büyüközkan & Çifçi, 2012a; Uygun & Dede, 2016).

Application areas of DEMATEL in GSCM practices are presented in Table 4. Although supplier selection and evaluation is the major application area of DEMATEL, it is also used for performance evaluation, implementation and evaluation of the green supplier development programs.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 3. Application of TOPSIS in GSCM practices

Authors	Application Area	Description (Objectives) of Study
Uygun & Dede, 2016	Supplier Selection and Evaluation	Presents a three-stage model to evaluate and choose the green suppliers. The proposed model uses fuzzy DEMATEL for determining the cause-effect relations, fuzzy ANP for factor weighting and fuzzy TOPSIS for selection process.
Boutkhoum, Hanine, Boukhriss, Agouti & Tikniouine, 2016	Implementation (Success Factors, Strategy Selection, Adoption or Benchmarking)	A combination of fuzzy AHP and fuzzy TOPSIS is presented for better understanding of sustainable strategies through the identification and evaluation of the most appropriate GSCM practices.
Govindan, Khodaverdi & Jafarian, 2015	Supplier Selection and Evaluation	Examines GSC initiatives and identifies the best possible model for supplier selection problem by fuzzy TOPSIS.
Hu, Rao, Zheng & Huang, 2015	Supplier Selection and Evaluation	Presents an optimization model includes linguistic 2-tuple TOPSIS method for supplier selection process in green procurement under the mode of low carbon economy.
Kuo, Hsu & Chen, 2015	Supplier Selection and Evaluation	Presents a mathematical model that includes fuzzy ANP and fuzzy TOPSIS methods for evaluating suppliers' carbon performance.
Kusi-Sarpong, Bai, Sarkis & Wang, 2015	Implementation (Success Factors, Strategy Selection, Adoption or Benchmarking)	Evaluates six different categories of green factors in mining industry with using of Rough Set Theory and fuzzy TOPSIS methods.
Li & Wu, 2015	Supplier Selection and Evaluation	Proposes a new improved intuitionistic fuzzy TOPSIS based model to identify the best 3rd Party Logistic firm.
Wang, 2015	Performance Evaluation	Suggests a decision making model based on Fuzzy Delphi, Fuzzy extent analysis and Fuzzy TOPSIS to evaluate green performance of supply chains.
White, Wang & Li, 2015	Performance Evaluation	Utilizing fuzzy AHP (for determining the weights) and fuzzy TOPSIS (for choosing the best alternative) to evaluate the green packaging performance of supply chains.
Kannan, de Sousa Jabbour & Jabbour, 2014	Supplier Selection and Evaluation	Introduces a fuzzy TOPSIS model to identify the best green suppliers.
Yazdani, 2014	Supplier Selection and Evaluation	Uses a two-stage process (AHP + TOPSIS) to choose the right supplier with green criteria. Both stages include fuzzy numbers rather than crisp values.
Diabat, Khodaverdi & Olfat, 2013	Performance Evaluation	Introduces a fuzzy TOPSIS model to explore the relationship between green supply chain practices (initiatives) and performance outcomes.
Kannan, Khodaverdi, Olfat, Jafarian & Diabat, 2013	Supplier Selection and Evaluation	Presents an integrated approach of fuzzy AHP, Fuzzy TOPSIS and Multi-objective linear programming for selecting the best green supplier and calculating the appropriate order quantity.
Sahu, Datta & Mahapatra, 2013	Performance Evaluation	Presents an interval-valued fuzzy number used modified TOPSIS method to evaluate candidate companies that operate in similar GSC hierarchy.
Shen, Olfa, Govindan, Khodaverdi & Diabat, 2013	Supplier Selection and Evaluation	Proposal of a fuzzy TOPSIS based multi criteria model that incorporates subjective linguistic preferences to generate an overall performance score for each supplier.
Wang & Chan, 2013	Implementation (Success Factors, Strategy Selection, Adoption or Benchmarking)	Fuzzy TOPSIS method is used to evaluate different green initiatives. AHP is used in first stage of the model to determine the criteria weights.
Büyüközkan & Çifçi, 2012a	Supplier Selection and Evaluation	Combines three different fuzzy MCDM methods (DEMATEL, ANP and TOPSIS) for green supplier selection process.
Kannan & Muresan, 2009	Supplier Selection and Evaluation	Presents a fuzzy TOPSIS based MCDM model for selecting the best 3rd party reverse logistics provider.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 4. Application of DEMATEL in GSCM practices

Authors	Application Area	Description (Objectives) of Study
Govindan, Muduli, Devika & Barve, 2016	Implementation (Success Factors, Strategy Selection, Adoption or Benchmarking)	Examines the factors that affect the adoption of green practices with using DEMATEL.
Uygun & Dede, 2016	Supplier Selection and Evaluation	Presents a three-stage model to evaluate and choose the green suppliers. Fuzzy DEMATEL is used to determine cause-effect relations, fuzzy ANP is used for factor weighting and fuzzy TOPSIS is used for the selection process.
Govindan, Khodaverdi & Vafadarnikjoo, 2015	Performance Evaluation	Presents intuitionistic fuzzy sets based DEMATEL method to handle the causal relationships between GSCM practices and both environmental and economic performances.
Guo & Tsai, 2015	Supplier Selection and Evaluation	Presents DEMATEL based green supplier selection model.
Wu & Chang, 2015	Implementation (Success Factors, Strategy Selection, Adoption or Benchmarking)	Investigates the GSCM success factors gathered from literature and interprets the cause effect relationships with using DEMATEL.
Falatoonitoosi, Ahmed & Sorooshian, 2014	Supplier Selection and Evaluation	Presents an evaluation framework for selecting the most eligible green suppliers by examining the important criteria and cause-effect relationships between them with DEMATEL method.
Pishdar, Toloun, Zamani & Farzianpour, 2014	Implementation (Success Factors, Strategy Selection, Adoption or Benchmarking)	Determines GSCM success factors among a number of green factors by fuzzy DEMATEL method.
Hsu, Kuo, Chen & Hu, 2013	Supplier Selection and Evaluation	Presents a DEMATEL based model to evaluate overall performance of suppliers in terms of carbon management.
Lin, 2013	Implementation (Success Factors, Strategy Selection, Adoption or Benchmarking)	Fuzzy DEMATEL method is used to examine the influential factors of a number of GSCM practices and to find out the cause and effect relationships among criteria.
Mavi, Kazemi, Najafabadi & Mousaabadi, 2013	Supplier Selection and Evaluation	Presents a fuzzy DEMATEL model to evaluate green suppliers considering logistical criteria.
Muduli & Barve, 2013	Market Analysis (Risks, Barriers or Pressures)	Investigates the barriers against greening practices and examines the cause-effect relationship between barriers with using DEMATEL. Results of DEMATEL are used for green strategy development.
Büyüközkan & Çifçi, 2012a	Supplier Selection and Evaluation	Combines three different fuzzy MCDM methods (DEMATEL, ANP and TOPSIS) for green supplier selection process.
Fu, Zhu & Sarkis, 2012	Green Supplier Development Program Evaluation	Suggests systematic and structural Grey based DEMATEL model to evaluate green supplier development programs.

Data Envelopment Analysis (DEA)

Data envelopment analysis (DEA), which was first introduced by Charnes, Cooper and Rhodes (1978), is a non-parametric mathematical tool for assessing the relative efficiency of homogeneous decision making units (DMUs) which consume multiple inputs to produce multiple outputs. DEA is a powerful mathematical method that utilizes linear programming to determine the relative efficiencies of a set of functionally similar DMUs (Mirhedayatian, Azadi & Saen, 2014).

DEA has a wide range of application area including transportation, banking, education, supply chain management etc. Also, in recent years, it emerges as a novel technique for GSCM practices. Application areas of DEA in GSCM practices are presented in Table 5. Similar to other MCDM tools, DEA

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 5. Application of DEA in GSCM practices

Authors	Application Area	Description (Objectives) of Study
Fallahpour, Olugu, Musa, Khezrimotlagh & Wong, 2016	Supplier Selection and Evaluation	Presents an extended DEA model which includes fuzzy numbers and Genetic Algorithm to evaluate green suppliers.
Shabani & Saen, 2015	Implementation (Success Factors, Strategy Selection, Adoption or Benchmarking)	Develops a model based on DEA and program evaluation and review technique/ critical path method (PERT/CPM) for determining prospective benchmarks. The proposed model is utilized in benchmarking green supply chain management.
Shi, Yan, Shi & Ke, 2015	Supplier Selection and Evaluation	Green index system with DEA method is used to evaluate and choose the best alternative green supplier.
Azadi, Shabani, Khodakarami & Saen, 2014	Implementation (Success Factors, Strategy Selection, Adoption or Benchmarking)	Proposal of a two-stage DEA model to identify critical focus areas of GSC practices and offers green strategies for public transportation companies.
Kumar, Jain & Kumar, 2014	Supplier Selection and Evaluation	Presents a model called Green DEA with carbon footprint monitoring and compares empirical result with an AHP-TOPSIS based model.
Mirhedayatian, Azadi & Saen, 2014	Performance Evaluation	Suggests a novel DEA model which includes network structure to evaluate GSCM under dual-role factors, undesirable outputs, and fuzzy data conditions.
Sueyoshi & Wang, 2014	Implementation (Success Factors, Strategy Selection, Adoption or Benchmarking)	Presents a DEA based model to evaluate supply chain current condition with respect of sustainability point of view and provides critical information regarding about how to invest for technology innovation.
Kuo, Wang & Tien, 2010	Supplier Selection and Evaluation	Introduce a novel four-stage model to supplier selection. Delphi method is used for gathering data and Artificial Neural Network is utilized for predicting performance measures. After that ANP is used for determining factor weights and last, DEA is utilized for selection process.

has mostly used in GSCM literature for green supplier selection. Also, since DEA is a benchmarking method, it allows researchers to make further analysis like benchmarking the GSCM strategies (Shabani & Farzipoor Saen, 2015) and target setting for green companies (Azadi, Shabani, Khodakarami and Saen, 2014). It is important to note that in most cases DEA was combined with other techniques like Genetic Algorithm, PERT/CPM, TOPSIS, Artificial Neural Network and ANP.

The Compromise Ranking Method (VIKOR)

VIKOR, which was first presented by Opricovic (2004), focuses on ranking and selecting from a set of alternatives, and determines compromise solutions for a problem with conflicting criteria, and helps the decision makers to reach a final decision (Hsu et al., 2013). VIKOR is a relatively new technique when compared to other MCDM methods. Because of that, limited number of studies has been done in GSCM literature. These studies are listed in Table 6.

Similar to other MCDM techniques, VIKOR is mostly used for supplier selection and evaluation problems. Also, it is utilized for the evaluation of green supplier development programs and performance evaluation of the green supply chain.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 6. Application of VIKOR in GSCM practices

Authors	Application Area	Description (Objectives) of Study
Awasthi & Kannan, 2016	Green Supplier Development Program Evaluation	Presents a model that based on VIKOR and Fuzzy Nominal Group technique to choose the best Green Supplier Development Program alternative .
Akman, 2015	Supplier Selection and Evaluation	Offers a three-stage model to evaluate supplier with respect to greening degree. Evaluation factors determined by factor analysis and selection process performed by C-means and finally greening degree of suppliers are determined by VIKOR.
Rostamzadeh, Govindan, Esmaeili & Sabaghi, 2015	Performance Evaluation	Suggests a quantitative evaluation model to evaluate GSCM activities under uncertainty with using intuitionistic fuzzy numbers based VIKOR model.
Hsu, Kuo & Chiou, 2014	Supplier Selection and Evaluation	Presents a model for evaluating suppliers' carbon performances with using ANP and VIKOR, respectively. Criteria weights were determined by ANP in the first stage and after that VIKOR is used for supplier selection process.
Datta, Samantra, Mahapatra, Banerjee & Bandyopadhyay, 2012	Supplier Selection and Evaluation	Presents a model based on VIKOR, interval-valued fuzzy numbers and fuzzy expert system for green supplier evaluation.

Goal Programming (GP)

GP is an extension of traditional linear programming which includes several conflicting objectives. Due to methods ability to cope with several objectives, it is useful for design and configuration of GSCM practices. As can be observed from Table 7, GP has been used to solve different problems in GSCM practices. Different from other MCDM techniques, GP is only utilized for the network design, optimization and configuration of green supply chains.

Elimination and Choice Expressing Reality (ELECTRE)

Roots of ELECTRE methods are based on the work of Benayoun, Roy and Sussman in early 1960s. ELECTRE family of methods includes ELECTRE I, ELECTRE II, ELECTRE III. Method also usually classified as an "outranking method". ELECTRE is generally used for discarding the inappropriate al-

Table 7. Application of GP in GSCM practices

Author	Application Area	Description (Objectives) of Study
Boonsothonsatit, Kara, Ibbotson & Kayis, 2015	Network Design, Optimization and Configuration	Introduces a decision support model to optimize the supply chain network. Model also includes supplier selection and facility layout operations.
Brandenburg, 2015	Network Design, Optimization and Configuration	Proposal of a GP model for reconfiguration of the supply chain when new product occurs with respect of environmental variables.
Ghorbani, Arabzad & Tavakkoli-Moghaddam, 2014	Network Design, Optimization and Configuration	Proposal of a fuzzy GP model for designing reverse supply chain with the objective of minimize recycling cost, rate of waste generated by recyclers and material recovery time.
Mari, Lee & Memon, 2014	Network Design, Optimization and Configuration	Presents a GP model to determine production quantity and assigned warehouse with green factors such as carbon emission and embodied carbon footprints

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

ternative and it is incorporated to the other MCDM methods for selecting the best alternative. Because of this elimination process, other MCDM methods become very productive with ELECTRE. In GSCM literature, ELECTRE method has a limited application area (see Table 8). ELECTRE III was used for two main problem areas; supplier selection and evaluation (Liu & Zhang, 2011; Tsui & Wen, 2014) and transportation path selection (Sawadogo & Anciaux, 2011).

Preference Ranking Organization Method for Enrichment Evaluation (PROMETHEE)

PROMETHEE methods family was firstly presented by Brans and Vincke (1985). Original PROMETHEE method (also known as PROMETHEE I) provides a partial ranking of alternatives, and the complete ranking can be derived from the PROMETHEE II method. PROMETHEE methods family is classified as "Outranking method" like ELECTRE and they require two types of information: the criteria weights and the performance values of alternatives for each criterion (Tsui, Tzeng & Wen, 2015). In most cases, criteria weights often calculated by other MCDM methods like ANP (Tuzkaya et al., 2009) or AHP (Tsui & Wen, 2012). In GSCM literature, PROMETHEE is only used for supplier selection problem as listed in Table 9.

Other MCDM Techniques

Over 40 MCDM techniques were applied to GSCM practices. However, in this chapter, we only examined well-known 9 MCDM techniques in detail. In addition to these techniques, other methods that

Table 8. Application of ELECTRE in GSCM practices

Authors	Application Area	Description (Objectives) of Study
Tsui & Wen, 2014	Supplier Selection and Evaluation	Presents a model that based on AHP and ELECTRE III to evaluate and select the best alternative suppliers with green variables.
Liu & Zhang, 2011	Supplier Selection and Evaluation	Uses entropy weight and ELECTRE III to select best alternative green supplier.
Sawadogo & Anciaux, 2011	Network Design, Optimization and Configuration	Introduced an ELECTRE based model to determine appropriate transportation path with green variables.

Table 9. Application of PROMETHEE in GSCM practices

Authors	Application Area	Description (Objectives) of Study
Tsui, Tzeng & Wen, 2015	Supplier Selection and Evaluation	Suggests a hybrid multiple criteria decision-making with extended PROMETHEE to evaluate and assist polarizer suppliers for improving the performance of green suppliers to achieve the aspiration level
Tsui & Wen, 2012	Supplier Selection and Evaluation	Created a two-stage model for green supplier selection procedure. AHP is used to determine each criterion weights and the best alternative is chosen with PROMETHEE.
Tuzkaya, Ozgen, Ozgen & Tuzkaya, 2009	Supplier Selection and Evaluation	Presents a two-stage model to evaluate the suppliers green performance. Fuzzy ANP is used to calculate factor weights and Fuzzy PROMETHEE used for selecting the best alternative.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

are applied in GSCM practices are listed in Table 10. Supplier selection and evaluation is the primary application area for these techniques. Also, performance evaluation and market analysis are the other application areas for these techniques.

RESEARCH FINDINGS

The evaluation of the literature review has shown that application areas of MCDM techniques in GSCM practices can be categorized in six groups (see Table 11). The major group is the "supplier selection and evaluation" which aims to evaluate the environmental performances of alternative suppliers and choose the best performer one. Indeed, 50 journal papers (51,02%) were addressed this issue. The second group is the "implementation" which aims to incorporating the green issues into traditional supply chains. Determining the success factors and key performance indicators in green supply chains, selection of the best green strategy, adoption of environmental criteria and benchmarking the environmental strategies are distinguished in this group. Literature review reveals that 18 journal papers (18,37%) were focused on

Table 10. Application of Other MCDM Techniques in GSCM practices

Authors	Application Area	MCDM Method
Mavi, R.K, 2015	Supplier Selection and Evaluation	Additive Ratio Assessment (ARAS)
Liao, C.N., 2016	Supplier Selection and Evaluation	
Liao, C.N., Fu, Y.K., Wu, L.C., 2015	Supplier Selection and Evaluation	
Rezaei et al., 2016	Supplier Selection and Evaluation	
Arroyo et al., 2016	Supplier Selection and Evaluation	Choosing by Advantages (CBA)
Wan, S.P. & Li, D.F., 2015	Supplier Selection and Evaluation	Linear Programming Technique for Multidimensional Analysis of Preference (LINMAP)
Shaik, M. & Abdul-Kader, W., 2011	Supplier Selection and Evaluation	Multi-attribute utility theory (MAUT)
Kusi-Sarpong, et al., 2016	Performance Evaluation	Multiplicative exponential weighting (MEW)
Ghorabaee, et al., 2016	Supplier Selection and Evaluation	Weighted Aggregated Sum Product Assessment (WASPAS)

Table 11. Application Areas of MCDM Techniques in GSCM practices

Area	In number	Percentage
Supplier Selection and Evaluation	50	51,02%
Implementation (Success Factors, Strategy Selection, Adoption or Benchmarking)	18	18,37%
Performance Evaluation	14	14,29%
Market Analysis (Risks, Barriers or Pressures)	8	8,16%
Network Design, Optimization and Configuration	5	5,10%
Green Supplier Development Program Evaluation	3	3,06%
Total	**98**	**100%**

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

the implementation of green strategies. The third group is the "performance evaluation" which focuses on developing a framework to evaluate and measure the environmental performances of green supply chains. 14 articles (14,29%) are included in this group.

The fourth group is the "market analysis". Risk analysis, barrier analysis and pressure analysis are considered in this group. Risk analysis is the risk assessment of green practices. Barrier analysis is related with determining the implementation barriers of green initiatives into traditional supply chains. On the other hand, pressure analysis aims to determine the most important pressures from market factors that force companies to be green. Accordingly, researchers preferred to use MCDM techniques for market analysis in 8 papers (8,16%). Another group is "network design, optimization and configuration". Network design, optimization and configuration analysis are mainly carried out with using goal programming. These analyses include supply chain optimization and designing reverse supply chains. In total, 5 journal papers (5,10%) used MCDM techniques for these purposes. The sixth and the last group is the "green supplier development program evaluation" which aims to evaluate supplier development programs for improving suppliers' environmental performances and determining the involvement level of suppliers in these programs. In literature, only 3 articles (3,06%) used MCDM techniques for these purposes.

The literature review shows that AHP is the most widely used MCDM technique in GSCM practices (see Table 12). Twenty eight (25,00%) papers applied AHP in order to address a variety of problems in green supply chains. ANP, TOPSIS and DEMATEL are other widely used methods in GSCM practices. They were applied in 21, 18 and 13 papers, respectively. On the other hand, DEA, VIKOR, GP, ELECTRE and PROMETHEE were preferred in less frequency when compared to other techniques (8, 5, 4, 3 and 3, respectively).

It is important to note that in twelve papers (12,12%), researchers preferred to combine two or more MCDM techniques in order to take advantage of each method. Ten papers (10,10%) integrated AHP or ANP methods with TOPSIS, PROMETHEE, DEA or VIKOR. Also, three MCDM techniques, ANP, TOPSIS and DEMATEL, were integrated in two papers (2,02%). In these studies, AHP and ANP were used for determining the criteria weights, DEMATEL was used for determining the cause-effect relations, and TOPSIS, PROMETHEE and VIKOR were used for selection of the best alternative.

Table 12. Frequencies of MCDM Techniques

No.	MCDM Techniques	In number	Percentage
1.	AHP	28	25,00%
2.	ANP	21	18,75%
3.	TOPSIS	18	16,07%
4.	DEMATEL	13	11,61%
5.	DEA	8	7,14%
6.	VIKOR	5	4,46%
7.	GP	4	3,57%
8.	ELECTRE	3	2,68%
9.	PROMETHEE	3	2,68%
10.	Others	9	8,04%
Total		**112**	**100%**

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Another important finding is that the combination of MCDM techniques with fuzzy number theory is quite common in GSCM practices. In thirty seven cases (33,03%), fuzzy number theory is combined with MCDM techniques. Also, two papers combined grey system theory with MCDM techniques (ANP and DEMATEL). Both fuzzy number theory and grey system theory were used for coping with the uncertainty and vagueness nature of problem and incorporating uncertain variables, such as linguistic preferences, into the model.

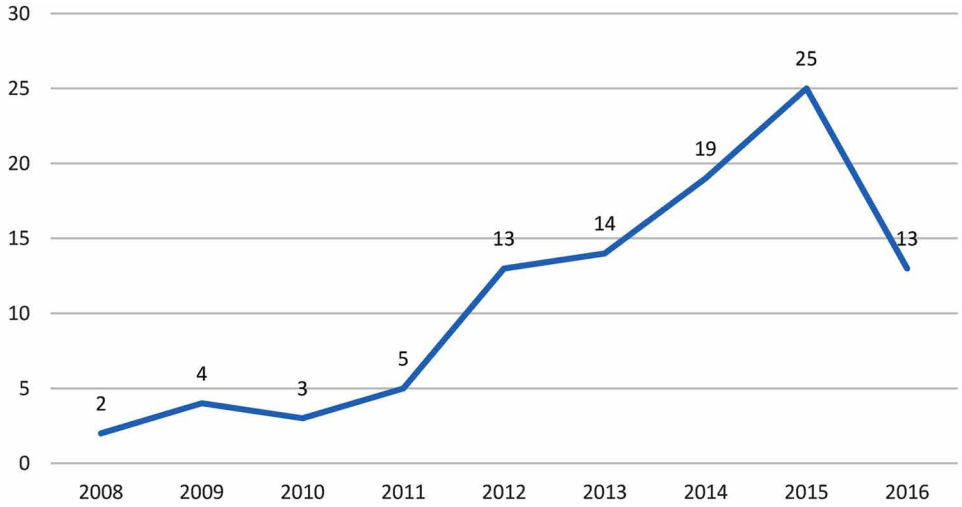
The last finding is about the distribution of examined articles over the research period. The distribution of the 98 journal articles between 2008 and the half of 2016 is presented in Figure 1. As it can be observed from Figure 1, there is an increasing trend towards the utilization of MCDM techniques in GSCM practices. While there are only 14 journal articles between 2008 and 2011, 84 papers were published between the period of 2012 and the first half of 2016. It is expected that the number of articles will increase by the end of 2016.

CONCLUSION

This paper is based on a literature review on the MCDM techniques for GSCM practices. It was found that 16 MCDM techniques were used for GSCM practices. However, only most frequent and well-known 9 techniques (ANP, AHP, TOPSIS, DEMATEL, DEA, VIKOR, GP, ELECTRE, PROMETHEE) were examined in detail.

Research results show that 50% of the examined papers focused on supplier selection and evaluation. Thus, it is clear that incorporation of environmental issues in supplier selection and evaluation process is the most popular issue for MCDM techniques. The most preferred MCDM techniques in GSCM practices are AHP and ANP. Indeed, almost half of the examined papers employed at least one of these techniques. Also, it was observed that the significant number of the MCDM problems in GSCM literature required the collaboration of grey system and fuzzy theories to cope with the vagueness, uncertainty, fuzziness, discrete interval use and linguistic nature of input variables.

Figure 1. Distribution of number of journal articles since 2008



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Another finding is that the integrated approaches are very common in GSCM practices. While some of the MCDM techniques provide the relative importance of various criteria (such as ANP and AHP), some others can be utilized for ranking the alternatives (such as TOPSIS, VIKOR ELECTRE, PROMETHEE). MCDM techniques can also be used for determining the cause-effect relationships (DEMATEL), benchmarking (such as DEA) and optimization (such as GP). Thus, integrating these techniques makes possible to take advantage of each method.

Despite the various advantages outlined in the paper, this study has its own limitations. First, only journal articles are examined and other publications (such as books, book chapters or proceedings) were excluded in this research. Also, only Scopus and Google Scholar search engines were used and specific keywords were scanned in this process. Furthermore, the research is limited between the periods of 2008 and the first half of 2016. Because of the abovementioned reasons, some of the literature could be missing from this paper. However, despite these limitations, we believed that this research has potential to provide some important insights for scholars and practitioners about the utilization of MCDM techniques for coping with GSCM problems.

For future researches, we suggest further exploring the usage of MCDM methods in GSCM literature with using data oriented systematic methods like web or text mining. Also, existing literature has a limited number of studies that integrates various MCDM techniques with heuristics, such as artificial intelligence techniques. GSCM practices will be much benefited by this integration since MCDM techniques can gain optimization and more complex problem solving capabilities. On the other hand, since DEA and GP are able to address different types of problems due to their benchmarking and optimization capabilities, they can be utilized for handling the different problems in GSCM practices. And last, although there are many MCDM techniques in literature, most of them haven't applied to GSCM practices yet. Some of these techniques can be listed as following: Aggregated Indices Randomization Method (AIRM), Characteristic Objects Method (COMET), Dominance-based rough set approach (DRSA), Generalized Regression with Intensities of Preference (GRIP), Measuring Attractiveness by a Categorical Based Evaluation Technique (MACBETH), Multi-attribute Value Theory (MVT), Multi-Objective Optimization by Ratio Analysis (MOORA), Simple Additive Weighting (SAW), Superiority and Inferiority Ranking Method (SIR), Stochastic Multi-criteria Acceptability Analysis (SMAA), Simple Multi-Attribute Ranking Technique (SMART), Step-Wise Weight Assessment Ratio Analysis (SWARA), Weighted Product Model (WPM), Weighted Sum Model (WSM). Consideration of the potential benefits of these MCDM techniques will provide alternative solutions for GSCM problems.

REFERENCES

Akman, G. (2015). Evaluating suppliers to include green supplier development programs via fuzzy c-means and VIKOR methods. *Computers & Industrial Engineering*, *86*, 69–82. doi:10.1016/j.cie.2014.10.013

Arroyo, P., Tommelein, I. D., & Ballard, G. (2015). Selecting Globally Sustainable Materials: A Case Study Using Choosing by Advantages. *Journal of Construction Engineering and Management*, *142*(2), 05015015. doi:10.1061/(ASCE)CO.1943-7862.0001041

Awasthi, A., & Kannan, G. (2016). Green supplier development program selection using NGT and VIKOR under fuzzy environment. *Computers & Industrial Engineering*, *91*, 100–108. doi:10.1016/j.cie.2015.11.011

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Azadi, M., Shabani, A., Khodakarami, M., & Saen, R. F. (2014). Planning in feasible region by two-stage target-setting DEA methods: An application in green supply chain management of public transportation service providers. *Transportation Research Part E, Logistics and Transportation Review*, *70*, 324–338. doi:10.1016/j.tre.2014.07.009

Azzone, G., & Bertele, U. (1994). Exploiting green strategies for competitive advantage. *Long Range Planning*, *27*(6), 69–81. doi:10.1016/0024-6301(94)90165-1

Baron, D. P. (1995). Integrated strategy: Market and nonmarket components. *California Management Review*, *37*(2), 47–65. doi:10.2307/41165788

Benayoun, R., Roy, B., & Sussman, N. (1966). Manual de reference du programme electre. *Note de synthese et Formation, 25*.

Boonsothonsatit, K., Kara, S., Ibbotson, S., & Kayis, B. (2015). Development of a generic decision support system based on multi-objective optimisation for green supply chain network design (GOOG). *Journal of Manufacturing Technology Management*, *26*(7), 1069–1084. doi:10.1108/JMTM-10-2012-0102

Boutkhoum, O., Hanine, M., Boukhriss, H., Agouti, T., & Tikniouine, A. (2016). Multi-criteria decision support framework for sustainable implementation of effective green supply chain management practices. *SpringerPlus*, *5*(1), 664. doi:10.118640064-016-2233-2 PMID:27350904

Brandenburg, M. (2015). Low carbon supply chain configuration for a new product–a goal programming approach. *International Journal of Production Research*, *53*(21), 6588–6610. doi:10.1080/00207543.2015.1005761

Brans, J. P., & Vincke, P. (1985). Note—A Preference Ranking Organisation Method: (The PROMETHEE Method for Multiple Criteria Decision-Making). *Management Science*, *31*(6), 647–656. doi:10.1287/mnsc.31.6.647

Büyüközkan, G., & Çifçi, G. (2011). A novel fuzzy multi-criteria decision framework for sustainable supplier selection with incomplete information. *Computers in Industry*, *62*(2), 164–174. doi:10.1016/j.compind.2010.10.009

Büyüközkan, G., & Çifçi, G. (2012a). A novel hybrid MCDM approach based on fuzzy DEMATEL, fuzzy ANP and fuzzy TOPSIS to evaluate green suppliers. *Expert Systems with Applications*, *39*(3), 3000–3011. doi:10.1016/j.eswa.2011.08.162

Büyüközkan, G., & Çifçi, G. (2012b). Evaluation of the green supply chain management practices: A fuzzy ANP approach. *Production Planning and Control*, *23*(6), 405–418. doi:10.1080/09537287.2011.561814

Cabral, I., Grilo, A., & Cruz-Machado, V. (2012). A decision-making model for lean, agile, resilient and green supply chain management. *International Journal of Production Research*, *50*(17), 4830–4845. doi:10.1080/00207543.2012.657970

Charnes, A., Cooper, W. W., & Rhodes, E. (1978). Measuring efficiency of decision making units. *European Journal of Operational Research*, *2*(6), 429–444. doi:10.1016/0377-2217(78)90138-8

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Che, Z. H. (2010). Using fuzzy analytic hierarchy process and particle swarm optimisation for balanced and defective supply chain problems considering WEEE/RoHS directives. *International Journal of Production Research*, *48*(11), 3355–3381. doi:10.1080/00207540802702080

Chen, C. B., Lin, C. T., & Ting, Y. C. (2011). A Green Purchasing Model by Using ANP and LP Methods. *Journal of Testing and Evaluation*, *40*(2), 203–210.

Chen, C. C., Shih, H. S., Shyur, H. J., & Wu, K. S. (2012). A business strategy selection of green supply chain management via an analytic network process. *Computers & Mathematics with Applications (Oxford, England)*, *64*(8), 2544–2557. doi:10.1016/j.camwa.2012.06.013

Chen, S. J., & Hwang, C. L. (1992). *Fuzzy multiple attribute decision making methods*. Springer Berlin Heidelberg. doi:10.1007/978-3-642-46768-4_5

Chung, C. C., Chao, L. C., & Lou, S. J. (2016). The Establishment of a Green Supplier Selection and Guidance Mechanism with the ANP and IPA. *Sustainability.*, *8*(3), 259. doi:10.3390u8030259

Darmawan, M. A., Putra, M. P. I. F., & Wiguna, B. (2014). Value chain analysis for green productivity improvement in the natural rubber supply chain: A case study. *Journal of Cleaner Production*, *85*, 201–211. doi:10.1016/j.jclepro.2014.01.098

Datta, S., Samantra, C., Mahapatra, S. S., Banerjee, S., & Bandyopadhyay, A. (2012). Green supplier evaluation and selection using VIKOR method embedded in fuzzy expert system with interval-valued fuzzy numbers. *International Journal of Procurement Management.*, *5*(5), 647–678. doi:10.1504/IJPM.2012.048880

Dey, P. K., & Cheffi, W. (2013). Green supply chain performance measurement using the analytic hierarchy process: A comparative analysis of manufacturing organizations. *Production Planning and Control*, *24*(8-9), 702–720. doi:10.1080/09537287.2012.666859

Diabat, A., Khodaverdi, R., & Olfat, L. (2013). An exploration of green supply chain practices and performances in an automotive industry. *International Journal of Advanced Manufacturing Technology*, *68*(1-4), 949–961. doi:10.100700170-013-4955-4

Dou, Y., Zhu, Q., & Sarkis, J. (2014). Evaluating green supplier development programs with a grey-analytical network process-based methodology. *European Journal of Operational Research*, *233*(2), 420–431. doi:10.1016/j.ejor.2013.03.004

Falatoonitoosi, E., Ahmed, S., & Sorooshian, S. (2014, March). A multicriteria framework to evaluate supplier's greenness. In *Abstract and Applied Analysis* (Vol. 2014). Hindawi Publishing Corporation. doi:10.1155/2014/396923

Fallahpour, A., Olugu, E. U., Musa, S. N., Khezrimotlagh, D., & Wong, K. Y. (2015). An integrated model for green supplier selection under fuzzy environment: Application of data envelopment analysis and genetic programming approach. *Neural Computing & Applications*, 1–19.

Felice, F. D., Petrillo, A., & Cooper, O. (2013). An integrated conceptual model to promote green policies. *International Journal of Innovation and Sustainable Development.*, *7*(4), 333–355. doi:10.1504/IJISD.2013.057037

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Friedman, M. (1962). *Capitalism and Freedom*. University of Chicago Press.

Fu, X., Zhu, Q., & Sarkis, J. (2012). Evaluating green supplier development programs at a telecommunications systems provider. *International Journal of Production Economics*, *140*(1), 357–367. doi:10.1016/j.ijpe.2011.08.030

Ghorabaee, M. K., Zavadskas, E. K., Amiri, M., & Esmaeili, A. (2016). Multi-criteria evaluation of green suppliers using an extended WASPAS method with interval type-2 fuzzy sets. *Journal of Cleaner Production*, *137*, 213–229. doi:10.1016/j.jclepro.2016.07.031

Ghorbani, M., Arabzad, S. M., & Tavakkoli-Moghaddam, R. (2014). A multi-objective fuzzy goal programming model for reverse supply chain design. *International Journal of Operational Research.*, *19*(2), 141–153. doi:10.1504/IJOR.2014.058947

Govindan, K., Kaliyan, M., Kannan, D., & Haq, A. N. (2014). Barriers analysis for green supply chain management implementation in Indian industries using analytic hierarchy process. *International Journal of Production Economics*, *147*, 555–568. doi:10.1016/j.ijpe.2013.08.018

Govindan, K., Khodaverdi, R., & Jafarian, A. (2013). A fuzzy multi criteria approach for measuring sustainability performance of a supplier based on triple bottom line approach. *Journal of Cleaner Production*, *47*, 345–354. doi:10.1016/j.jclepro.2012.04.014

Govindan, K., Khodaverdi, R., & Vafadarnikjoo, A. (2015). Intuitionistic fuzzy based DEMATEL method for developing green practices and performances in a green supply chain. *Expert Systems with Applications*, *42*(20), 7207–7220. doi:10.1016/j.eswa.2015.04.030

Govindan, K., Muduli, K., Devika, K., & Barve, A. (2016). Investigation of the influential strength of factors on adoption of green supply chain management practices: An Indian mining scenario. *Resources, Conservation and Recycling*, *107*, 185–194. doi:10.1016/j.resconrec.2015.05.022

Grant, J. (2007). *Green Marketing Manifesto* (1st ed.). Istanbul: MediaCat Kitapları.

Güner S. & Coşkun E. (2010), *The role of customer choices in green supply chain management: An empirical study in Sakarya region*. 8th International Logistics & Supply Chain Management Congress, Istanbul, Turkey.

Guo, J. J., & Tsai, S. B. (2015). Discussing and evaluating green supply chain suppliers: A case study of the printed circuit board industry in China. *South African Journal of Industrial Engineering*, *26*(2), 56–67. doi:10.7166/26-2-956

Ho, J. C., Shalishali, M. K., Tseng, T. L., & Ang, D. S. (2009). Opportunities in green supply chain management. *The Coastal Business Journal.*, *8*(1), 18–31.

Hsu, C. W., & Hu, A. H. (2008). Green supply chain management in the electronic industry. *International Journal of Environmental Science and Technology*, *5*(2), 205–216. doi:10.1007/BF03326014

Hsu, C. W., & Hu, A. H. (2009). Applying hazardous substance management to supplier selection using analytic network process. *Journal of Cleaner Production*, *17*(2), 255–264. doi:10.1016/j.jclepro.2008.05.004

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Hsu, C. W., Kuo, R. J., & Chiou, C. Y. (2014). A multi-criteria decision-making approach for evaluating carbon performance of suppliers in the electronics industry. *International Journal of Environmental Science and Technology*, *11*(3), 775–784. doi:10.100713762-013-0265-5

Hsu, C. W., Kuo, T. C., Chen, S. H., & Hu, A. H. (2013). Using DEMATEL to develop a carbon management model of supplier selection in green supply chain management. *Journal of Cleaner Production*, *56*, 164–172. doi:10.1016/j.jclepro.2011.09.012

Hsueh, S. L., & Yan, M. R. (2013). A multimethodology contractor assessment model for facilitating green innovation: The view of energy and environmental protection. *The Scientific World Journal*, *2013*, 1–14. doi:10.1155/2013/624340 PMID:24311979

Hu, Z., Rao, C., Zheng, Y., & Huang, D. (2015). Optimization decision of supplier selection in green procurement under the mode of low carbon economy. *International Journal of Computational Intelligence Systems.*, *8*(3), 407–421. doi:10.1080/18756891.2015.1017375

Kannan, D., de Sousa Jabbour, A. B. L., & Jabbour, C. J. C. (2014). Selecting green suppliers based on GSCM practices: Using fuzzy TOPSIS applied to a Brazilian electronics company. *European Journal of Operational Research*, *233*(2), 432–447. doi:10.1016/j.ejor.2013.07.023

Kannan, D., Khodaverdi, R., Olfat, L., Jafarian, A., & Diabat, A. (2013). Integrated fuzzy multi criteria decision making method and multi-objective programming approach for supplier selection and order allocation in a green supply chain. *Journal of Cleaner Production*, *47*, 355–367. doi:10.1016/j.jclepro.2013.02.010

Kannan, G., Haq, A. N., Sasikumar, P., & Arunachalam, S. (2008). Analysis and selection of green suppliers using interpretative structural modelling and analytic hierarchy process. *International Journal of Management and Decision Making.*, *9*(2), 163–182. doi:10.1504/IJMDM.2008.017198

Kannan, G., Murugesan, P., Senthil, P., & Noorul Haq, A. (2009). Multicriteria group decision making for the third party reverse logistics service provider in the supply chain model using fuzzy TOPSIS for transportation services. *International Journal of Services Technology and Management.*, *11*(2), 162–181. doi:10.1504/IJSTM.2009.022523

Kotler, P. (2004). *Philip Kotler's FAQs on Marketing* (2nd ed.). Istanbul: Translated in Turkish by Ümit Şensoy, Optimist Yayınları.

Kumar, A., Jain, V., & Kumar, S. (2014). A comprehensive environment friendly approach for supplier selection. *Omega*, *42*(1), 109–123. doi:10.1016/j.omega.2013.04.003

Kuo, R. J., Hsu, C. W., & Chen, Y. L. (2015). Integration of fuzzy ANP and fuzzy TOPSIS for evaluating carbon performance of suppliers. *International Journal of Environmental Science and Technology*, *12*(12), 3863–3876. doi:10.100713762-015-0819-9

Kuo, R. J., Wang, Y. C., & Tien, F. C. (2010). Integration of artificial neural network and MADA methods for green supplier selection. *Journal of Cleaner Production*, *18*(12), 1161–1170. doi:10.1016/j.jclepro.2010.03.020

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Kusi-Sarpong, S., Bai, C., Sarkis, J., & Wang, X. (2015). Green supply chain practices evaluation in the mining industry using a joint rough sets and fuzzy TOPSIS methodology. *Resources Policy*, *46*, 86–100. doi:10.1016/j.resourpol.2014.10.011

Kusi-Sarpong, S., Sarkis, J., & Wang, X. (2016). Assessing green supply chain practices in the Ghanaian mining industry: A framework and evaluation. *International Journal of Production Economics*, *181*, 325–341. doi:10.1016/j.ijpe.2016.04.002

Larsen, T. S. (2000). European Logistics Beyond 2000. *International Journal of Physical Distribution & Logistics Management*, *30*(5), 377–387. doi:10.1108/09600030010336144

Lee, A. H., Kang, H. Y., Hsu, C. F., & Hung, H. C. (2009). A green supplier selection model for high-tech industry. *Expert Systems with Applications*, *36*(4), 7917–7927. doi:10.1016/j.eswa.2008.11.052

Lee, K. H. (2009). Why and How to Adopt Green Management into Business Organizations? The Case Study of Korean SMEs in Manufacturing Industry. *Management Decision*, *47*(7), 1101–1121. doi:10.1108/00251740910978322

Lee, S. Y. (2008). Drivers for the participation of small and medium sized suppliers in green supply chain initiatives. *Supply Chain Management: An International Journal.*, *13*(3), 185–198. doi:10.1108/13598540810871235

Li, M., & Wu, C. (2015). Green supplier selection based on improved intuitionistic fuzzy TOPSIS model. *Metallurgical & Mining Industry.*, *6*, 193–205.

Liao, C. N. (2016). A fuzzy model to green supplier selection using AHP, ARAS and MCGP approach. *Transylvanian Review, 24*(8).

Liao, C. N., Fu, Y. K., & Wu, L. C. (2015). *Integrated FAHP, ARAS-F and MSGP methods for green supplier evaluation and selection.* Technological and Economic Development of Economy.

Lin, C., Madu, C. N., Kuei, C. H., Tsai, H. L., & Wang, K. N. (2015). Developing an assessment framework for managing sustainability programs: A Analytic Network Process approach. *Expert Systems with Applications*, *42*(5), 2488–2501. doi:10.1016/j.eswa.2014.09.025

Lin, R. J. (2013). Using fuzzy DEMATEL to evaluate the green supply chain management practices. *Journal of Cleaner Production*, *40*, 32–39. doi:10.1016/j.jclepro.2011.06.010

Lin, Y., Tseng, M. L., Chiu, A. S., & Wang, R. (2014). Implementation and performance evaluation of a firms green supply chain management under uncertainty. *Industrial Engineering and Management Systems.*, *13*(1), 15–28. doi:10.7232/iems.2014.13.1.015

Liu, P., & Zhang, X. (2011). Research on the supplier selection of a supply chain based on entropy weight and improved ELECTRE-III method. *International Journal of Production Research*, *49*(3), 637–646. doi:10.1080/00207540903490171

Liu, X. W., & Wang, Z. G. (2011). The performance evaluation of green supply chain of enterprise. In Applied Economics, Business and Development (pp. 304-309). Springer Berlin Heidelberg. doi:10.1007/978-3-642-23023-3_46

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Luthra, S., Garg, D., & Haleem, A. (2013). Identifying and ranking of strategies to implement green supply chain management in Indian manufacturing industry using analytical hierarchy process. *Journal of Industrial Engineering and Management.*, *6*(4), 930. doi:10.3926/jiem.693

Mangla, S. K., Kumar, P., & Barua, M. K. (2015a). Risk analysis in green supply chain using fuzzy AHP approach: A case study. *Resources, Conservation and Recycling*, *104*, 375–390. doi:10.1016/j.resconrec.2015.01.001

Mangla, S. K., Kumar, P., & Barua, M. K. (2015b). Flexible decision modeling for evaluating the risks in green supply chain using fuzzy AHP and IRP methodologies. *Global Journal of Flexible Systems Management.*, *16*(1), 19–35. doi:10.100740171-014-0081-x

Mardani, A., Jusoh, A., Nor, K. M. D., Khalifah, Z., Zakwan, N., & Valipour, A. (2015). Multiple criteria decision-making techniques and their applications – a review of the literature from 2000 to 2014. *Economic Research Journal*, *28*(1), 516–571.

Mari, S. I., Lee, Y. H., & Memon, M. S. (2014). Sustainable and resilient supply chain network design under disruption risks. *Sustainability.*, *6*(10), 6666–6686. doi:10.3390u6106666

Mathiyazhagan, K., Govindan, K., & Noorul Haq, A. (2014). Pressure analysis for green supply chain management implementation in Indian industries using analytic hierarchy process. *International Journal of Production Research*, *52*(1), 188–202. doi:10.1080/00207543.2013.831190

Mavi, R. K. (2015). Green supplier selection: A fuzzy AHP and fuzzy ARAS approach. *International Journal of Services and Operations Management*, *22*(2), 165–188. doi:10.1504/IJSOM.2015.071528

Mavi, R. K., Kazemi, S., Najafabadi, A. F., & Mousaabadi, H. B. (2013). Identification and assessment of logistical factors to evaluate a green supplier using the fuzzy logic DEMATEL method. *Polish Journal of Environmental Studies*, *22*(2), 445–455.

Meade, L., & Sarkis, J. (1998). Strategic analysis of logistics and supply chain management systems using the analytical network process. *Transportation Research Part E, Logistics and Transportation Review*, *34*(3), 201–215. doi:10.1016/S1366-5545(98)00012-X

Mehrabi, J., Gharakhani, D., Jalalifar, S., & Rahmati, H. (2012). Barriers to green supply chain management in the petrochemical sector. *Life Science Journal*, *9*(4), 3438–3442.

Mirhedayatian, S. M., Azadi, M., & Saen, R. F. (2014). A novel network data envelopment analysis model for evaluating green supply chain management. *International Journal of Production Economics*, *147*, 544–554. doi:10.1016/j.ijpe.2013.02.009

Molina-Azorin, J. F., Claver-Cortes, E., Lopez-Gamero, M. D., & Tari, J. J. (2009). Green management and financial performance: A literature review. *Management Decision*, *47*(7), 1080–1100. doi:10.1108/00251740910978313

Muduli, K., & Barve, A. (2013). Establishment of a sustainable development framework in small scale mining supply chains in India. *International Journal of Intelligent Enterprise*, *2*(1), 84–100. doi:10.1504/IJIE.2013.057340

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Nie, X. (2016). Dynamic Assessment of Business Performance in Green Supply Chain based on Analytic Hierarchy Process Method. *International Journal of Security and Its Applications*, *10*(2), 185–196. doi:10.14257/ijsia.2016.10.2.17

Odeyale, S. O. (2014). Performance appraisal for green/environmental friendliness of a supply chain department. *Journal of Industrial Engineering and Management*, *7*(5), 1316–1333. doi:10.3926/jiem.1057

Opricovic, S., & Tzeng, G. H. (2004). Compromise solution by MCDM methods: A comparative analysis of VIKOR and TOPSIS. *European Journal of Operational Research*, *156*(2), 445–455. doi:10.1016/S0377-2217(03)00020-1

Palmer, K., Oates, W. E., & Portney, P. R. (1995). Tightening Environmental Standards: The Benefit-Cost or the No-Cost Paradigm? *The Journal of Economic Perspectives*, *9*(4), 119–132. doi:10.1257/jep.9.4.119

Peng, J. (2012). Research on the optimization of green suppliers based on AHP and GRA. *Journal of Information and Computational Science*, *9*(1), 173–182.

Pishdar, M., Toloun, M. R. S. H., Zamani, S., & Farzianpour, F. (2014). Development of factors effective in the success of green supply chain management. *American Journal of Agricultural and Biological Sciences*, *9*(1), 33–43. doi:10.3844/ajabssp.2014.33.43

Rezaei, J., Nispeling, T., Sarkis, J., & Tavasszy, L. (2016). A supplier selection life cycle approach integrating traditional and environmental criteria using the best worst method. *Journal of Cleaner Production*, *135*, 577–588. doi:10.1016/j.jclepro.2016.06.125

Roarty, M. (1997). Greening Business in a Market Economy. *European Business Review*, *97*(5), 244–254. doi:10.1108/09555349710179898

Rostamzadeh, R., Govindan, K., Esmaeili, A., & Sabaghi, M. (2015). Application of fuzzy VIKOR for evaluation of green supply chain management practices. *Ecological Indicators*, *49*, 188–203. doi:10.1016/j.ecolind.2014.09.045

Saaty, T. L. (1980). *The analytic hierarchy process: planning, priority setting, resources allocation*. New York: McGraw.

Sahu, A. K., Datta, S., & Mahapatra, S. S. (2013). Green supply chain performance benchmarking using integrated IVFN-TOPSIS methodology. *International Journal of Process Management and Benchmarking*, *3*(4), 511–551. doi:10.1504/IJPMB.2013.058272

Sarkis, J. (1998). Evaluating environmentally conscious business practices. *European Journal of Operational Research*, *107*(1), 159–174. doi:10.1016/S0377-2217(97)00160-4

Sarkis, J., Zhu, Q., & Lai, K. H. (2011). An organizational theoretic review of green supply chain management literature. *International Journal of Production Economics*, *130*(1), 1–15. doi:10.1016/j.ijpe.2010.11.010

Sarmiento, R., & Thomas, A. (2010). Identifying improvement areas when implementing green initiatives using a multitier AHP approach. *Benchmarking: An International Journal*, *17*(3), 452–463. doi:10.1108/14635771011049399

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Sawadogo, M., & Anciaux, D. (2011). Intermodal transportation within the green supply chain: An approach based on ELECTRE method. *International Journal of Business Performance and Supply Chain Modelling*, *3*(1), 43–65. doi:10.1504/IJBPSCM.2011.039973

Shabani, A., & Farzipoor Saen, R. (2015). Developing a novel data envelopment analysis model to determine prospective benchmarks of green supply chain in the presence of dual-role factor. *Benchmarking: An International Journal*, *22*(4), 711–730. doi:10.1108/BIJ-12-2012-0087

Shaik, M., & Abdul-Kader, W. (2011). Green supplier selection generic framework: A multi-attribute utility theory approach. *International Journal of Sustainable Engineering*, *4*(01), 37–56. doi:10.1080/19397038.2010.542836

Sharma, V. K., Chandana, P., & Bhardwaj, A. (2015). Critical factors analysis and its ranking for implementation of GSCM in Indian dairy industry. *Journal of Manufacturing Technology Management*, *26*(6), 911–922. doi:10.1108/JMTM-03-2014-0023

Shaw, K., Shankar, R., Yadav, S. S., & Thakur, L. S. (2012). Supplier selection using fuzzy AHP and fuzzy multi-objective linear programming for developing low carbon supply chain. *Expert Systems with Applications*, *39*(9), 8182–8192. doi:10.1016/j.eswa.2012.01.149

Shen, L., Muduli, K., & Barve, A. (2013). Developing a sustainable development framework in the context of mining industries: AHP approach. *Resources Policy*, *46*(1), 15–26.

Shen, L., Olfat, L., Govindan, K., Khodaverdi, R., & Diabat, A. (2013). A fuzzy multi criteria approach for evaluating green suppliers performance in green supply chain with linguistic preferences. *Resources, Conservation and Recycling*, *74*, 170–179. doi:10.1016/j.resconrec.2012.09.006

Shi, P., Yan, B., Shi, S., & Ke, C. (2015). A decision support system to select suppliers for a sustainable supply chain based on a systematic DEA approach. *Information Technology Management*, *16*(1), 39–49. doi:10.100710799-014-0193-1

Sueyoshi, T., & Wang, D. (2014). Sustainability development for supply chain management in US petroleum industry by DEA environmental assessment. *Energy Economics*, *46*, 360–374. doi:10.1016/j.eneco.2014.09.022

Theißen, S., & Spinler, S. (2014). Strategic analysis of manufacturer-supplier partnerships: An ANP model for collaborative CO 2 reduction management. *European Journal of Operational Research*, *233*(2), 383–397. doi:10.1016/j.ejor.2013.08.023

Tsui, C. W., Tzeng, G. H., & Wen, U. P. (2015). A hybrid MCDM approach for improving the performance of green suppliers in the TFT-LCD industry. *International Journal of Production Research*, *53*(21), 6436–6454. doi:10.1080/00207543.2014.935829

Tsui, C. W., & Wen, U. P. (2012). Developing the Green Supplier Selection Procedure Based on Analytical Hierarchy Process and Outranking Methods. In *International Conference on Industrial Engineering and Operations Management*, (pp. 3-6).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Tsui, C. W., & Wen, U. P. (2014). A hybrid multiple criteria group decision-making approach for green supplier selection in the TFT-LCD industry. *Mathematical Problems in Engineering*, *2014*, 1–13. doi:10.1155/2014/709872

Tuzkaya, G., Ozgen, A., Ozgen, D., & Tuzkaya, U. R. (2009). Environmental performance evaluation of suppliers: A hybrid fuzzy multi-criteria decision approach. *International Journal of Environmental Science and Technology*, *6*(3), 477–490. doi:10.1007/BF03326087

Uygun, Ö., & Dede, A. (2016). (in press). Performance evaluation of green supply chain management using integrated fuzzy multi-criteria decision making techniques. *Computers & Industrial Engineering*. doi:10.1016/j.cie.2016.02.020

Wan, S. P., & Li, D. F. (2015). Fuzzy mathematical programming approach to heterogeneous multiattribute decision-making with interval-valued intuitionistic fuzzy truth degrees. *Information Sciences*, *325*, 484–503. doi:10.1016/j.ins.2015.07.014

Wang, X. (2015). A comprehensive decision making model for the evaluation of green operations initiatives. *Technological Forecasting and Social Change*, *95*, 191–207. doi:10.1016/j.techfore.2015.02.004

Wang, X., & Chan, H. K. (2013). A hierarchical fuzzy TOPSIS approach to assess improvement areas when implementing green supply chain initiatives. *International Journal of Production Research*, *51*(10), 3117–3130. doi:10.1080/00207543.2012.754553

Wang, X., Chan, H. K., Yee, R. W., & Diaz-Rainey, I. (2012). A two-stage fuzzy-AHP model for risk assessment of implementing green initiatives in the fashion supply chain. *International Journal of Production Economics*, *135*(2), 595–606. doi:10.1016/j.ijpe.2011.03.021

White, G. R., Wang, X., & Li, D. (2015). Inter-organisational green packaging design: A case study of influencing factors and constraints in the automotive supply chain. *International Journal of Production Research*, *53*(21), 6551–6566. doi:10.1080/00207543.2014.975854

Wu, C., & Barnes, D. (2016). An integrated model for green partner selection and supply chain construction. *Journal of Cleaner Production*, *112*, 2114–2132. doi:10.1016/j.jclepro.2015.02.023

Wu, H. H., & Chang, S. Y. (2015). A case study of using DEMATEL method to identify critical factors in green supply chain management. *Applied Mathematics and Computation*, *256*, 394–403. doi:10.1016/j.amc.2015.01.041

Yazdani, M. (2014). An integrated MCDM approach to green supplier selection. *International Journal of Industrial Engineering Computations*, *5*(3), 443–458. doi:10.5267/j.ijiec.2014.3.003

Yu, Q., & Hou, F. (2016). An approach for green supplier selection in the automobile manufacturing industry. *Kybernetes*, *45*(4), 571–588. doi:10.1108/K-01-2015-0034

Zaltman, G., & Zaltman, L. (2008). *Marketing Metaphors* (1st ed.). Istanbul: Optimist Yayınları.

Zhou, R., Ma, X., Li, S., & Li, J. (2012). The green supplier selection method for chemical industry with analytic network process and radial basis function neural network. *Advances in Information Sciences & Service Sciences*, *4*(4), 147–158. doi:10.4156/aiss.vol4.issue4.18

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

KEY TERMS AND DEFINITIONS

AHP: Analytical Hierarchy Process.
ANP: Analytical Network Process.
DEA: Data Envelopment Analysis.
DEMATEL: Decision Making Trial and Evaluation Laboratory.
ELECTRE: Elimination and Choice Expressing Reality.
GP: Goal Programming.
GSCM: Green Supply Chain Management.
MCDM: Multi-Criteria Decision Making Techniques.
PROMETHEE: Preference Ranking Organization Method for Enrichment Evaluation.
TOPSIS: Technique for Order Preference by Similarity to Ideal Solution.
VIKOR: The Compromise Ranking Method.

This research was previously published in Ethics and Sustainability in Global Supply Chain Management edited by Ulas Akkucuk, pages 261-287, copyright year 2017 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 76
Green Tourism and the Ambiguities of Sustainability Discourse: The Case of New Orleans's Lower Ninth Ward

Kevin Fox Gotham
Tulane University, USA

Joshua A. Lewis
Tulane University, USA

ABSTRACT

This paper uses a case study of the Lower Ninth Ward neighborhood in New Orleans to examine the relationships between green tourism and sustainability discourse in shaping the post-Katrina rebuilding process. Specially, we draw on long-term ethnographic field observations to highlight the tensions between abstract and idealized conceptions of sustainability and the complicated realities of uneven rebuilding and neighborhood disinvestment. We focus on changes in the tourism sector since Hurricane Katrina, the promotion of green tourism through actor Brad Pitt's Make It Right (MIR) Foundation, and the ambiguities and paradoxes of sustainability discourse. Overall, our goal is to develop a critical understanding of niche tourism in a disaster-devastated neighborhood and highlight the ways in which unspoken norms about sustainability create political-economic blind-spots to the ways in which socio-spatial inequalities, disinvestment, and entrenched social problems structure life in the city and the Lower Ninth Ward.

INTRODUCTION

Over the last decade or so, much research has focused on the increasing differentiation and specialization of tourism practices and activities into particular segments or niches. "Niche tourism" is a practice of splitting, fragmenting, and differentiating cultural forms, places, and groups into ever smaller slices in order to tap into and exploit consumer desires and preferences for profit and economic gain (for an

DOI: 10.4018/978-1-5225-7915-1.ch076

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

overview, see Novelli, 2012). What distinguishes "mass tourism" from "niche tourism" is that the profitability for the former rests on economies of scale and exploitation of mass, relatively homogeneous markets. Profitability and competitiveness in niche tourism in contrast depends on economies of scope and market segmentation (for overviews see Urry, 2002; Meethan, 2001). Examples of niche tourism include cultural tourism, heritage tourism, romance tourism, dark tourism, sports tourism, sex tourism, ethnic tourism, eco- or green tourism, and so on (Rojek, 1993; Stone & Sharpley, 2008; Stone, 2006; Miles, 2002; Wood, 1998; Sheller, 2003; Ryan & Hall, 2001; Picard, 1997; Gotham, 2007; Wearing & Neill, 2009; Murphy & Price, 2012). Overall, the growth of niche tourism represents conscious attempts by governments and elites to revitalize the local tax base, attract visitors to spend money, and enhance livability through the construction and promotion of urban or cultural niches where the tourism product relates to a particular symbol, topic, theme, or interest group (Hoffman, Fainstein, & Judd, 2008; Robinson & Novelli, 2005; Rath, 2007).

In this paper, we use a case study of the Lower Ninth Ward neighborhood in New Orleans to examine the relationships between green tourism and sustainability discourse in shaping the post-Katrina rebuilding process. Specifically, we focus on the ways in which the discourse of "green sustainability" has been appropriated by tourism boosters and used as a sophisticated niche marketing technique. Through various forms of advertising and promotion, tourism boosters seek to banish negative images of post-Katrina destruction from media and the public consciousness and encourage neighborhood repopulation and rebuilding. We argue that the term "sustainability" has a high level of interpretative flexibility (Jacob, 1997) and therefore symbolic value and utility for cities and neighborhoods struggling to rebuild in the aftermath of a major disaster. The term does not exclude any particular activity or group, exudes positive traits and inclusive activities, and does not seem to have any intrinsic negative features. More important, the term "sustainability" can allow a discursive space for vastly different interpretations and articulations, and can be aligned with a variety of touristic and entertaining activities. Thus, the term tends to be embraced by a variety of different communities, people, and groups for different goals. For tourism boosters and promoters, "sustainability" contains a multiplicity of meanings that provide social actors with a strategic vocabulary but one that leaves the specifics of content ambiguous. Overall, as we show, the growth of green tourism highlights the convergence between sustainability discourse and tourism in the sense that sustainability itself becomes a major tourist attraction and recovery tool for disaster-devastated places.

GREEN TOURISM AND URBAN SUSTAINABILITY

Ecotourism or green tourism is one of the fast growing areas of the tourism sector and has become a major economic revitalization tool for cities and rural towns. A number of scholars have developed typologies of green tourism, theories of green tourism experiences, and examined the role of climate change and sustainability in marketing green tourism, among other concerns (Butcher, 2007; Wu, Wang, & Ho, 2010; Béteille, 1996). One can find conceptualizations of green tourism as travel to places that are defined by their fragile natural environments, a form of natural resource management, a set of practices for generating environmental awareness and conserving biodiversity, and a force for environmental commodification (for overviews, see Holden, 2007; Honey, 2008; Weaver, 2012). Examples of green tour-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

ism include tours that foster awareness for the environment and cultural practices in a local community, landscape museums, agritourism accommodation resorts, spa resorts, one-village-one-product programs, farmers' markets, and promotion of carbon reduction initiatives and carbon offsetting schemes (Kandari & Chandra, 2005; Font & Tribe, 2001). The notion of "green" tourism seeks to encourage people to pursue leisure activities in a manner that will benefit, rather than harm, the environment, a concern that is gaining popularity especially in the context of global climate change (Gibson, et al., 2003). Despite much research, only recently have scholars begun to examine the effect of green tourism on patterns of social inequality in cities, the social-ecological consequences of green tourism, and the impact of green tourism projects on local and indigenous cultures.

Around the world green tourism remains a source of much debate and controversy. On one hand, proponents claim that green tourism promotes sustainable development, enhances leisure facilities for residents, and empowers local people through the preservation and affirmation of local ecological knowledge (Bhattacharya & Dey, 2013; da Costa & da Costa, 2010; Zhang & Lai Lei, 2012). Critics, on the other hand, maintain that green tourism promotes the growth of low wage jobs with few benefits, diverts public monies from addressing crucial local problems, and damages the environment (for overviews, see Bramwell, 2012; Duffy, 2012; Higham, 2007). When planning for green tourism, for example, much of the academic literature rightfully addresses the potential for biophysical impacts resulting from hordes of tourists traveling to a particular place defined as "fragile." Research suggests that some variants of green tourism can promote inauthentic cultural representations and distort local ecological knowledge and history (for an overview, see Butcher, 2011). In contrast, other researchers argue that green tourism can be a mechanism to combat ethnocentrism and foster an appreciation of indigenous cultures (Singh & Mishra 2004). While planners have suggested that green tourism can contribute to problem amelioration and community revitalization, other scholars have argued that ecotourism can promote the external control of conservation spaces by international organizations that ultimately contribute to, rather than alleviate, poverty and dependency in local communities (Laudati, 2010).

In the study that follows, we use content analysis, ethnographic field research, and participant observation methods in the Lower Ninth Ward neighborhood of New Orleans to examine the tensions and contradictions of sustainability discourse in the context of the rise of green tourism in the city. Our analysis of green tourism focuses on the efforts of actor Brad Pitt and his Make It Right (MIR) Foundation to promote "environmental awareness," provide "financial benefits for conservation," and respect local culture (Make it Right Foundation (MIR), 2013a). Founded by Brad Pitt in 2007, the MIR Foundation seeks to leverage public and private resources to build environmentally conscious, "healthy homes" that enhance the natural environment and meet "the highest standards of green building" (MIR, 2013b). Green tourism extolls the virtues of sustainability, celebrates sustainability as a value in itself, and describes sustainability as vehicle of post-Katrina recovery and rebuilding. Yet, as we show, sustainability tourism and its related discourses can obscure the deeper socio-spatial inequalities in the city and mask the negative consequences of the post-disaster rebuilding process. What makes green tourism and sustainability discourse so potent and problematic is precisely the way they appear to engage contemporary social problems yet do not grasp the social inequalities and structural and historical roots that accompany them. Overall, our goal is to develop a critical understanding of niche tourism in a disaster-devastated neighborhood and highlight the ambiguities and paradoxes of sustainability discourse.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

METHOD AND DATA SOURCES

Research Design

This study draws on content analysis of tourism publications, long-term ethnographic field research and participant observation since 2006 in New Orleans. Various promotional brochures, travel features, annual reports, websites, and policy and research documents published by New Orleans Tourism Marketing Corporation, the New Orleans Metropolitan Conventional and Visitors Bureau, and the New Orleans Multicultural Tourism Network were all analyzed for thematic and topical information on post-Katrina tourism rebuilding initiatives and strategies. Other promotional material advertisements from organizations such as Grey Line Bus Tours, Big Easy Tours, and Diamond Tours were analyzed to identify the major themes, symbols, and motifs used by tourism organizations to represent post-Katrina New Orleans. We also consulted the *New Orleans Times-Picayune* newspaper annual index and online search engines (e.g., Lexis-Nexis and Factivia) for references to newspaper articles on the Lower Ninth Ward, post-Katrina tourism rebuilding in New Orleans and other information on businesses and non-profit organizations involved in sustainability and redevelopment efforts.

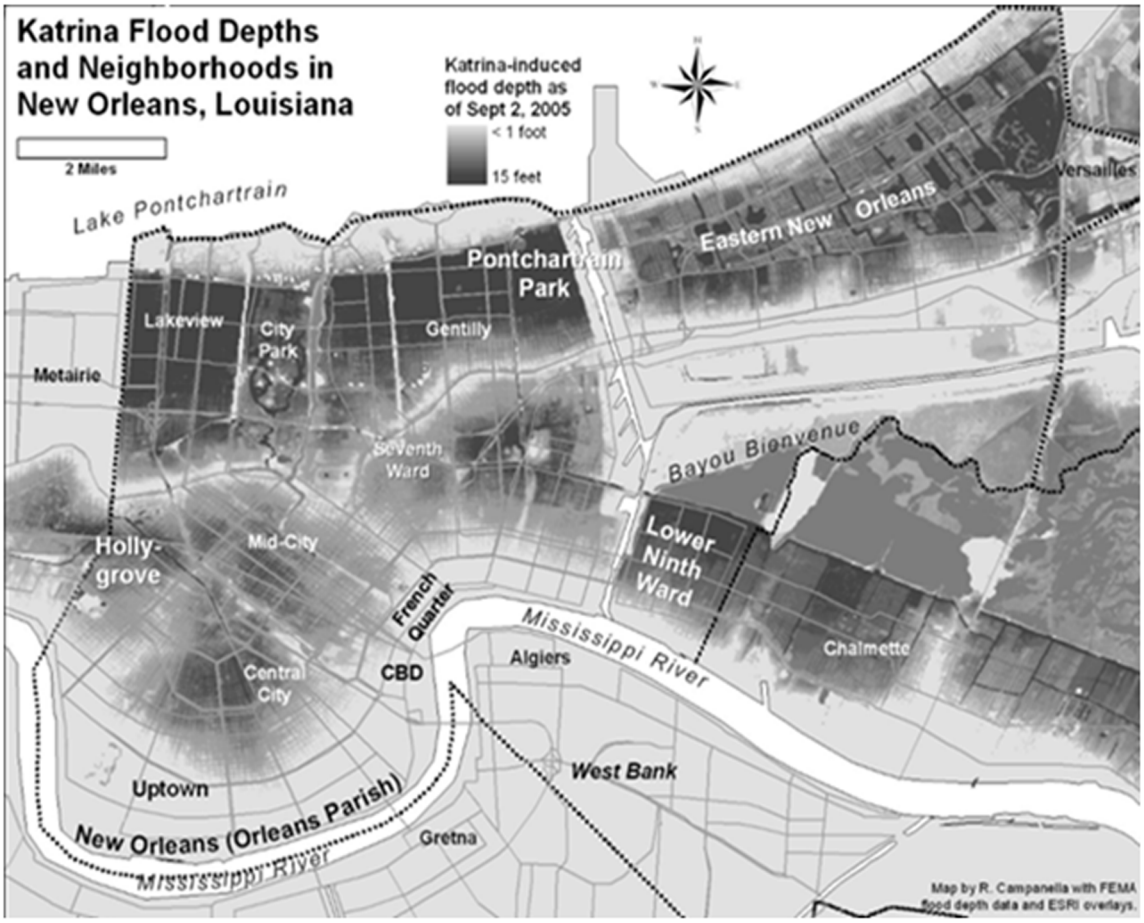
The research for this project is part of a multi-year team ethnography composed of students and faculty working in several different New Orleans neighborhoods. The two authors of this ethnographic study are long-term residents who have lived in New Orleans since the 1990s. The second author took on the role of primary data gatherer and field researcher while the first author assumed the role of a detached observer, functioning as a sideline coach to the overall project. Since the field researcher had repeated interactions with residents, he had the opportunity to query them over time about their meanings and uses of "sustainability" and encourage them to expand on responses that were unclear. The purpose in being alert to the different meanings of sustainability was to dig below surface appearances, to appreciate more fully the cultural nuances we observed, and unravel the rich social and political texture of "everyday life" (Lefebvre, 1991) which ordinarily eludes surveys and statistical methods. Field observations and conversations with residents helped focus subsequent field encounters and move from an empirical analysis of sustainability and niche tourism to shed theoretical and empirical light on the ways in which tourism and sustainability intertwine with post-disaster recovery and rebuilding processes. Overall, this study is innovative because it uses a triangulation mixed-methods design to examine a phenomenon – niche tourism in a disaster-impacted city – that social scientists have not examined extensively and has the potential to advance theory on the relationships between tourism and post-disaster sustainability.

Research Site

The research site is the Lower Ninth Ward neighborhood in New Orleans, an area that was devastated by flood waters caused by the collapse of the United States Army Corps of Engineers levee walls, which line the Inner Harbor Navigation Canal (or Industrial Canal), a century-old waterway constructed in the 1920s to serve the Port of New Orleans (see Figure1). The levee breaches directed water swiftly through the area, pushing homes off their foundations, carrying a unmoored barge into the neighborhood, and creating the now infamous images of urban destruction that covered front pages and television screens throughout the world. Structural damage to homes in the neighborhood was widespread and hundreds of homes were demolished rather than rebuilt. The neighborhood was depopulated for months, as government engineers worked to drain the area, which was inundated again a few weeks later by Hurricane Rita.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 1. Katrina flood depths and neighborhoods in New Orleans, Louisiana



As table 1 indicates, repopulation in the neighborhood has lagged far behind the city average. The Lower Ninth Ward registered a population decline of more than 71 percent after the deluge. According to the 2010 census, 5556 Lower Ninth Ward residents live in the neighborhood out of a pre-Katrina population of 19,515. Electricity and basic sewer services took up to a year or more to restore to many addresses. Business development has also been slow to return and, as of 2013, the neighborhood still did not have a grocery store, pharmacy, or many other anchor businesses.

The devastation of the Lower Ninth Ward can be explained with reference to longstanding patterns of socially produced marginality, flood risk, and vulnerability to storms. At various points in history, flood waters have entered the neighborhood across all four of its borders, though the primary flood risk for the area is the Industrial Canal, which flooded the neighborhood severely in 1965 during Hurricane Betsy as well as in 2005. Originally settled in the 1880s by primarily working class European immigrant families, development was initially constrained to the narrow strip of high ground along the Mississippi River (Campanella, 2008). The development of a municipal drainage system beginning in the early 1900s gradually opened up the contemporary footprint of the neighborhood to residential development. While

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 1. Total Population and Ethnic/Racial Population for New Orleans and the Lower Ninth Ward, 2000-2010

	2000	2010	Change 2000-2010
Orleans Parish:			
Total Population	484,676	343,829	-140,845 (-29%)
White	128,871 (27%)	104,770 (30%)	-24,101 (-37%)
African American	323,392 (67%)	204,866 (60%)	-118,526 (-19%)
Asian	11,007 (2.0%)	9988 (3.0%)	-1019 (-9.0%)
Hispanic	14,826	18,051	3225 (21%)
Lower Ninth Ward:			
Total Population	19,515	5,556	-13,959 (-71.5%)
White	591 (3%)	237 (4.3%)	-354 (-40.1%)
African American	18,632 (95.5%)	5137 (92.4%)	-13,495 (-72.4%)
Asian	16 (<0.1%)	7 (<0.1%)	-9 (-43.7%)
Hispanic	147 (0.8%)	99 (1.8%)	-48 (-32.6%)

the older housing stock along the Mississippi River enjoys an elevation of up to ten feet above sea level, the rear portion of the neighborhood has subsided to up to four feet below sea level after drainage authorities cut and drained the freshwater swamps in the area during the early to mid twentieth century. City authorities have for a century made use of the fact that the neighborhood lies at the city's downstream perimeter, to site slaughterhouses, maritime industrial sites, drainage outfall canals, sewage treatment facilities, and landfills in the area (Landphair, 2007; 1999).

Three major developments during the twentieth century events contributed to the area's social and historic marginalization within the city while exacerbating the neighborhood's vulnerability to flood and storm damage. First, the Industrial Canal was modernized and expanded after the Second World War to create a direct ship canal between the city's inner harbor and the Gulf of Mexico. Second, a protracted battle over school desegregation in the early 1960s triggered a demographic transformation in the neighborhood, as the token integration of white schools in the Lower Ninth Ward led to a mass exodus of whites to neighboring St. Bernard Parish (Wieder, 1987; Spain, 1979). Third, levee breaks caused by Hurricane Betsy in 1965 flooded the neighborhood with 6-8 feet of water. Over 80 percent of the neighborhood flooded, leading to further out-migration by whites and wealthier African-Americans. By 2000, whites represented only 0.5% of the population of the lower-lying portion of the neighborhood, and only 10% along the high ground skirting the Mississippi, out of an estimated total population of approximately 20,000 people (Greater New Orleans Community Data Center, 2013). This classic pattern of "white flight" coincided with the increasing fiscal constraints in the public sector in the 1970s and later. By the 1980s and 1990s, researchers and neighborhood leaders recognized the neighborhood's increasing vulnerability to hurricane storm surges due to subsidence, coastal wetlands loss, substandard flood protection systems, and shipping canal construction between the city and the Gulf of Mexico (Campanella 2008; Landphair 1999; 2007).

With the emergence of the Environmental Justice (EJ) movement in the 1980s, some Lower Ninth Ward activists began to reframe the neighborhood's geographic dilemmas and flood hazards as an ex-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

ample of environmental racism (Bullard, 2005; 2000; 1994; Cole & Foster, 2001; Harvey, 1996; Szasz, 1994). In particular, the neighborhood's relationship to the Port of New Orleans' Industrial Canal has been a major point of concern for residents, as the Port has worked for nearly eighty years to expand the canal, dig new connecting channels to the Gulf of Mexico, expand and enlarge the river lock system, and in general encourage public and private capital investment along the waterway. For residents, the canal acts as a physical and symbolic barrier between the neighborhood and the rest of the city that is a marker and source of inequality and injustice. Other resident concerns – e.g., the operation of the bridges which serve as the community's only evacuation route, the toxic sediments that line the canal bed, and the canal's involvement in the salinization and destruction of freshwater swamps - have been cited by neighborhood activists as examples of the rampant social and ecological injustices that plague the neighborhood. Most importantly, residents have targeted the canal's capacity as a conduit for floodwaters as a major focal point of mobilization and contestation and activists have initiated frequent protests and joined with civic associations to oppose the modernization and continued use of the canal.

Residents' emerging interest in the EJ framework in the 1980s and 1990s catalyzed the formation of new networks linking neighborhood activists with the broader environmental community and social justice movements around the world. One neighborhood association has repeatedly enrolled university-based attorneys to sue the Port and the US Army Corps of Engineers on their behalf to prevent the expansion of the Industrial Canal. By the late 1990s, the environmental community had largely come to embrace EJ as an important perspective in environmentalism, and more traditional environmental organizations, like the Sierra Club for example, began forming relationships with neighborhood activists. On the eve of Hurricane Katrina in 2005, Ninth Ward activists and residents had formed a plethora of cross-scale networks and connections with environmental groups, low-income housing advocates, anti-poverty groups, and civil rights organizations located in the United States and around the world. These diverse networks operated as communicatory infrastructure through which grassroots and global organizations could share information and resources to assist each other in their campaigns for social justice.

FROM ENVIRONMENTAL JUSTICE TO URBAN SUSTAINABILITY

Shortly after, Hurricane Katrina struck in August 2005, the neighborhood activists who had developed many close-knit and strategic partnerships over the preceding two decades activated their professional networks in an effort to bring public attention to the devastation of the Lower Ninth Ward. One of their first initiatives included the development of a grassroots post-disaster planning process to access state and philanthropic resources to rebuild the neighborhood. Prior to Katrina, neighborhood activists frequently articulated their grievances through a distribution-oriented EJ frame, but after Katrina, mirroring broader trends in environmentalism, neighborhood activists began using "sustainability" as a discursive strategy to articulate their agenda.

Specifically, neighborhood activists worked with residents, urban designers, and sustainability experts throughout late 2005 and early 2006 to draft the "Sustainable Restoration" plan for the neighborhood. This document, printed and posted online, is heavily infused with ideas about urban development rooted in sustainability and green urbanism. The circulation of this document within the sustainable urban design community attracted the attention of dozens of organizations and universities, including the staff of Global Green USA, an arm of the International Green Cross, who in 2006 began working on an initiative to build a cluster of green homes along the Mississippi River in the neighborhood. Actor Brad Pitt

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

was an early spokesman and fundraiser for the project, and through conversations with neighborhood activists and sustainability advocates, a North Carolina investment company agreed to provide financing for a more ambitious project, envisioned as the largest cluster of green homes in the United States. Over 2007 and early 2008, this project evolved into the Make it Right (MIR) Foundation, with Brad Pitt mobilizing his celebrity status and well-heeled networks to raise funds for the project. MIR organizers selected the tract of vacant lots along the Industrial Canal floodwall, where the most traumatic flooding had occurred in 2005.

In addition to the MIR Foundation, neighborhood activists hosted and facilitated projects by dozens of university-based groups and non-governmental organizations that, after hearing about the Sustainable Restoration Plan through professional networks or media, sought collaborative ties with community-based groups. Many of these organizations worked with community groups to identify individual families and homeowners to install various technologies of sustainability in their homes and yards. Common examples have included home weatherization and energy efficiency retrofitting technologies like radiant barrier, tree plantings, small-scale storm water management measures like rain gardens and bioswales, backyard gardening and urban agriculture, and so on. In some cases, these interventions have been only one component of a larger agenda of rehabilitating damaged homes and other more traditional disaster recovery projects.

Sustainability advocates from the world over have visited the neighborhood, and the narrative of the neighborhood's transformation from a devastated "wasteland" to a globally significant example of the power of sustainability in disaster recovery are frequently found in media and scholarly accounts concerning the neighborhood's redevelopment. Years after floodwaters overwhelmed the neighborhood, the Lower Ninth Ward now includes three urban farms, the highest per-capita use of solar arrays in New Orleans, and more "green" houses than any other neighborhood in the United States, as reported by the Sierra Club (Reckdahl, 2012). These transformations underscore a tension between the distribution-oriented discursive strategies of much of the neighborhood's civil society before Katrina, and the sustainability centered discourses that have emerged since the flood. The EJ movement emerged primarily out of the practical political experience of organizers, maintaining a focus on the uneven distribution of environmental hazards and amenities, and exploring the various legal and political strategies to contest particular industries, infrastructures, patterns of risk, and so on (Swyngedouw & Heynen, 2003). Post-Katrina sustainability discourse, on the other hand, has emerged from more elite policy concerns and abstract normative versions of how the Lower Ninth Ward should be rebuilt. As we point out below, these interrelated themes have been articulated with tourism modes of visualization, discourse, and staging.

GOING GREEN IN THE BIG EASY: SUSTAINABLE DEVELOPMENT AS POST-KATRINA REBUILDING STRATEGY

For decades, New Orleans has been one of the world's most popular tourist and convention destinations, drawing around nine million visitors per year in the years before Hurricane Katrina. With a variety of entertainment venues, celebrated festivals, niche tours, historical and cultural heritage sites, and other attractions, the city and region had acquired a reputation as a place of fun, enjoyment, and unquestioned authenticity. Before Hurricane Katrina, tourism was a $5.5 billion dollar industry that accounted for 40 percent of the city's tax revenues and employed 85,000 people. The levee breaches caused by Hur-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

ricane Katrina flooded 80 percent of the city including hundreds of thousands of homes and businesses and contributed to more than 1300 deaths. While the main tourist areas - the French Quarter, Garden District and Uptown - escaped major flooding and suffered only minor wind damage, the tourism sector lost approximately 22,900 jobs.

Since the disaster, political and economic elites and local and regional tourism organizations have attempted to expel negative impressions, neutralize the stigma of disaster, and create a more favorable destination brand image using sophisticated marketing strategies. According to data gathered by the Morial Convention Center, the city hosted 111 events at the Morial Convention Center in 2008, an all-time high. Just over nine million tourists and business travelers spent a record $6 billion in New Orleans in 2012, the highest since Hurricane Katrina and the second-highest ever, according to a study commissioned by the New Orleans Metropolitan Convention and Visitors Bureau (CVB) and the New Orleans Tourism Marketing Corporation (McConnaughey, 2013).

One of the most significant changes in the tourism sector since Hurricane Katrina is the proliferation of a variety of niche marketing campaigns and advertising efforts to promote New Orleans as a place of environmental sustainability. Since the disaster, the Mayor's Office, the Chamber of Commerce, the Greater New Orleans (GNO), Inc. and other organizations have attempted to redefine New Orleans as place of entrepreneurship based on "green industry" and sustainability including art-based commerce, bio-technology, film and media production. In 2011, GNO Inc., a public-private organization promoting economic development in the region, unveiled its "Sustainable Industries Initiative" (SII), aimed at "developing sustainable services" that "will help companies not only manage environmental issues but even profit from them (e.g., waste-to-energy technology)" (GNO, 2011). Sustainability's potential as a catalyst for economic growth lies in cultivating what the GNO, Inc. calls a "sustainable entrepreneurial culture" premised on the use of "green incentives" to spur development and target businesses that specialize in water management/hydrology, sustainable building, renewable energy, coastal restoration and disaster mitigation. "Green incentives" include tax credits, tax exemptions, and enterprise zones to "make the region an ideal place to build sustainable technologies, products and services" (GNO, 2012). "There's no question the New Orleans area has an experience and a brand that is inextricably linked to the environment," according to Michael Hecht, President and CEO of GNO, Inc. "We have an opportunity to leverage that brand and that experience" (as quoted in Riegel, 2010).

Today, a variety of green tourism strategies and practices have been incorporated in the repertoire of urban place marketing to help rebuild New Orleans and influence social, economic, and environmental sustainability. The formation of the "Green Committee" of the New Orleans Chamber of Commerce in 2011 reflects an interest in developing sustainability strategies; raising the profile of green commerce in New Orleans; and assisting "New Orleans businesses to build local political support for green industries" (New Orleans Chamber of Commerce, 2012). In recent years, the CVB has created a meeting planner resources guide and assembled information on greening efforts and other eco-friendly attractions from the City of New Orleans and the local hospitality community (CVB, 2012). As part of their aforementioned projects in the Lower Ninth Ward, Global Green USA sponsored an international design competition for their housing development, voicing their "commitment to the sustainable rebuilding of New Orleans and demonstrating green building as a solution to global warming nationally" (Global Green USA, 2013). Global Green USA in particular has invoked the crisis of climate change as a central motivation for much of their programming in New Orleans, where notions of "carbon neutrality" and "carbon sequestration" were key themes in their public relations and programming discourse.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

In addition, Global Green USA and the New Orleans Tourism Marketing Corporation (NOTMC) have partnered to provide a list of eco-friendly "Green Hotels in New Orleans." The criteria for inclusion on the list of green hotels include "environmentally friendly practices in place to conserve water, electricity and reduce … overall carbon footprint." Green hotels are "making strides toward sustainability and offer the environmentally-conscious traveler to New Orleans some options" (New Orleans Tourism Marketing Corporation, 2013). Swamp tour companies now routinely advertise themselves as eco-tours that take travelers through the marshes and wetlands in the New Orleans region for the purpose of promoting conservation and appreciation of biodiversity as expedients to sustaining coastal ecosystems.

The previous points draw our attention to the significant cultural, political, and socio-economic importance and resources diverse actors and organized interests are placing on tourism to help rebuild post-Katrina New Orleans. From city government agencies, non-profit organizations, a variety of tourism industry players are attempting to brand New Orleans as a green tourism destination. In New Orleans, the development of green tourism has been an outgrowth of a variety of tourism and non-tourism practices that have been infused with sustainability discourses. By utilizing processes of strategic framing, cross-scale collaboration, and leveraging of public and private resources, various individuals and organizations within and outside the tourism industry have been able to develop and promote a tourism destination based on green sustainability.

GREEN TOURISM AND BRAD PITT'S MAKE IT RIGHT FOUNDATION

In the years since the Hurricane Katrina disaster, Brad Pitt's MIR Foundation has become a major institution for the promotion of eco-tourism and green sustainability by partnering with leaders in environmental design, sustainable redevelopment, and community organization. The mission of the MIR Foundation is to rebuild the Lower Ninth Ward by using high quality, affordable, and environmentally conscious building materials founded on the Cradle to Cradle design approach pioneered by architect William McDonough and chemist Dr. Michael Braungart. The Cradle to Cradle design approach stresses the use biologically safe materials and products designed for disassembly/recovery. The approach is premised on the idea that communities should be able to use renewable energy, maintain and enhance water quality, honor social fairness and human dignity, and improve in a continuous and aspirational fashion. MIR began by commissioning designs for an initial 150 low-cost homes from thirteen prominent architecture firms. Construction began on the first homes in early 2008. The houses have many flood-protection features including some with foundations that can float, roof patios for hurricane and flood relief, and innovative recycling and energy-generating installations to reduce costs. As of March 2013, the MIR Foundation had completed 87 homes in the Lower Ninth Ward (MIR, 2013b).

Brad Pitt's MIR homes not only function as physical dwellings for returning residents, but they operate as advertisements for a celebrity-inspired form of sustainability in which changes in architecture and physical form - e.g., construction of energy efficient homes, solar arrays, raised homes, and so on - become the *sine qua non* for sustainable post-disaster rebuilding. While Pitt and the MIR Foundation recognize the problems that have affected the Lower Ninth Ward, their narrative is crafted to persuade people to donate to the relief effort, and to help build 150 homes out of more than 220,000 that were flooded by Katrina. While praiseworthy and important to the individual homeowners who receive a

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

MIR home, the philanthropic approach is largely piecemeal and individualistic. That is, the goals of the MIR Foundation are not explicitly coordinated with federal or local low-income housing programs to sufficiently address and remedy the housing problems of the poor or the long-term displaced.

It is important to note that, in the Lower Ninth Ward, the newly erected beautiful homes cannot hide the swaths of neglect and ruin that plague the neighborhood and other parts of the metropolitan area. This chaotic arrangement of new homes amid blocks of destruction is accepted and celebrated as a result of a community wide and international concern with sustainable development, and celebrity advocacy on the part of Brad Pitt and his MIR Foundation. Because the new homes are advertised as exemplars of sustainable development, they focus and absorb the spectator's attention upstaging the devastated homes and neighborhoods spaces that exist in a perpetual state of disrepair and abandonment. For those who travel into the Lower Ninth Ward, the newly built homes become tourist spectacles that efface the distinctions between the real cityscape with its inequalities and injustices, and the entertaining spectacle.

We can view Brad Pitt's MIR Foundation as a conflictual and contradictory set of practices that interconnect philanthropic revitalization efforts with tourism modes of discourse, visualization, and staging. The MIR Foundation reflects and reinforces broader green tourism efforts to (re)present and showcase the Lower Ninth Ward as a site of tourist consumption. The MIR Foundation's "self-guided tour" advertises itself as a tour where "you will learn about our architects and their home designs, visit our sustainable playground and get more information on what makes this neighborhood 'the largest, greenest community of single family homes in the world,' according to the U.S. Green Building Council" (MIR, 2013c). The goal here is to enhance the tourism value of the Lower Ninth Ward in a way that will produce a ripple effect through the local community and economy and also sustain the unique cultural character of the neighborhood, especially its newfound status as an exemplar of sustainable development. On one hand, the representation of the neighborhood as a tourist site reflects conscious and strategic efforts to capitalize on the tourist's desire for the dramatic, spectacular, and the unusual. On the other hand, the MIR Foundation operates as a supplier of disaster tourism which depends on the commodification of leisure and the transformation of tragic events into as entertaining attractions that can deliver extraordinary experiences.

Through our ethnographic work and we find that the MIR Foundation is an institutional resource and set of relations that residents and non-local people can use to increase local capacity building and empower local communities to address a poorly managed formal recovery policies, and fight against social injustice. With an emphasis on enriching personal experiences and environmental awareness through interpretation, green tourism seeks to promote greater understanding and appreciation for nature, local society, and culture. The MIR Foundation appropriates this discourse of green tourism through practices such as hiring and training local workers in green building practices, creating volunteer opportunities for local residents to aid and assist rebuilding efforts, the establishment of an online "green library," and the promotion of critical dialogue and discussions in their "green building laboratory," a blog to encourage debate over sustainable development. While some groups have received funding for programming articulated in the language of sustainability, in many cases those programs represent only one facet of the scope of the organization's work in the community. Receiving resources through and participating in the "urban sustainability" work of the MIR Foundation and other neighborhood institutions has been a significant catalyst for the creation of new networks for community organizing and planning for a sustainable future.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

THE DARK SIDE OF SUSTAINABILITY DISCOURSE

What unites the sustainability discourse and practices of various tourism suppliers, government agencies, non-profit organizations, and the Make It Right Foundation is that all praise the merits of sustainability, proclaim sustainability as an end in itself, and describe sustainability as the new cornerstone, foundation, and hope for post-Katrina New Orleans. Yet there is a dark side to sustainability discourse. Particularly noteworthy are the ways in which unspoken norms about sustainability create political-economic blind-spots to the ways in which social inequalities, disinvestment, and long-standing and entrenched social problems structure life in the city and the Lower Ninth Ward. We point to three ambiguities.

One ambiguity concerns the tendency of niche tourism rhetoric to downplay and disavow past social problems and segregative actions that interconnect with current forms of poverty and uneven development. In much of the promotional rhetoric of niche tourism there is a tendency to downplay any negative features and undesirable characteristics of the past that may deter visitors from visiting a particular destination. In New Orleans, green tourism is rooted in future concerns with how post-Katrina New Orleans ought to look like, rather than acknowledging how past actions and decisions contributed to the flooding of New Orleans. Continuing poverty, for example, is explicitly ostracized from niche tourism promotional strategies and rhetoric.

More important, how current patterns of poverty may discourage the development of long-term sustainability is not mentioned in tourism promotional rhetoric or sustainability discourse, an omission that makes it difficult to construct a progressive politics of post-Katrina urban rebuilding. Table 2 shows poverty rates in the neighborhood and city. While the table shows declines in rates of poverty for individuals in New Orleans and the Lower Ninth Ward, the latter shows stubbornly high rates (34.4 percent in 2000 and 29.5 percent) compared to the overall city average of 27.9 percent in 2000 and 24.4 percent in 2010. The decline in the rate of poverty for New Orleans and the Lower Ninth Ward reflect the fact that the poor were the most vulnerable to flood damage and least likely to have the resources to return to the city after the deluge. The high poverty rate in the Lower Ninth Ward implicates the area as a very poor neighborhood plagued by disinvestment.

Second, sustainability discourse emanating from tourism organizations, city agencies, and the MIR Foundation obscures the negative socio-spatial consequences and inequality reinforcing features of current recovery programs and rebuilding policies. We see this very clearly in MIR efforts to link architectural design with sustainable development outcomes:

Design has the power to improve the quality of affordable housing and enhance occupants' living conditions; it also plays a key role in creating vibrant, sustainable communities. Innovation results in affordable building designs, methods and materials that drive new industry standards for green buildings. (MIR, 2013a)

Table 2. Poverty status of individuals, in 2000 and 2010 for New Orleans and the Lower Ninth Ward

	2000	2010	Change
New Orleans	135,224 (27.9%)	83,894 (24.4%)	-51,330 (-37.9%)
Lower Ninth Ward	6717 (34.4%)	1,639 (29.5%)	-5078 (-75.5%)

Aggregated data between Holy Cross and Lower Ninth Ward neighborhood data. Greater New Orleans Community Data Center Neighborhood (GNOCDC) Profiles. Based on US Census Bureau Data.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The sustainability discourse of the MIR Foundation is infused with architecture and physical design principles, an orientation that views social problems such as continuing flood and storm risks as the problems of individual homes and households rather than as systemic problems that interconnect with the particular infrastructural and ecological systems that have produced those risks. These points resonate with McGregor's (2004) suggestion that the dominance of corporate-driven sustainable development discourse is troubling because of the extremely narrow urban policy repertoire based on capital subsidies, place promotion, supply-side intervention, and local boosterism. "It becomes extremely difficult to mobilize a population around issues that do not relate directly to sustainability" without the ideas, logic and language (e.g., critiquing inequalities, injustices, institutional discrimination, and the exploitative nature of global capitalism) that can be used as "rallying points" on other issues (p. 603).

In addition, the appropriation of sustainable development discourses by tourism organizations, the MIR Foundation, and other corporate proponents reduces the potency and applicability of sustainability ideas and makes the discourse much more amenable to relatively conservative environmental goals. More systemic theorizations and interconnected analyses can become marginalized and ostracized along with the discourses that support them. In doing so, the actions we can relate to sustainability are reduced to green design, recycling, energy conservation, and so on.

Third, what the MIR Foundation and other tourism promoters seek to promote is a simulated sustainability, a discourse that emphasizes anti-hierarchical relations and consensus, altruism, and cooperation while ignoring social divisions, conflicts, and struggles as essential features of the post-Katrina rebuilding process. This tendency, we argue, is most typical and problematic in local discussions about neighborhood identity and local control that are intended to address issues of inclusion, affordability, and grassroots input into public debates over the pace trajectory of the rebuilding effort. MIR's foundational principles are statements emanating from a vision that communities should have "energy efficient, well-designed homes" that are "affordable and available for everyone." Affordability is infused with sustainable development but the discourse of sustainability, as promoted by MIR and tourism organizations, does not offer a series of policy remedies for increasing housing affordability for low-income Katrina victims. Abstract statements such as "everyone has the right to live in a high-quality, healthy home that enhances the natural environment" avoid discussions of present inequalities that point to the centrality of race and class in structuring the life chances of Lower Ninth Ward residents. Moreover, statements such as "communities should be fully engaged in defining their own needs and have a leading role in designing appropriate ways to meet those needs" fail to address who gets to define the "community" and for what purpose.

Overall, rebuilding efforts in post-Katrina New Orleans reveal the dominance of a new sustainable development discourse that emphasizes physical design, green technology, niche tourism promotion, and celebrity activism as expedients of disaster recovery. This promotional rhetoric and orientation tends to valorize individually adopted technological solutions to the structurally produced and systemic problems of risk exposure particular to the Lower Ninth Ward. By presenting "green technologies" in the context of a flood devastated neighborhood, the designers and architects involved in the MIR project promote the fetishization of these technologies as individually adopted panaceas that are resilient to certain patterns of flood and storm risk. What is important is that patterns of risk and vulnerability to storms and flooding are not simple by-products of "natural" ecosystems but are outcomes of past land-use practices and the historically contested politics of urban development and policymaking (Gotham and Campanella 2011). Moreover, while the fusion of green sustainability discourse with niche tourism practices may offer new representations of cities and regions they also promulgate a series of obfuscations and blindspots that diminish chances for long-term sustainability.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

CONCLUSION

The discourse of sustainability radiating through New Orleans institutions is not homogeneous but involves a diversity of multifaceted and contested themes and symbols that interconnect with tourism practices and discourses. For many advocates working in the Lower Ninth Ward, sustainability discourse depoliticizes complex political struggles over continuing quality of life concerns, equity and access to public services, and social problem melioration. But as David Harvey (1996) has noted, discourses are not monolithic, and are characterized by "all sorts of slippages, ambiguities, and incoherencies" (p. 89). As we have shown, this ambiguity enables sustainability programs to reframe, repackage, and (re)present urban disaster for spectators, and in doing so, tend to silence and shroud issues of uneven development and socio-spatial inequality. Yet our ethnographic work also suggests that for community activists in New Orleans, "urban sustainability" represents a toolkit of diverse themes, symbols, motifs that they can strategically appropriate and deploy in an eclectic fashion to challenge marginality and contest social injustice.

While our paper sheds light on the contradictory and paradoxical elements of green tourism, our findings also reveal positive features and suggest a series of recommendations for using tourism as a vehicle for post-disaster recovery and rebuilding. First, our ethnographic works suggests that greater inclusion of local residents in green tourism decision-making processes and in the design of green tourism sights and sites can facilitate local buy-in and help promote long-term sustainability of ecological and cultural resources. This was an admittedly difficult task in the Lower Ninth Ward, where many residents were displaced and the majority have yet to return, making them difficult to reach out to for neighborhood groups and activists. Still, community input can be important for strengthening environmental education and management of tourism sites and can also broaden the support base for attracting increased public and private sector funding for enforcement of environmental regulations protecting green spaces. Following past research, we agree that green tourism is concept that can promote environmental responsibility and post-disaster recovery provided that local residents are amenable and are meaningfully included in the planning and decision-making that will affect their lives and communities. Moreover, community input and grassroots participation in green tourism planning can mitigate the "dark" side of sustainability and can also be a means of both enhancing local economic vitality and strengthening community attachments to place.

In addition, our findings suggest that green tourism practices can be fruitful strategy of post-disaster rebuilding but active government participation at all levels is required. The establishment and regulation of green tourism in community and environmentally sensitive ways depends on the establishment and enforcement of public policies, municipal codes, and socio-legal regulations that integrate eco-businesses, green spaces, galleries and heritage sites, natural food stores, and sustainable transportation options among other features. Green tourism should not be viewed as an ancillary component of tourism or an add-on to already existing economic development tools. Rather, we believe that green tourism practices should be incorporated and integrated into the overall repertoire of economic development on a regional scale. These practices can include green tourism training and education programs, and information disseminated to tourists and residents on the need to understand the costs of destroying natural assets (Cheung & Fok, 2013), the potential impacts of global climate change on cities, continuing risks and vulnerabilities to hazards that many cities face. New training programs for tour guides and education promotion for tourists

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

and residents can curb tendencies toward sustainability discourses to be compartmentalized and used for exploitative economic activities. Active government participation including planning and monitoring toward the realization of sustainability goals must be central efforts to promote green tourism.

ACKNOWLEDGMENT

We gratefully acknowledge the support of the National Science Foundation (under award number: 0958993) in funding the research and data collection for this paper.

REFERENCES

Bhattacharya, D., & Dey, S. (2013). Ecotourism for sustainable development: A study on environmental awareness of tourists. *EXCEL International Journal of Multidisciplinary Management Studies*, *3*(4), 274–288.

Bramwell, B. (2012). Critical and normative responses to sustainable tourism. In T. V. Singh (Ed.), *Critical debates in tourism* (pp. 39–43). Channel View Publications Ltd.

Bullard, R. D. (1994). *Unequal protection: Environmental justice and communities of color*. New York: Random House.

Bullard, R. D. (2000). *Dumping in Dixie: Race, class, and environmental quality*. Boulder, CO: Westview Press.

Bullard, R. D. (2005). *The quest for environmental justice: Human rights and the politics of pollution*. Sierra Club Books.

Butcher, J. (2007). *Ecotourism, NGOs and development: A critical analysis*. London: Routledge.

Butcher, J. (2011). Can ecotourism contribute to tackling poverty? The importance of 'symbiosis'. *Current Issues in Tourism*, *14*(3), 295–307. doi:10.1080/13683500.2011.555526

Campanella, R. (2008). *Bienville's dilemma: a historical geography of New Orleans. Center for Louisiana Studies*. University of Louisiana at Lafayette/Garrett County Press.

Chatterton, P., & Hollands, R. (2003). *Urban Nightscapes: Youth Cultures, Pleasure Spaces, and Corporate Power*. London, New York: Routledge. doi:10.4324/9780203402054

Cheung, L. T. O., & Fok, L. (2013). Assessing the Role of Ecotourism Training in Changing Participants' Pro-Environmental Knowledge, Attitude and Behaviour. *Asia Pacific Journal of Tourism Research.* Retrieved July 20, 2013 from http://www.tandfonline.com/doi/abs/10.1080/10941665.2013.797003

Cole, Luke W., & Foster, S.R. (2001). *From the ground up: Environmental racism and the rise of the environmental justice movement*. New York: NYU Press.

da Costa, N. C., & da Costa, V. C. (2010). Ecotourism in Brazil: Geographical perspectives of development in protected areas. *Sustainable Tourism IV*, *139*, 295.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Desmond, J. C. (2001). *Staging tourism: Bodies on display from Waikiki to Sea World*. University of Chicago Press.

Duffy, R. (2012). *A trip too far: ecotourism, politics, and exploitation*. Earthscan.

Feighery, W. G. (2011). Discourse and the governance of diversity in England's official tourism texts. *Journal of Policy Research in Tourism. Leisure and Events*, *3*(2), 121–146. doi:10.1080/19407963.2011.555456

Font, X., & Tribe, J. (2001). Promoting green tourism: The future of environmental awards. *International Journal of Tourism Research*, *3*(1), 9–21. doi:10.1002/1522-1970(200101/02)3:1<9::AID-JTR244>3.0.CO;2-Q

Gibson, A., Dodds, R., Joppe, M., & Jamieson, B. (2003). Ecotourism in the city? Toronto's green tourism association. *International Journal of Contemporary Hospitality Management*, *15*(6), 324–327. doi:10.1108/09596110310488168

Global Green, U. S. A. (2013). "Rebuilding Green in New Orleans." Retrieved March 20, 2013, from http://www.globalgreen.org/articles/global/115

Gotham, K. F. (2007). *Authentic New Orleans: Tourism, culture, and race in the big easy*. NYU Press.

Gotham, K. F., & Campanella, R. (2011). Coupled vulnerability and resilience: The dynamics of cross-scale interactions in post-Katrina New Orleans. *Ecology and Society*, *16*(3), 12. doi:10.5751/ES-04292-160312

Greater New Orleans Community Data Center. (2013). *Neighborhood Data: Lower Ninth Ward and Holy Cross Neighborhoods.* Based on US Census Bureau data. Retrieved March 22, 2013, from http://gnocdc.org/NeighborhoodData/8/index.html

Greater New Orleans, Inc. (2011). "SII the Future." *News and Publications*. Vol. 26: 06/17/2011. Retrieved July 1, 2012 from http://gnoinc.org/news/publications/region-report/sii-the-future/

Greater New Orleans, Inc. (2012). "Sustainable Industries." Industry Sectors. Retrieved Jule 2, 2012, from http://gnoinc.org/industry-sectors/sustainable-industries/

Hall, M. C., & Ryan, C. (2001). *Sex tourism: Marginal people and Liminalities*. New York: Routledge.

Harvey, D. (1996). *Justice, nature and the geography of difference*. Oxford: Blackwell.

Higham, J. (Ed.). (2007). *Critical issues in ecotourism*. New York: Routledge.

Hoffman, L. M., Fainstein, S. S., & Judd, D. R. (Eds.). (2008). *Cities and visitors: regulating people, markets, and city space*. New York: Wiley-Blackwell.

Holden, A. (2007). *Environment and tourism*. New York: Routledge.

Honey, M. (2008). *Ecotourism and Sustainable Development: Who Owns Paradise?* (2nd ed.). Washington, DC: Island Press.

Jacob, M. (1997). Critical theory in political practice: Sustainable development and development theory. *Science, Technology & Society*, *2*(1), 99–129. doi:10.1177/097172189700200104

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Judd, D. R., & Fainstein, S. S. (1999). *The Tourist City*. New Haven, CT: Yale University Press.

Kandari, O. P., & Chandra, A. (2005). *Tourism Development – Principle and Practices*. Shri Publication.

Kearns, G., & Philo, C. (1993). *Selling places: the city as cultural capital, past and present*. London: Permagon.

Landphair, J. (1999). Sewerage, sidewalks, and schools: The New Orleans Ninth Ward and public school desegregation. *Louisiana History*, (40): 35–62.

Landphair, J. (2007). The Forgotten People of New Orleans": Community, Vulnerability, and the Lower Ninth Ward. *The Journal of American History*, *94*(3), 837–845. doi:10.2307/25095146

Laudati, A. (2010). Ecotourism: The modern predator? Implications of gorilla tourism on local livelihoods in Bwindi Impenetrable National Park, Uganda. *Environment and Planning. D, Society & Space*, *28*(4), 726–743. doi:10.1068/d15708

Lefebvre, H. (1991). *The Production of Space*. Oxford: Blackwell.

MacCannell, D. (1973). Staged authenticity: Arrangements of social space in tourist settings. *American Journal of Sociology*, *79*(3), 589–603. doi:10.1086/225585

Make It Right Foundation (MIR). (2013a). *About the MIR.* Retrieved March 19, 2013, from http://makeitright.org/about/

Make It Right Foundation (MIR). (2013b). *About the MIR:FAQs.* Retrieved March 19, 2013, from http://makeitright.org/about/faq

Make It Right Foundation (MIR). (2013c). *How to Help: Tours.* Retrieved March 19, 2013, from http://makeitright.org/about/how-to-help/tours/

McConnaughey. Janet. (2013). 2012 tourism in New Orleans: A record $6 billion. Associated Press Wire. Retrieved July 23, 2013 from http://www.huffingtonpost.com/huff-wires/20130313/us-travel-brief-new-orleans-tourism/?utm_hp_ref=green&ir=green

McGregor, A. (2004). Sustainable development and 'warm fuzzy feelings': Discourse and nature within Australian environmental imaginaries. *Geoforum*, *35*(5), 593–606. doi:10.1016/j.geoforum.2004.02.001

Meethan, K. (2001). *Tourism in global society*. Basingstoke: Palgrave.

Miles, W. F. (2002). Auschwitz: Museum interpretation and darker tourism. *Annals of Tourism Research*, *29*(4), 1175–1178. doi:10.1016/S0160-7383(02)00054-3

Murphy, P. E., & Price, G. G. (2005). Tourism and sustainable development, In: William F. Theobald, W.F. (Ed) Global Tourism (Third Edition). Boston: Butterworth-Heinemann, Boston, 2005.

New Orleans Chamber of Commerce. (2012). "Green Committee." Retrieved July 1, 2012, from http://neworleanschamber.org/member-benefits/green-committee/

New Orleans Metropolitan Convention and Visitors Bureau. (2012). "Sustainability and Green Meetings." Retrieved July 1, 2012, from http://www.neworleanscvb.com/meeting-planners/plan-your-meeting/sustainability-green/

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

New Orleans Tourism Marketing Corporation. "Green Hotels in New Orleans." Retrieved March 18, 2013 from http://www.neworleansonline.com/book/rooms/green.html

Novelli, M. (Ed.). (2005). *Niche tourism: Contemporary issues, trends and cases*. Burlington, MA: Elsevier Butterworth-Heinemann.

Novelli, M. (Ed.). (2012). *Niche tourism*. Routledge.

Picard, M. (1997). Cultural Tourism, Nation-Building, and Regional Culture: The Making of a Balinese Identity. In M. Picard & R. E. Wood (Eds.), *Tourism, Ethnicity, and the State in Asian and Pacific Societies*. Honolulu: University of Hawai'i Press.

Rath, J. (Ed.). (2007). *Tourism, ethnic diversity and the city* (Vol. 6). Routledge. doi:10.4324/9780203413869

Reckdahl, K. (2012). *Sierra Club Trumpets 'Green Wave' in Lower 9th Ward. February 25*. New Orleans Times-Picayune.

Riegel, S. (2010). "Looking On the Green Side." News and Publications. August 1, 2010. Greater New Orleans (GNO), Inc. Retrieved July 2, 2012, from http://gnoinc.org/news/region-news/looking-on-the-green-side/

Robinson, M., & Novelli, M. (2005). Niche tourism: An introduction. In M. Novelli (Ed.), *Niche tourism: Contemporary issues, trends and cases* (pp. 1–11). Burlington, MA: Elsevier Butterworth-Heinemann. doi:10.1016/B978-0-7506-6133-1.50007-X

Rojek, C. (1993). *Ways of Escape*. Basingstoke: MacMillian. doi:10.1057/9780230373402

Sheller, M. (2003). *Consuming the Caribbean: from Arwaks to zombies*. Psychology Press.

Singh, R. B., & Mishra, D. K. (2004). Green tourism in mountain regions-reducing vulnerability and promoting people and place centric development in the Himalayas. *Journal of Mountain Science*, *1*(1), 57–64. doi:10.1007/BF02919360

Spain, D. (1979, January). Race relations and residential segregation in New Orleans: Two centuries of paradox. *The Annals of the American Academy of Political and Social Science*, *441*(1), 82–96. doi:10.1177/000271627944100107

Spirou, C. (2010). *Urban Tourism and Urban Change: Cities in a Global Economy*. Taylor & Francis.

Stone, P. (2006). A dark tourism spectrum: Towards a typology of death and macabre related tourist sites, attractions and exhibitions. *Tourism: An Interdisciplinary International Journal*, *54*(2), 145–160.

Stone, P., & Sharpley, R. (2008). Consuming dark tourism: A thanatological perspective. *Annals of Tourism Research*, *35*(2), 574–595. doi:10.1016/j.annals.2008.02.003

Swyngedouw, E., & Heynen, N. C. (2003). Urban political ecology, justice and the politics of scale. *Antipode*, *35*(5), 898–918. doi:10.1111/j.1467-8330.2003.00364.x

Szasz, A. (1994). *EcoPopulism: Toxic waste and the movement for environmental justice*. Minneapolis, MN: University Of Minnesota Press.

Urry, J. (2002). *Sociology beyond societies: Mobilities for the twenty-first century*. Routledge.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Van den Berghe, P. L. (1980). Tourism as ethnic relations: A case study of Cuzco, Peru. *Ethnic and Racial Studies*, *3*(4), 375–392. doi:10.1080/01419870.1980.9993312

Wearing, S., & Neil, J. (2009). *Ecotourism: impacts, potentials and possibilities?* Routledge.

Weaver, D. B. (2012). Organic, incremental and induced paths to sustainable mass tourism convergence. *Tourism Management*, *33*(5), 1030–1037. doi:10.1016/j.tourman.2011.08.011

Wieder, A. (1987). The New Orleans School Crisis of 1960: Causes and Consequences. *Phylon*, *48*(2), 122–131. doi:10.2307/274776

Wood, R. E. (1998). Touristic ethnicity: A brief itinerary. *Ethnic and Racial Studies*, *21*(2), 218–241. doi:10.1080/014198798329991

Wu, Y., Wang, H., & Ho, Y. (2010). Urban ecotourism: Defining and assessing dimensions using fuzzy number construction. *Tourism Management*, *31*(6), 739–743. doi:10.1016/j.tourman.2009.07.014

Zhang, H., & Lei, S. L. (2012). A structural model of residents' intention to participate in ecotourism: The case of a wetland community. *Tourism Management*, *33*(4), 916–925. doi:10.1016/j.tourman.2011.09.012

This research was previously published in the International Journal of Social Ecology and Sustainable Development (IJSESD), 6(2); edited by Elias G. Carayannis, pages 57-73, copyright year 2015 by IGI Publishing (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 77
Awareness of Sustainability, Green IT, and Cloud Computing in Indian Organisations

Tomayess Issa
Curtin University, Australia

Girish Tolani
Curtin University, Australia

Vanessa Chang
Curtin University, Australia

Theodora Issa
Curtin University, Australia

ABSTRACT

This chapter examines the level of awareness that organizations in India have of the concepts, strengths and benefits of sustainability, green IT and cloud computing. Very few research papers have examined the sustainability, green IT awareness and cloud computing issues in India, and it has become necessary to ascertain just where Indian organizations stand when it comes to these concerns. Before determining whether these organisations are progressing towards sustainability, green IT and cloud computing, it is first necessary to determine whether, and to what extent, they are aware of these concepts. This research is to obtain answers, which hopefully will be a first step in a shift towards sustainability and green IT, via an online survey. Seventy-five respondents from public and private Indian organizations participated in this survey and confirmed that cloud computing is efficient, flexible and easy to maintain, although security and privacy are major concerns for Indian organizations.

INTRODUCTION

Sustainability, green IT and cloud computing are currently hot topics in research studies as well as in organizations and businesses. Due to the increase of greenhouse gases and global warming, many organizations and businesses are shifting towards becoming green and sustainable. One of the first changes

DOI: 10.4018/978-1-5225-7915-1.ch077

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

that they implement is in their IT infrastructure because the ICT sector is a major contributor to the increase in greenhouse gases which leads to an increase in global warming. The topics of green IT and cloud computing are attracting much discussion and research. These changes in IT infrastructure and the IT sector are taking place all over the world, not just in a few countries. In some countries, governments are promoting green IT and cloud computing by providing policies and guidelines, and encouraging businesses to adopt environment-conscious practices by giving them special benefits. Much research has been conducted on the issues of sustainability, green IT and cloud computing with a common understanding that there is a need to initiate a shift towards sustainability and green IT because of increasing environmental problems and social pressure. Cloud computing is also emerging as a hot topic of research and discussion because it is considered to be the next wave of sustainability and green IT.

Sustainability means using resources wisely to save for the future generation without compromising the needs of the present generation. With technology moving towards sustainability, IT practices and products need to be made greener and safer. Green IT is considered to be the first wave of sustainability. Green IT means implementing green practices in terms of all IT processes and product life cycles. Green IT also includes the use of energy efficient IT products, use of power management software and reusing and recycling IT devices. Cloud computing, on the other hand, is considered as the second wave of sustainability and an extension of green IT which simply is the sharing of resources and applications by a number of people at a single cloud provided by a single vendor.

This conserves power that would otherwise be consumed by huge data centres, and requires less hardware at the user end which results in less wastage of resources. This chapter aims to examine the levels of awareness, regarding sustainability, green IT and cloud computing, of Indian organizations. India is the second largest country in terms of population so it contributes a lot to global warming so it becomes necessary to find out the initiatives and steps taken by the Indian government and organizations in making IT green.

Cloud computing is a relatively new concept in the business world and not many companies in India are thoroughly familiar with it. In actual fact, many Indian-based IT companies are outsourcing cloud computing services to companies in other countries, but have made little effort to introduce this concept in the Indian business world because of cost factors. The conclusion was that the awareness was there but the level of awareness was low or negligible. Some companies have adopted cloud computing in their operations but these are few and far between. The Indian government has done little to promote sustainability, green IT and cloud computing.

IT companies have shown the same lack of effort to promote these concepts in India. The time to take action is now – before it is too late and India is left behind by the more forward-thinking nations. India is also considered to be a technologically advanced country as there are numerous Indian-based IT companies who are actually providing IT services worldwide. In order to collect data for the research work, a survey questionnaire was prepared to determine whether or not Indian organizations are aware of the concepts of sustainability, green IT and cloud computing; and if they are, their level or degree of awareness. Non-probability sampling techniques were used to select the samples; in this case, the snowball technique was used. For the purposes of analysis, the Factor Analysis indicated that Indian organizations are aware of these concepts in their IT operations. They are also a little aware of the benefits of implementing these trends, and the potential harm to their organization by not adopting green IT and IT sustainability as security and privacy are major concerns from the Indian organizations' perspective.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Finally, this chapter aims to examine the level of awareness of Indian organizations' – public and private – about sustainability and cloud computing. This chapter is organized as follows: 1) Introduction; 2) Sustainability and IT; 3) Green IT 4) Cloud Computing; 5) Sustainability and Green IT awareness and Initiatives in India; 6) Chapter Significance; 7) Research Method Design and Research question; 8) Data Collection; 9) Participants; 10) Results; 11) Discussion; 12) Limitations; 13) Conclusion.

SUSTAINABILITY AND IT

Sustainability has emerged as an alarming issue much discussed by scholars and practitioners. This is because the last two decades have brought much economic growth accompanied by increasing concern about both wealth disparity and natural resource depletion (Dao, 2011). The concept of *triple bottom line* has been developed for defining sustainability that includes three components: the natural environment, society and economic performance (Dao, 2011). Sustainability as an issue has increased to the point where there is now a need to guide all businesses towards sustainable development. Consumers now are demanding much more energy-efficient and eco-friendly products, and businesses should recognize the needs of the new consumer that is emerging in the market. During the last two decades, there has been a rapid growth in the ICT sector which has resulted in an increase in the rate of greenhouse gas emissions (Prasad, Saha, P.Misra, B.Hooli, & M.Murakami, 2010).

In 2007, the ICT sector alone was responsible for 0.8 billion tonnes of carbon emission which was 2 per cent of overall emissions and estimation is that it is going to increase to 1.4 billion by 2020 (Prasad et al., 2010). The ICT sector, more than any other sector, needs to seriously consider a shift towards a green and sustainable future. Energy resources need to be used sensibly; irresponsible use will affect the environment and rapidly deplete these resources (Ketting, 1995). Many organizations are not moving towards sustainability as they think that it will increase the cost of production and will erode their competitiveness, but sustainability drives organization towards organizational and technological innovations that yield both top line and bottom line returns (Nidumolu, 2009).

Sustainability should not be confined to IT; it should be applied to the entire business process of an organization. Today, consumers are becoming more environmentally conscious than ever before, so there is a need to incorporate managerial concern with consumer concern about the natural and physical environment; this will contribute to superior business performance and enhance the corporate reputation (Sharma, 2010). Sustainability consists of seven key elements: *governance* which means top management should consist of people who support sustainability; *leadership* which means that the leader responsible for the sustainability agenda must pay attention to how the concept is to be framed and introduced; *business plan* should be made consisting of three diagnostics - situational, goal and implementation; *measure and report* which means activities need to be measured against identified progress and must be reported; *organizational learning* should be encouraged as this helps in speedy transition; *culture* is also necessary for sustainability; and lastly *information systems* - by developing models, information systems can help to achieve sustainability in an eco-efficient, eco-equity and eco-effective way (Smith & Sharicz, 2011). Basically, sustainable IT is also considered as green IT but now is the time to move on to the second wave of sustainable IT which would be more externally focussed and service oriented, allowing IT to exploit both enterprise and customer opportunities while addressing broader societal problems (Harmon & Demirkan, 2011).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

GREEN IT

Green IT presents new concepts of manufacturing and recycling computers and devices with minimal impacts on the environment. Currently, data centre and servers are using green IT technology to reduce energy and cost, provide an effective performance, promote recyclability, and reduce the use of hazardous materials. Currently, several companies locally and globally are using green IT technology in their organizations to improve energy efficiency to protect our planet and saving the current resources for the seventh generation (Newton, 2000; Newton, 2003)

Green computing is intended to reduce hazardous material and maximize energy efficiency and it should be recyclable. Green IT refers to saving energy at various levels including hardware, software and services (Agarwal & Nath, 2011). Data centres should be set up in deserts where there is an abundance of available land and geo-tectonic stability, and non-conventional sources of energy - solar and wind - should be used, although the regulation of temperature and humidity must be considered (Vijaykumar, 2011). Virtualization is also important for green IT. There are three types of virtualization: storage virtualization which condenses several storage spaces to a single storage location; network virtualization divides bandwidth into independent channels and combines computing resources into one; and server virtualization hides the physical server resources (Yamini & Selvi, 2010). Data and programs are being swept away from the desktops and PCs, and software are used as services. The internet is the platform for cloud computing services (Hayes, 2008) and has the advantage of decreasing the amount of storage that individual computers require to store a software. Server and storage virtualization are the third generation of virtualization that brings together server and storage to form a whole entity combined into a dynamic, centrally managed resource pool, where any application or operating system can maintain continuous optimization and high availability status (Xianmin, 2011). Green cloud is also introduced as a new architecture for data centres. It will reduce power consumption and give guaranteed performance to the users by leveraging live virtual machine migration technology. This green cloud architecture uses virtual machines to meet the workload requirements (Liu et al., 2009)

CLOUD COMPUTING

Cloud computing refers to applications that are provided as services on the internet, and the hardware and system software in the data centres that provide those services (Armbrust, 2010). The data centre that provides these services including the hardware and the software is called a "cloud" (Armbrust, 2010). These services, when provided to the general public, are called "public cloud" and the services are called "utility computing" because the user can access services according to his/her requirements without having to know where these services are being hosted and how they are delivered (Buyya, 2009). When a company uses a data centre for its own purposes and this centre is not available to the public, this is called "private cloud" (Armbrust, 2010). It simply means that now the computing world is developing software not just for their own requirements, but for millions of others to consume as a service; this is what is done in cloud computing (Buyya, 2009; Singh & Malhotra, 2012; Zissis & Lekkas, 2012).

Buyya (2009) even compared cluster, grid and cloud computing: Cluster computing is a type of parallel and distributed system, which consists of a collection of inter-connected, stand-alone computers working together as a single, integrated computing resource. Grid computing is a type of parallel and distributed system that enables the sharing, selection, and aggregation of geographically distributed `autonomous'

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

resources dynamically at runtime depending on their availability, capability, performance, cost, and users' quality-of-service requirements. Cloud computing is a type of parallel and distributed system consisting of a collection of inter-connected and virtualized computers that are dynamically provisioned and presented as one or more unified computing resource(s) based on service-level agreements (SLA) established through negotiation between the service provider and consumers.

The hardware and infrastructure required for cloud computing are (Singh & Malhotra, 2012; Velte, Velte, & Elsenpeter, 2010; Weiss, 2007; Zhang & Chen, 2010): firstly, clients- the end user devices which are required to interact with the cloud. There are different types of client: 1) Mobile clients include devices like laptops, PDAs and smart phones. These devices generally are subject to security and speed issues as there are certain places where connections are slow (e.g. hotels, restaurants or WIFI- enabled public places) 2) Thin clients are those clients which lack hard drives and any kind of CD/DVD ROM and display just what is on the server. Thin clients are generally used when the applications or the information can be taken from the cloud and there is no additional requirement of storing on individual systems. These are less expensive and are used in small scale or medium scale businesses.

Security is good as no data is stored on the clients. 3) Thick clients are those which are normally used as desktops with all the required hardware. They are connected to the clouds for some particular applications. When cloud computing is introduced in the organization, if company has a low budget, they can use the desktops that are already present in the organisation instead of getting new thin clients. These are handy when one needs to store files on one's own systems instead of fetching it from clouds every time. Security is an issue as data is stored on the client machine itself.

Secondly, security is another aspect to consider when introducing cloud computing. There is always a concern about the security of data as the data is stored by a third party and not by the client itself. There are certain security benefits of storing data on cloud: for example, there is comparatively less data leakage as the storage is centralised and not spread among various clients; clients never need to worry about the security as this is the responsibility of the cloud provider; there are always new developments that address security issues related to the cloud; and lastly, if there is a security breach, the cloud provider can respond to the incident with less downtime than if this were done by the organisation itself (Marston, Li, Bandyopadhyay, Zhang, & Ghalsasi, 2011; Redmap, n.d)

Cloud computing can bring several benefits to an organisation including technical, user, architectural and organizational advantages as follows: (Aymerich, 2008): firstly, the technical advantages are that it does not require additional hardware to handle peak load situations because of which hardware infrastructure can be highly under-utilised; these resources can be virtualised and presented to customers as virtual servers which they can manage by themselves, but if this is done physically, it might require multiple computers or data centres. Finally, Nandgaonkar and Raut (2014) confirm that cloud computing services depend fully on availability, speed, quality and performance of the internet, which is provided by the service provider.

Secondly, the user is no longer stuck with traditional computing and there is no need to buy special devices such as PDAs or specially-configured phones in order to use a particular application. In future, any device that is internet-enabled will be able to use cloud-based applications. Moreover, when using those applications, the end user will not have to worry at all about capacity or compatibility or other issues apart from device maintenance. There are no concerns about upgrading a software version on the hard disk as the cloud provides the latest version.

Thirdly, cloud computing can be set up in places at lower costs of space and electricity. Furthermore, by using cloud computing, an organisation can achieve efficiency in their hardware and software infra-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

structure as the related costs will be reduced and resource utilization will be increased, thereby increasing profitability. Furthermore, the resources can be pooled, thereby increasing utilization by delivering them only when they are required.

Fourthly, cloud computing is advantageous for low-capital, small and medium-scale businesses as they will not need to spend a great deal on buying in-house resources and technical equipment. Finally, even large-scale businesses and organizations are adopting cloud computing as it saves costs, can be remotely accessed, is easily available, and allows real-time collaboration.

Finally, cloud computing considers the new smart technology which needs to be adopted by organizations and users to reduce the impact of IT technology on environment from design, energy and e-waste (Brender & Markov, 2013; Johnson, 2013; Singh & Malhotra, 2012)

SUSTAINABILITY AND GREEN IT AWARENESS AND INITIATIVES IN INDIA

India is an emerging economy and IT products and services are used at a greater rate here because of the high population and therefore power consumption rate is equally high. The world is relying heavily on non-renewable sources of energy for its power supply. Eighty-five per cent of the world's power comes from fossil fuels, 9 per cent from hydro, 4 per cent from nuclear and 2 per cent from new renewable sources (Naidu, 1996). In India, there is a pressing need to adopt green IT because of the rapid growth of technology, expected shortages of power supply, huge maintenance of data centres and e-wastage of IT hardware and products (SaniaKhan, AbdulRazak, & KrishnaKumar, 2011). The adoption of green IT in India needs a mind-set wave in education, awareness programs and information, technology and commitment, as environmental issues related to carbon footprints, e-wastage and disposals of IT hardware, data centre maintenance are rarely discussed. However, some companies such as MNC IT and other international customers are trying to do business the green IT way, although it is still difficult to adopt green IT practices in India at every level due to the need for huge investment and a drastic change to the entire IT infrastructure (SaniaKhan et al., 2011). Implementing these approaches in India will increase green IT awareness, and this can lead to a reduction of e-waste and carbon footprints.

CHAPTER SIGNIFICANCE

In terms of its practical significance, this chapter will help organizations to acquire knowledge about sustainability, green IT and cloud computing from the base level. They will become aware of the progress made to date, in terms of adopting these concepts in organizational practice, in the world and in India. It will help them to gain a competitive edge because it will allow them to monitor the progress and they can adopt and implement appropriate practices before any other competitor in the market. The chapter draws its data from a wide range of industries in both the private and public sectors, thereby avoiding bias and providing a complete scenario of every organization. This chapter will enable both large organisations and small businesses to become more aware of these concepts. Also, the research data includes several companies which have already shifted to cloud computing, and this is useful for those who are still unsure of it, or are planning future implementation of cloud computing in their businesses. Vendors who provide cloud computing services will also benefit from this research as it also emphasizes the importance of the services provided by these organizations.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

At present, no company in India produces green IT products so this chapter will make companies aware of the potential market for such products that exists in India as it is one of the largest IT hubs in the world. The results of the surveys conducted will help organizations to identify the sectors that are already aware of these concepts and also the advantages and disadvantages of putting these into practice if they adopt them in their businesses. This will help new firms to gain a competitive edge by introducing these concepts in their businesses before entering into the market as they would be already familiar with the current scenario as a result of this research.

As for the theoretical significance, this chapter will help those students studying the issues of sustainability, green IT and cloud computing as it can be used as an article for analysis and evaluation. This will help them understand these concepts more broadly and thoroughly. The discussion presented in this chapter on the concepts of sustainability, green IT and cloud computing has been undertaken after analyzing many research works in the literatures, so students will be able to read one research work comprising various other research works. Researchers in the field of green IT, cloud computing and sustainability will benefit from this research as it takes into consideration these concepts in general and in relation to India in particular. This chapter will be of help to researchers who intend to carry out research on the concepts of sustainability, green IT and/or cloud computing based in India. The results of the research work will help them to analyze the current scenario in India and Indian organizations in regards to sustainability, green IT and cloud computing. The results of the surveys provide secondary data for research work and will familiarize students and researchers with the attitudes of Indian organizations towards sustainability, green IT and cloud computing.

RESEARCH METHOD DESIGN AND RESEARCH QUESTION

A mixed-method approach to data collection is used in this chapter. Quantitative data is gathered by means of an online survey. The online survey allows qualitative data to be collected as respondents are invited to provide personal opinions or comments in a separate text box in the survey itself (Issa, 2013; Sexton, Miller, & Dietsch, 2011). Based on the current literature review, the online survey was developed with the intention of examining Indian organizations' awareness of sustainability and cloud computing. The survey consists of two sections: the formal demographic information followed by a second section containing fourteen statements seeking participants' opinions regarding the risks and opportunities of cloud computing as well as sustainability via a five-point Likert scale with a range of 'Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree'.

This chapter aims to examine major and minor research questions. The Primary research aims to answer this question: To what extent are Indian organizations aware of sustainability, green IT and cloud computing technology? Furthermore, this chapter will address the following minor research questions: "What is the degree of sustainability and green IT awareness among India organizations? This question aims to identify the degree or level of awareness. Once we know whether or not Indian organizations are aware of sustainability, green IT and cloud computing, it will become easier to ascertain their level or degree of awareness, and whether organizations are just aware of these concepts (i.e. basic awareness) or whether they are planning to implement them (i.e. intermediate level of awareness) or whether they have already implemented them (advanced level of awareness). These levels of awareness will assist with the analysis of the results presented in this chapter.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Furthermore, the second minor research question is "What are the strengths and weaknesses of cloud computing in terms of its potential impact on the performance of Indian companies?" This question concentrates mainly on the level of cloud computing awareness. Responses to this question will indicate if Indian organizations actually have implemented cloud computing in their operations and to identify the advantages outweigh its shortcomings. Cloud computing is considered to be the second wave of sustainability and an extension of green IT, so if businesses and organizations have adopted cloud computing, this implies that they are aware of the concepts of sustainability, green IT and cloud computing and that they are shifting towards sustainability and green IT.

DATA COLLECTION

The data collection techniques include the techniques and procedures for data or sample collection which include the basis on which it was collected, how it was collected and from whom it was collected. Data is the main element of every research. It can be primary which means collected directly from sources such as surveys and samples, or it can be secondary collected from existing research work, magazines, articles, newspapers and theses. For collection of data, a sampling technique is used which includes probability sampling and non-probability sampling.

For the purposes of this study, a non-probability sampling technique was used because firstly, there was no way to select a sample population because our aim was to ascertain the awareness levels among Indian organisations from two sectors of industry, private and public, and from all across the country. Secondly, probability techniques would not have been feasible if a company chosen by the researcher as part of the sample, had not replied, thereby returning a negative result. Thirdly, the researcher did not want to predetermine a particular sample size, since it was desirable to collect as many surveys as possible. Non-probability technique provides flexibility in selecting sample size and the number of responses. It is the best technique to use when sample population is not to be selected on the basis of any factor and one has to take into consideration the entire population in that field. Non-probability techniques include: Quota sampling; Purposive sampling; Snowball sampling; Self-selection sampling; and Convenience sampling.

In this study, snowball sampling was used as a means of data collection. With this method, initial contact is made with a few potential respondents who are in turn invited to pass copies of the survey or the survey link to other individuals or companies who in turn forward these on and so on, creating a snowball effect, so to speak. To avoid sampling bias, the respondent sample included males and females, a range of professions, and a variety of industries from both the private and public sectors. Moreover, the researcher did not focus on only one particular region of the country, but made contact with people residing in different regions. This technique suited the purpose of this study which was to find out the degree of awareness of green IT, cloud computing and sustainable IT among Indian organizations.

PARTICIPANTS

This study was conducted in India to examine the *Awareness of Sustainability, Green IT and Cloud Computing in Indian Organisations*. The survey was distributed to organizations in India and the sur-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

vey response rate was 83.3%. Table 1 provides a summary of the respondents' details including gender, industry sector type and qualifications.

Table 2 shows the number of survey respondents in public and private organizations in India. It was noted that the majority of respondents work in small, medium and large organizations. Furthermore, the majority of respondents worked in communication services and finance and insurance, 18% to 24% respectively (see Table 3).

Finally, Table 4 indicates confirmation that 61% of personnel in Indian organizations are still unaware of cloud computing applications although 16% are currently using various applications such as Amazon and National Green Database.

Table 1. Summary of the respondents' details

Number and Percentage of Questionnaires	
Questionnaires Distributed	90
Questionnaires Returned (valid)	75
Response Rate	83.3%
Gender	
Male Respondents	61
Female Respondents	27
Sector Type	
Public Sector Organization	14
Private Sector Organization	75
Qualifications	
Bachelor's Degree	38
Master's Degree	46
Doctorate (PhD)	2
Other, Please specify	2

Table 2. Number of employees in public and private organizations in India

0-50	17
51 to 200	16
201 to 500	15
501 to 2000	16
2001 to 8000	13
8001 - 100000	9
Total	86

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 3. Organization types in India

Organizations	Number	Percentage
Accommodation, Cafes and Restaurants	4	4%
Agriculture, Forestry and Fishing	3	3%
Communication Services	16	18%
Construction	9	10%
Education	7	8%
Electricity, Gas and Water Supply	4	4%
Finance and Insurance	22	24%
Government Administration and Defence	6	7%
Health and Community Services	7	8%
Manufacturing	4	4%
Mining	2	2%
Personal and Other Services	5	6%
Property and Business Services	6	7%
Retail Trade	10	11%
Transport and Storage	3	3%
Wholesale Trade	3	3%

Table 4. Cloud computing usage in private and public organizations in India

Answer	Response
Don't Know	20
No	54
Yes If you answered 'yes' to this question, please provide details in the space below of applications you access via cloud computing.	14

RESULTS

A total of 77 participants from India responded to the online survey. With two responses not accepted because of missing data, this resulted in 75 valid cases of responses for India for the following Factor Analysis. Based on the Mean and STD Deviation results, it was confirmed that the majority of the personnel in Indian organizations agreed that cloud computing services are efficient, flexible and sustainable (see Table 5).

To examine the online survey results further, the researchers adopted principal axis factoring for factor extraction, and oblique rotation was applied using the direct oblimin method to correlate the variables (Costello & Osborne, 2005; Hair, Black, Babin, & Anderson, 2009). To measure the sampling adequacy, researchers carried out specific testing from Cronbach's Alpha, Kaiser-Meyer-Olkin and Bartlett's test. Firstly, the Cronbach's Alpha for all 14 variables was .816, indicating an acceptable internal consistency of the items in the scale (Gliem & Gliem, 2003). Secondly, the Kaiser-Meyer-Olkin measure of sampling adequacy was .739 above the recommended value of .6, indicating that a sufficient sample size has been

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 5. Descriptive statistics – Mean and STD deviation

	Mean	Std. Deviation
Q8_1 Cloud computing is more flexible than traditional computing	3.68	1.010
Q8_2 Cloud computing is more efficient than traditional computing	3.74	.882
Q8_3 Cloud computing helps organisations become 'greener'	3.59	1.109
Q8_4 Cloud computing helps provide scalable services	3.68	.788
Q8_5 Cloud computing helps provide reliable services	3.44	.963
Q8_6 Cloud computing helps provide ease of maintenance	3.62	.973
Q8_7 Cloud computing makes staffing easier	3.39	.959
Q8_8 Cloud computing decreases operating expenses	3.65	.969
Q8_9 Cloud computing increases operating expenses	3.11	1.097
Q8_10 Cloud computing reduces capital costs	3.32	.947
Q8_11 Cloud computing introduces security problems	3.35	1.060
Q8_12 Cloud computing is more risky than traditional computing	3.27	1.031
Q8_13 Cloud computing reduces organisations' carbon footprint	3.18	1.006
Q8_14 Cloud computing contributes to organisations' sustainability	3.61	.857

obtained from the analysis (Hill, 2012). Thirdly, the Bartlett's test of sphericity is highly significant, $X^2 = 396.588$, $df = 91$, $p < .000$, indicating that the items of the scale are sufficiently correlated to factors to be found (Burns & Burns, 2008). Finally, the communalities were all over .05 (see Table 6) except for statements 11 and 14, as Indian organizations still have some concerns about security and sustainability.

Table 6. Cloud computing – Communalities

	Initial	Extraction
Q8_1 Cloud computing is more flexible than traditional computing	.651	.719
Q8_2 Cloud computing is more efficient than traditional computing	.606	.636
Q8_3 Cloud computing helps organisations become 'greener'	.585	.538
Q8_4 Cloud computing helps provide scalable services	.687	.657
Q8_5 Cloud computing helps provide reliable services	.440	.444
Q8_6 Cloud computing helps provide ease of maintenance	.662	.594
Q8_7 Cloud computing makes staffing easier	.624	.469
Q8_8 Cloud computing decreases operating expenses	.559	.898
Q8_9 Cloud computing increases operating expenses	.555	.646
Q8_10 Cloud computing reduces capital costs	.529	.421
Q8_11 Cloud computing introduces security problems	.375	.325
Q8_12 Cloud computing is more risky than traditional computing	.529	.704
Q8_13 Cloud computing reduces organisations' carbon footprint	.501	.467
Q8_14 Cloud computing contributes to organisations' sustainabiliy	.358	.321
Extraction Method: Principal Axis Factoring		

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Furthermore, the researchers used principle components analysis to estimate the factor loading matrix for the factor analysis model as well the standard correlation matrix. The Eigen values are assessed to determine the number of factors accounting for the correlations amongst the variables. As demonstrated in Table 7, this model of eight factors explains a total of 56.398% of the variation. The Eigen values and the amount of variances explained by each of these factors are presented in Table 7 (after rotation).

Furthermore, to measure the regression coefficients (i.e. slopes), the researchers carried out the factor loadings. The *factor loadings* are based on most of the items that have a high loading value and the one with the cleanest factor structure is considered as important. Hair et al (2010) suggested the

Table 7. Cloud computing - Total variance explained

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings (a)
1	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
2	3.247	36.082	36.082	2.791	31.006	31.006	2.770
3	1.821	20.228	56.310	1.571	17.461	48.467	1.454
4	1.027	11.414	67.724	.714	7.931	56.398	.999
5	.853	9.474	77.198				
6	.511	5.681	88.842				
7	.435	4.835	93.677				
8	.346	3.846	97.523				
9	.223	2.477	100.000				
Extraction Method: Principal Axis Factoring							
a. When factors are correlated, sums of squared loadings cannot be added to obtain a total variance							

Table 8. Cloud computing – Pattern matrix

x (a)			
	Factor		
	1	2	3
Q8_2 Cloud computing is more efficient than traditional computing	.815		
Q8_1 Cloud computing is more flexible than traditional computing	.758		-.131
Q8_6 Cloud computing helps provide ease of maintenance	.718		.116
Q8_5 Cloud computing helps provide reliable services	.693		
Q8_4 Cloud computing helps provide scalable services	.555	-.244	.318
Q8_8 Cloud computing decreases operating expenses	.425		-.131
Q8_12 Cloud computing is more risky than traditional computing	.116	1.005	
Q8_11 Cloud computing introduces security problems		.459	.208
Q8_11 Cloud computing increases operating expenses		.257	.832
Extraction Method: Principal Axis Factoring Rotation Method: Oblimin with Kaiser Normalization			
a. Rotating converged in 10 iterations			

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

lowest sample size is 50 cases. If the sample size ranges from 71 to 84, the sufficient factor loading is .60. Items Q8_8 and Q8_11 are shared with other factors (Costello & Osborne, 2005). The Q8_8 under Factor 1 and Q8_11 each has a factor loading below .6 (Hair et al, 2010). The statements 4, 8 and 11 were excluded and are highlighted in light blue.

The Pattern Matrix revealed three factors. However, factoring requires at least more than one variable or item grouped in the same factor, referred to share commonness or correlations (Hair et al, 2010). With this, only Factor 1 can be fit for labelling, as Factor 2 and Factor 3 each has only one variable which is Q8_12 and Q8_9 respectively. A score was calculated for this factor by averaging across each individual item. The mean and standard deviation of the factor average is presented below in Table 9.

Overall, it became evident that those who already know about 'cloud computing' even to a limited extent, think of such technology as efficient, flexible, scalable, reliable, easy to maintain. However, the survey outcomes confirmed that although cloud computing usage in India has brought various benefits, there is nevertheless some concern regarding the issue of risk and security of cloud computing as well as sustainability.

DISCUSSION

The chapter aims to assess the awareness of green IT, cloud computing and sustainability among Indian organizations. This research was intended to discover the extent to which Indian organizations are aware of green IT, cloud computing and sustainability in IT. The survey results indicated that organizations are aware of these concepts in their IT operations, but they have little awareness of the benefits of implementing these trends, and the potential harm that can be caused to their organization by not adopting green IT and IT sustainability. Cloud computing is a relatively new concept in the business world and not many companies in India are thoroughly familiar with it. In actual fact, many Indian-based IT companies (i.e. Wipro, Infosys, and Tata) are outsourcing cloud computing services to companies in other countries, but have made little effort to introduce this concept in the Indian business world because of cost factors.

According to the survey results, there is some degree of awareness of sustainability, green IT and cloud computing in Indian organisations, although this is very low. This is partly due to the fact that that both the government in India and Indian-based companies have made little or negligible efforts to promote green IT, sustainability or cloud computing in India. There appears to be no logical reason for this apparent indifference which seems to be the main reason for the low level of awareness and adoption of these concepts.

Finally, the results presented in this chapter indicate that the advantages of cloud computing outweighs its disadvantages: it helps organisation to become greener, increase operating profits, and provide more reliable services. Several studies ((Avram, 2014; Oliveira, Thomas, & Espadanal, 2014; Son, Lee, Lee, & Chang, 2014) indicate that cloud computing is more efficient and more flexible than traditional computing; it reduces the carbon footprint and promotes sustainability; it is easy to maintain and staffing

Table 9. Cloud computing – Descriptive statistics (N=75)

	Mean	Std. Deviation
Factor 1: Operational benefits	3.621	0.957

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

requirements are simplified. However, respondents also believed that it is more risky than traditional computing and increases the security threats to the organisation as the data is handled by some other entity that provides these services.

To conclude, it appears that Indian organizations are aware of these concepts of sustainability, green IT and cloud computing, but the level of awareness is very low or negligible. Hence, the government and IT companies need to put more effort into promoting cloud computing (i.e. training, workshops, conferences, newsletters via social networking and other facilities, education and others) as a better alternative to traditional computing in many ways. However, despite its many benefits and advantages, it may pose security risks to companies, of which they should be aware.

LIMITATIONS

The study presented in this chapter was limited to 75 participants from both public and private organizations in India. The rationale behind this study is to assess the Indian organizations' awareness of sustainability, green IT and cloud computing. The online survey responses strongly indicated that Indian organizations are aware of these concepts, although the level of awareness is low. Therefore, further research with larger and more diverse groups of organizations is required in the future to strengthen the research findings.

CONCLUSION

Sustainability, green IT and cloud computing are the current hot topics in the fields of IT research and IT business. This research was conducted with organizations located only in India and no other parts of the world. The results of the surveys were noteworthy, indicating that most of the personnel from organizations who participated in the surveys actually were aware of the terms 'sustainability', 'green IT' and 'cloud computing'. Most of them were even using cloud computing in their organizations. However, it emerged that although they knew about these concepts, none of them actually adopted the principles sustainability and green IT in their operations. The purpose of this research paper was to identify whether organizations in India are aware of the concepts of sustainability, green IT and cloud computing, and if so, what is their level of awareness, do they just know about it, or are they considering adopting it, or they are on their way to adopting it, or they are using it? The second important purpose was to identify whether or not those businesses that have adopted cloud computing actually know its strengths and weaknesses, and whether or not they find cloud computing beneficial for their organization.

The answers to the research questions led to the conclusion that, although businesses are familiar with the concepts of sustainability green IT and cloud computing, their levels of awareness of these concepts are very low or negligible. Although companies have responded to these questions, awareness alone is not enough to make a change. More effort should be made to increase companies' awareness of these concepts and move towards incorporating the notion of sustainability within their organisational and business practices. In order to increase both public and corporate awareness, the government and Indian-based IT companies need to collaborate more effectively to ensure that sustainability and green IT are being implemented in organizations and businesses in India. There is an urgent need to make a

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

transition towards sustainability and green IT because of the alarming rate of increase in carbon footprints and global warming. Cloud computing is a second wave towards sustainability and an extension of green IT. According to the survey results presented in this chapter, companies do know the strengths and weaknesses of green IT although few companies have attempted to adopt green IT practices in their businesses.

The security issues related to cloud computing are of concern to large organizations. There is a service level agreement between the vendor and buyer, but the data of the company stored with the vendor is always at risk because the employees working in the vendor's organization can pose a threat to the data. The conclusion of this research paper was that although companies are aware of the concept of sustainability, green IT and cloud computing, they are not actually planning or even considering implementing these concepts in their businesses or organizations. Government and IT companies need to put more effort into sustainability and encourage companies by giving them subsidies or rewards for implementing these concepts. In this way, companies can shift towards a more sustainable future because India needs to keep pace with other countries and global trends which are moving towards sustainability and green IT.

REFERENCES

Agarwal, S., & Nath, A. (2011). *Green Computing - A New Horizon of Energy Efficiency and Electronic Waste Minimization: A Global Perspective.* Paper presented at the Communication Systems and Network Technologies (CSNT), 2011 International Conference on. http://dx.doi.org: doi:10.1109/csnt.2011.148

Armbrust, M., Stoica, I., Zaharia, M., Fox, A., Griffith, R., Joseph, A. D., ... Rabkin, A. (2010). A view of cloud computing. *Communications of the ACM*, *53*(4), 50. doi:10.1145/1721654.1721672

Avram, M. G. (2014). Advantages and Challenges of Adopting Cloud Computing from an Enterprise Perspective. *Procedia Technology, 12*(0), 529-534.

Aymerich, F. M. (2008). An approach to a cloud computing network 2008 First International Conference on the Applications of Digital Information and Web Technologies (ICADIWT). 113.

Brender, N., & Markov, I. (2013). Risk perception and risk management in cloud computing: Results from a case study of Swiss companies. *International Journal of Information Management*, *33*(5), 726–733. doi:10.1016/j.ijinfomgt.2013.05.004

Burns, R., & Burns, R. (2008). Business Research Methods and Statistics Using SPSS. *Sage (Atlanta, Ga.)*.

Buyya, R., Yeo, C. S., Venugopal, S., Broberg, J., & Brandic, I. (2009). Cloud computing and emerging IT platforms: Vision, hype, and reality for delivering computing as the 5th utility. *Future Generation Computer Systems*, *25*(6), 599–616. doi:10.1016/j.future.2008.12.001

Costello, A., & Osborne, J. (2005). Best Practices in Exploratory Factor Analysis: Four Recommendations for Getting the Most From Your Analysis. *Practical Assessment, Research & Evaluation*, *10*(7), 1–9.

Dao, V., Langella, I., & Carbo, J. (2011). From green to sustainability: Information Technology and an integrated sustainability framework. *The Journal of Strategic Information Systems*, *20*(1), 63–79. doi:10.1016/j.jsis.2011.01.002

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Gliem, J., & Gliem, R. (2003). Calculating, Interpreting, and Reporting Cronbach's Alpha Reliability Coefficient for Likert-Type Scales2003 Midwest Research to Practice Conference in Adult, Continuing and Community Education (pp. 82 - 88).

Hair, J., Black, W., Babin, B., & Anderson, R. (2009). *Multivariate data analysis*. Upper Saddle River, NJ: Prentice Hall.

Harmon, R., & Demirkan, H. (2011). The Next Wave of Sustainable IT. *IT Professional*, *13*(1), 19–25. doi:10.1109/MITP.2010.140

Hayes, B. (2008). Cloud computing. *Communications of the ACM*, *51*(7), 9–11. doi:10.1145/1364782.1364786

Hill, B. D. (2012). *The Sequential Kaiser-Meyer-Olkin Procedure As An Alternative For Determining The Number Of Factors In Common-Factor Analysis: A Monte Carlo Simulation* USA: Proquest, Umi Dissertation Publishing

Issa, T. (2013). *Online Survey: Best Practice In Information Systems Research and Exploring Social Artifacts: Approaches and Methodologies* (pp. 1–19). IGI Global;

Johnson, P. E. (2013). A Review of "Cloud Computing for Libraries". *Journal of Access Services*, *10*(1), 71–73. doi:10.1080/15367967.2013.738572

Ketting, N. G. (1995). Towards a sustainable energy future. *Energy Policy*, *23*(7), 637–638. doi:10.1016/0301-4215(95)98219-I

Khan, Razak, & Kumar. (2011). Prioritization of Green IT Parameters for Indian IT Industry Using Analytical Hierarchy Process. *World Journal of Social Sciences*, *1*(4), 179–194.

Liu, L., Wang, H., Liu, X., Jin, X., He, W. B., Wang, Q. B., & Chen, Y. (2009). GreenCloud: a new architecture for green data center. In *Proceedings of the 6th international conference industry session on Autonomic computing and communications industry session* (pp. 29-38). ACM. http://dx.doi.org: doi:10.1145/1555312.1555319

Marston, S., Li, Z., Bandyopadhyay, S., Zhang, J., & Ghalsasi, A. (2011). Cloud computing — The business perspective. *Decision Support Systems*, *51*(1), 176–189. doi:10.1016/j.dss.2010.12.006

Naidu. (1996). Indian scenario of renewable energy for sustainable development. *Energy Policy, 24*(6), 575-581.

Nandgaonkar, S., & Raut, A. B. (2014). A Comprehensive Study on Cloud Computing. *International Journal of Computer Science and Mobile Computing*, *3*(4), 733–738.

Newton, L. H. (2000). Millennial Reservations. *Business Ethics Quarterly*, *10*(1), 291–303. doi:10.2307/3857714

Newton, L. H. (2003). *Ethics and Sustainability, Sustainable Development and the Moral Life*. New Jersey, NY: Prentice-Hall, Inc.

Nidumolu, R. (2009). Why sustainability is now the key driver of innovation.(Sustainability Innovation). *Harvard Business Review, 87*(9), 56.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Oliveira, T., Thomas, M., & Espadanal, M. (2014). Assessing the determinants of cloud computing adoption: An analysis of the manufacturing and services sectors. *Information & Management*, *51*(5), 497–510. doi:10.1016/j.im.2014.03.006

Prasad, A. R., Saha, S., P.Misra, B.Hooli, & M.Murakami. (2010). back to green. *Journal of Green Engineering*, 89-110.

Redmap. (n.d). *CloudUp! An analysis of security in the cloud.* Retrieved from http://www.redmap.com/downloads/whitepapers/lo/smartCloud%20-%20Whitepaper%20-%20CloudUp!%20An%20Analysis%20of%20Security%20in%20the%20Cloud.pdf

Sexton, N., Miller, H., & Dietsch, A. (2011). Appropriate uses and considerations for online surveying in human dimensions research. *Human Dimensions of Wildlife*, *16*(3), 154–163. doi:10.1080/10871209.2011.572142

Sharma, A., Iyer, G. R., Mehrotra, A., & Krishnan, R. (2010). Sustainability and business-to-business marketing: A framework and implications. *Industrial Marketing Management*, *39*(2), 330–341. doi:10.1016/j.indmarman.2008.11.005

Singh, A., & Malhotra, M. (2012). Agent Based Framework for Scalability in Cloud Computing *International Journal of Computer Science & Engineering Technology,* 41 - 45.

Smith, P., & Sharicz, C. (2011). The shift needed for Sustainability. *The Learning Organization*, *18*(1), 73–86. doi:10.1108/09696471111096019

Son, I., Lee, D., Lee, J.-N., & Chang, Y. B. (2014). Market perception on cloud computing initiatives in organizations: An extended resource-based view. *Information & Management*, *51*(6), 653–669. doi:10.1016/j.im.2014.05.006

Velte, A. T., Velte, T. J., & Elsenpeter, R. (2010). *Cloud Computing - A Practical Approach*. McGraw Hill.

Vijaykumar, N. (2011). Datacenters in the Desert. *Technology and Society Magazine, IEEE, 30*(2), 31-38.

Weiss, A. (2007). *Computing in the Clouds*. Retrieved from http://di.ufpe.br/~redis/intranet/bibliography/middleware/weiss-computing08.pdf

Xianmin, W. (2011). *Application of Server Virtualization Technology in Enterprise Information.* Paper presented at the Internet Computing & Information Services (ICICIS), 2011 International Conference on. http://dx.doi.org: doi:10.1109/icicis.2011.13

Yamini, B., & Selvi, D. V. (2010). *Cloud virtualization: A potential way to reduce global warming*. Paper presented at the Recent Advances in Space Technology Services and Climate Change (RSTSCC), 2010. http://dx.doi.org: doi:10.1109/rstscc.2010.5712798

Zhang, W., & Chen, Q. (2010). From E-government to C-government via Cloud Computing *International Conference on E-Business and E-Government* (pp. 679 - 682). 10.1109/ICEE.2010.177

Zissis, D., & Lekkas, D. (2012). Addressing Cloud Computing Security Issues. *Future Generation Computer Systems*, *28*(3), 583–592. doi:10.1016/j.future.2010.12.006

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

ADDITIONAL READING

Ageron, B., Gunasekaran, A., & Spalanzani, A. (2012). Sustainable Supply Management: An Empirical Study. *International Journal of Production Economics*, *140*(1), 168–182. doi:10.1016/j.ijpe.2011.04.007

Amann, B., Caby, J., Jaussaud, J., & Pineiro, J. (2009). Shareholder activism for corporate social responsibility: law and practice in the United States, Japan, France and Spain. In D. McBarnet, A. Voiculescu, & T. Campbell (Eds.), *The New Corporate Accountability - Corporate Social Responsibility and the Law* (pp. 336–364). Cambridge.

Armbrust, M., Fox, A., Griffith, R., Joseph, A. D., Katz, R., Konwinski, A., . . . Zaharia, M. (2009). Above the Clouds: A View of Cloud Computing. 1 Dec 2009,http://radlab.cs.berkeley.edu/w/uploads/2/24/9_-_Above_the_Clouds-_A_View_of_Cloud_Computing_.pdf

Basciani, M. (2011). *Is the Cloud Green?* Zurich, Switzerland.

Bateman, A., & Wood, M. (2009). Cloud Computing. *Bioinformatics (Oxford, England)*, *25*(12), 1475. doi:10.1093/bioinformatics/btp274 PMID:19435745

Berl, A., Gelenbe, E., Di Girolamo, M., Giuliani, G., De Meer, H., Quan Dang, M., & Pentikousis, K. (2009). Energy Efficient Cloud Computing. *The Computer Journal*, 1–7.

Berl, A., Gelenbe, E., Di Girolamo, M., Giuliani, G., Meer, H., Dang, M., & Pentikousis, K. (2010). Energy-Efficient Cloud Computing. *The Computer Journal*, *53*(7), 1046–1051. doi:10.1093/comjnl/bxp080

Chang, V., Issa, T., & Issa, T. (2011). Cloud computing and sustainability: an Australian public sector perspective*XXII - International Society for Professional Innovation Management (ISPIM) Conference, held in Hamburg - Germany*

Elliot, S. (2007). *Environmentally Sustainable ICT: A Critical Topic for IS Research?* Paper presented at the Pacific Asia Conference on Information Systems

Goldsmith, S., & Samson, D. (2006). *Sustainable Development and Business Success*. Melbourne: Thomson.

Grossman, R. L. (2009). The Case for Cloud Computing. Computer.org/ITPro, 23 -27.

Hayward, B. (2012). Sustainable ICT. *Telecommunications Journal of Australia*, *62*(5), 1–10. doi:10.7790/tja.v62i5.373

Issa, T., Chang, V., & Issa, T. (2010). The Impact of Cloud Computing and Organizational Sustainability *Cloud Computing and Virtualization 2010, held in Singapore*

Issa, T., Chang, V., & Issa, T. (2010). Sustainable Business Strategies and PESTEL Framework. *GSTF International Journal on Computing*, *1*(1), 73–80.

Issa, T., Issa, T., & Chang, V. (2011). Would teaching sustainable development business strategies shift students' mindsets? An Australian experience. *The International Journal of Environmental, Cultural. Economic & Social Sustainability*, *7*(5), 257–272.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Loorback, D., Bakel, J., Whiteman, G., & Rotmans, J. (2010). Business Strategies for Transitions Towards Sustainable Systems. *Business Strategy and the Environment*, *19*, 133–146.

Mayo, R., & Perng, C. (2009). Cloud Computing Payback: An explanation of where the ROI comes from. 1-20.

Schulz, W. (2009). What is SaaS, Cloud Computing, PaaS and IaaS? 15 Feb 2010,http://www.s-consult.com/2009/08/04/what-is-saas-cloud-computing-paas-and-iaas/

ScottJ.StahelW.LovinsH.GraysonD. (2010). *The Sustainable Business*

Sengers, P., Boehner, K., & Knouf, N. (2009). *Sustainable HCI Meets Third Wave HCI: 4 Themes.* Paper presented at the CHI 2009

Skilton, M. (2010a). 8 ways to measure cloud ROI. May 21st,http://www.itworld.com/it-managementstrategy/109126/8-ways-measure-cloud-roi?page=0%2C2

Skilton, M. (2010b). Building Return on Investment from Cloud Computing.

Wakkary, R. (2009). *A Sustainable Identity: Creativity of Everyday Design.* Paper presented at the CHI2009 10.1145/1518701.1518761

Wirtenberg, J. (2009). *Beyond Green: Going Green and Sustainable Environments Transitioning to Green* Retrieved from http://www.greenbaumlaw.com/Wirtenberg.ppt

Wittow, M., & Buller, D. (2010). Cloud Computing: Emerging Legal Issues for Access to Data, Anywhere, Anytime. *Journal of Internet Law*, *14*(1), 1–10.

KEY TERMS AND DEFINITIONS

Cloud Computing: Is a smart technology used to save energy and reduce carbon emission.
Green IT: Using technology and computer resources in an efficient way.
Opportunities: Advantages and prospects occurred during practice of working with a technology.
Risks: Uncertain aspects occurred during usage or implementation a technology (new or Old).
Sustainability: Sustain and manage resources for the next generations.

This research was previously published in Green Services Engineering, Optimization, and Modeling in the Technological Age edited by Xiaodong Liu and Yang Li, pages 269-287, copyright year 2015 by Information Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Section 8
Emerging Trends

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 78
Green Marketing Mix:
A Review of Literature and Direction for Future Research

Prashant Kumar
National Institute of Industrial Engineering (NITIE), India

Bhimrao Ghodeswar
National Institute of Industrial Engineering (NITIE), India

ABSTRACT

The purpose of this paper is to report the findings of a systematic review of literature in green marketing domain and to propose directions for future research. Green marketing issues are delineated from literature extending marketing orientation and marketing mix frameworks. As society becomes more concerned with the natural environment, businesses modify their behaviour in an attempt to address society's concerns. Based on the literature review, the conceptual review and direction for future research have been delineated and discussed. The paper concludes with the evidences of integration between sustainability and marketing in forms of corporate environmental actions and green marketing practices in businesses. The paper deals with the concept of 4-Ps and the green marketing practice as business response to the increasing environmental consciousness of consumers in the market. The discussion highlights future research avenues and consequent implications for marketers of green products in designing their marketing strategies.

1. INTRODUCTION

Convergence of sustainability thoughts in marketing has given rise to addressing environmental issues in marketing (Hult, 2011). It believes that economic growth has greatly influenced by society and ecology, and emphasizes upon adopting a variety of management approaches (Crittenden *et al.*, 2011) that reflect business responsibility for the wider societal good (Matten and Moon, 2008). This gives an opportunity to elevate its focus from meeting the needs of consumers to managing a broader market-related issues related to economy, society and the natural environment. This has given rise to the debate to incorporate

DOI: 10.4018/978-1-5225-7915-1.ch078

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

social and environmental impact along with economic performance in business assessment. In result, rising worldwide public concern over degrading environmental quality resulting from harmful effects of certain industry practices and stricter environmental regulations posed by governments across the borders can be witnessed. This has altered established norms and rules of business across the world, and has raised the need to adopt environmentally friendly approaches in their sourcing, operating, and marketing activities for companies (Banerjee, 2002; Menon and Menon, 1997). So, companies embrace 'ecological consuming approach' perspective to ensure their survival in the market. They now address environmental issues in their management (Pujari *et al.*, 2003; Beamon, 1999) and marketing decision-making (Wong *et al.*, 1996). And, they choose to differentiate themselves by meeting the stricter national and international environmental regulations and demands of environmentally-conscious consumers (Banerjee *et al.*, 2003; Polonsky, 1995). They address environmental issues in several business activities such as designing and manufacturing products, their pricing, distribution and promotion, and develop green marketing practices and strategies (Papadopoulos *et al.*, 2010; Gurau and Ranchhod, 2005). This approach of green marketing is perceived as a profitable and sustainable management process to identify, anticipate and satisfy the requirements of consumers and society (Chan, 2013). Thus, once limited to the ideology of activists, environmental consciousness has become a matter of market competition (Follows and Jobber, 2000).

In contemporary business environment, marketing orientation is shifting to green marketing as firms' environmental actions and product offerings are now catering to eco-conscious consumers, and communicating their environmental actions to stakeholders and consumers (Jones *et al.*, 2008). The concept of sustainability is embraced by the marketing professionals that develop a long term vision for the growth and development of companies as well as for a sustainable future. The recent changes in marketing has raised the need to develop a holistic perspective of green marketing "that embraces all aspects of the company, the product, and the means of production, consumption, and disposal" so that opportunities to make substantive progress towards sustainability can lead to minimizing a transaction's negative impact on the natural environment and a change in corporate thinking towards environmental commitment (Peattie and Crane, 2005; Polonsky and Rosenberger III, 2001). Though environmental sustainability is gaining importance for business performance and competitive advantage, green marketing literature mainly elaborates upon its strategic development (Rivera-Camino, 2007; D'Souza, 2004; Peattie and Crane, 2005; Kilbourne, 1998; Polonsky, 1995). It lacks significant conceptual and empirical development (Polonsky, 1994) that can develop characteristics of green marketing to develop and exploit the benefits of the concept. There is a need to study green marketing to develop an understanding of interaction between firm and consumers in the marketplace that can act as a medium to develop an environmentally responsible marketplace and a sustainable society. Kotler (2011) has also raised several important issues to explore in green marketing, such as factors leading companies to compete on the basis of sustainability, changes required in marketing practices and opportunities offered by the concept of sustainability, etc. Further, Sharma *et al.* (2010) has recognized that research on inclusion of active role of environmental issues in marketing is still in infant stage and the related discussions are limited to the disciplines of environment management, production, and supply chain, and thus in context of entire value chain. Hence, developing green marketing mix to examine the interface of marketing with other functions of management and business with their impact on the environment is the objective of the paper.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

1.1. Methodology for the Review

The objective of this paper is to understand the current state of research in green marketing and to conceptualize green marketing mix. Using a systematic review approach (Tranfield *et al.*, 2003) and methodologically guided by Greer and Lei (2012), it makes an effort to collect and synthesize the available literature (books, edited volumes and journal articles) in the domain from 1965 to 2013. A single research paper/book was considered as the unit of analysis. The literature in English language was accessed from popular electronic databases such as ABI Inform, ISI Web of Knowledge, Blackwell Synergy, Emerald, EBSCO and Elsevier Science Journals. A number of keywords were identified based on need for the review, and discussion of review proposal and objectives with academic experts. These keywords were constructed into search strings to access the literature. The list of keywords include green marketing, sustainability marketing, sustainability management, environmental marketing, environmental management, sustainability communication, communication tools for green products, eco-labels, green product design, green product development, green supply chain, green logistics, green distribution, green procurement, green consumers, and green consumer market segmentation. A preliminary search using these keywords was performed to identify further keywords for the main search. As suggested by Srivastava (2007), searching articles by cross-referencing was also adopted. This resulted in 196 research papers in total published in peer-reviewed journals which were filtered based on their relevance to the topic by analyzing the titles of the articles and then, analyzing the abstracts. The articles with highly technical work and highly ecological perspective, which were not in line with the outlined objective, were excluded. This resulted in total number of 105 papers for inclusion in the literature review out of which most (88%) of them were quantitative in nature. The several articles were categorized under several sub-categories of green marketing (as stated in Table 1): ethical standards, environmental responsibility, stakeholder engagement, social responsibility and marketing mix (product, price, place and promotion). Out of them, ethical standards were covered in 15% of the papers, environmental responsibility was covered in 68% of the papers, stakeholder engagement was covered in 55% of the papers and social responsibility was covered in 19% of the papers. Papers on green products included product design (in 18% of the papers), packaging design (in 12% of the papers) and stakeholder engagement (in 14% of the papers). 38% of the papers covered pricing-related aspects of green products and 26% of the papers covered retailing and distribution-related issues. And, 22% of the papers had sustainability focus in communication, 29% of them addressed eco-labeling aspects and 34% of them elaborated upon the use of internet and social media.

Out of the 105 papers, 4% of them were published in 1970s and 1980s, 16% in 1990s, 50% in 2000s, and 31% in 2010s. Out of 93 empirical papers, 38% of them were based in American cities, 32% in European cities, 18% in Australian cities and rest were in Asian cities. Also, 14% of the studies were comparative studies those captured the data from two or more cities across the globe.

2. MARKETING AND THE NATURAL ENVIRONMENT

Marketing is a broad term to represent the activities facilitating exchanges between companies and consumers. It is described in terms of distinct organisational culture, and a fundamental set of shared beliefs and values that lead to consumer-centered corporate strategy and operations (Deshpande and Webster,

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Table 1. Examples of the topics included in the literature review

Sr. No.	Topics Included in Review	Sub-Topics
1.	Environmental ethics	Environmental protection
		Environmental code of conduct
		Ethical behaviour
2.	Environmental responsibility	Corporate behaviour
		Environmentally-responsible behaviour
		Firm actions
		Regulatory compliance
		Corporate policies and procedures
3.	Stakeholder engagement	Environmental stakeholders
		GRI indicators
		Community
		Strategic alliances
4.	Green products	Product design
		Packaging design
		Product ingredients
		Consumer perceptions
5.	Pricing	Higher pricing strategy
		Willingness-to-pay
		Value-for-money
6.	Green retailing	Retail atmospherics
		Sustainability-based programme
		Environmental goals and operations
7.	Green communication	Eco-labeling
		Information credibility
		Communication tools
		Consumer engagement
		Determinants of green purchase intentions

1989). Esteban *et al.* (2002) described marketing as "a set of attitude towards the market" that recommends distinct ways of thinking about the organisation, and its products and customers. Crane (1997) states that marketing comprises of content (what marketing decisions are made and which marketing activities are undertaken) as well as process (how the decisions are reached, and how the activities come to take place). Fundamental to marketing literature is a philosophy that "an organisation should try to satisfy customers' needs through the development of a coordinated set of activities that will allow the organisation to achieve its goals" (Deng and Dart, 1999). In the academic literature, marketing has evolved as a managerial function that focuses upon information accessibility and its processing. Originated from fundamental marketing concepts, marketing, at present, has dramatically advanced to address widely conscious and highly active consumers across the globe. In recent years, profound insistence of compa-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

nies on marketing is observed. Marketing is based on the assumption that needs, which are originated at consumer end, should be identified by the companies and to be acted upon when these needs become consumer demand (Knights *et al,* 1994).

Since its introduction, the concept of marketing has undergone many changes with changing focus of the domain, changing orientation and changing consumer needs. With the time, issues faced by marketing have also changed. Recently, marketing domain witnessed how the competitive environment is changing. Now, consumers have become more assertive, have more understanding of marketing and related activities, look for high quality and high value products, and make and trust their own judgments. Recent developments have favoured relational marketing activities over transactional marketing. Developments in communication technologies, and changing national and cultural contexts have given rise to such market conditions that are demanding changes in objectives of marketing practices to customer retention (Webster, 1992). The importance of customer retention strategy and long-term customer relationship to achieve effective marketing performance is now recognized in marketing practices. This has motivated companies to develop unique marketing strategies to gain competitive advantage in the market. This has also raised the need of searching for new marketing approaches that is broad enough to provide unique and sustained competitive advantage. Incorporating sustainability issues in marketing is one of such approaches. This is rooted in the fundamentals of what impact marketing has on society and the environment. The present ideologies of consumption have brought concern over ecological impact of marketing under scrutiny. This has resulted in bringing environmental issues into public debate. Schot *et al.* (1997) describe sustainability with two different sets of imperatives for business – eco-efficiency and system change. Eco-efficiency describes company's acceptance of adverse impact on the environment as a result of its business activities and this has impact on competitive business environment (consumers, competitors and regulators). Survival of a company in the market is determined by the proven ability of companies to minimize resource input, to produce green products and to reduce environmental impact of their business processes. This has demanded company innovations to produce competitively priced goods and services satisfying human needs and improving quality of life. On the other hand, system change imperative reflects companies and the economic system a part of social and ecosystem. This view of sustainability focuses upon promoting compatibility of company practices with ecosystem and developing the new value system reflecting sustainable development. Both the imperatives in an integrated manner develop a better view on key issues and strategies in future, and to identify mechanisms and ways of transforming our society to a sustainable one (Schot *et al.*, 1997).

Many researchers have drawn conclusions suggesting that integrating environmental concerns and green strategies in corporate philosophy, and marketing policies and practices lead to sustainable growth (Shrivastava, 1995; Bernstam, 1991; Lecomber, 1975). The increasing trend of adopting eco-friendly business, eco-friendly technologies and services is creating new business opportunities presenting strong potential for making profit and satisfying stakeholders who have significant influence on the availability of financial, human and other resources of companies (Biloslavo and Trnavcevic, 2009). Thus, this trend is seen as growing relationship between marketing and sustainability (Jones *et al.*, 2008) and has led to emergence of the term 'Green Marketing'. Emerged in late 1980s, the concept of green marketing addresses environmental issues in several activities such as designing and manufacturing products, their pricing, distribution and promotion. It is perceived as a profitable and sustainable management process to identify, anticipate and satisfy the requirements of consumers and society (Chan, 2013). It involves greening of marketing by launching environmentally friendly products in the market for the ecologically conscious consumers (Kilbourne, 1998) and aims at developing competitive advantage, increasing mar-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

ket share, improving customer loyalty, and promoting profitability (LeCren and Ozanne, 2011; Chang and Fong, 2010; Sharma *et al.*, 2010). Peattie and Crane (2005) view green marketing more as response to what consumers wanted, rather than a proactive initiative in companies. Though initially it lacked exhibiting patience and commitment to achieve full rewards from sustainability actions (Peattie and Crane, 2005), gradually it has been recognized that environmentally-conscious and ecologically-friendly strategies lead to superior financial performance as well as competitive advantages in the marketplace (Sharma *et al.*, 2010).

On the other hand, Wong *et al.* (1996) argue that green marketing is sensible only if consumers have taste and preferences for green products, and supply side decisions (availability, promotion, pricing etc.) meet consumers' need and requirements as well as government policies and regulations. Consumers have a key role as decision makers in moving towards sustainability (Jones *et al.*, 2008). Being educated through formal and informal environmental education channels, the environmental concerns have been altering consumers' basic habits and changing their consumption behaviour to preserve the environment (D'Souza, 2004) and the number is ever increasing (Gam, 2011; Mostafa, 2009). So, the relationship between consumer behaviour, marketing and the environment has emerged as a new trend in business which has led to increase in public awareness about environmental aspects as well as an increase in the evidences of environmental responsibility in the marketing activities (Gupta and Ogden, 2009; do Paco and Raposo, 2009). This has motivated marketers to focus on environmental dimension of their products, packaging and processes (Hur *et al.*, 2004) and incorporate green initiatives in their marketing strategies and advertising as well (Jansson *et al.*, 2010). Marketers now understand green marketing functionally so as to develop strategies aimed to meet the green consumers' needs (D'Souza, 2004). A number of companies have been implementing a number of green marketing strategies to meet the demand of environmentally conscious consumers. For instance, a number of companies are investing in research and development for developing green technologies and green products. For companies, energy saving and environmental protection policies are definitely a priority factor (Proto *et al.*, 2007). They are also engaged in establishing standards restricting the use of hazardous substances, environmental guidelines for their suppliers at all levels of the supply chain, and collaborating with their trading partners to develop environmentally conscious value chain (Hu and Hsu, 2010; Zhu and Sarkis, 2004). Recycling programs, cleaner production, environmental management systems and eco-efficiency, environmental certifications, water/waste reduction programs, packaging material and its design, environmentally-friendly purchasing, and lowering greenhouse gas emission have emerged as main environmentally friendly practices (Zhu *et al.*, 2010; Zhu *et al.*, 2005; Mandaraka and Kormentza, 2000). With such strategies, they also establish themselves in a niche for consumers with environmental concerns (Essoussi and Linton, 2010; Schubert *et al.*, 2010). Thus, the scope of environmental practices within their operations and supply chains with clear environmental objectives has become pronounced. Further, they regularly collect market-related information, implement their inferences across functional departments, and develop and improve of green marketing mix in response to the inferences. It represents their organisation-wide focus on creating superior value to the consumers and for the business, and behaving in the best interest of the consumers. As well, they identify special needs of consumers and develop environment-oriented business strategies to satisfy their changing needs. It aims at developing and offering superior products and value than the competitors catering to the present and future needs of the market. It is an indication of commitment to their relationship with the consumers. Thus, an increasing interest towards green marketing orientation is witnessed in the recent years.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Green marketing has attracted considerable research interest and green marketing orientation has gained significant importance in guiding companies' behaviour favourable to the environment. Green marketing orientation is described to place greater emphasis on collecting and using information related to consumer needs and developing strategies that respond to consumers' present and future needs, competitor actions and regulatory environments. The goal of green marketing orientation is to satisfy present and expressive consumer needs with their green product offering. It also aims at identifying hidden market needs as well future needs of the consumers, and accordingly altering existing product offerings and if required, develop and invest their resources, skills and capabilities to develop new products to cater to the rising needs in the market. Green marketing orientation has greater significance in development business practices and marketing strategies. It is determined important for companies to leverage their potential advantages of flexibility, market intelligence and adaptability into green product offering with superior value. Thus, green marketing orientation is perceived as a marketing philosophy that effectively and efficiently guides company behaviour to create learning from consumers and competitors, to create superior value to consumers of the company and continuously generate superior business performance.

The recent changes in marketing has raised the need to develop a holistic perspective of green marketing "that embraces all aspects of the company, the product, and the means of production, consumption, and disposal" so that opportunities to make substantive progress towards sustainability can lead to minimizing a transaction's negative impact on the natural environment and a change in corporate thinking towards environmental commitment (Peattie and Crane, 2005; Polonsky and Rosenberger III, 2001). Though environmental sustainability is gaining importance for business performance and competitive advantage, Sharma *et al.* (2010) has recognized that research on inclusion of active role of environmental issues in marketing is still in infant stage and the related discussions are limited to the discipline of management, production, and supply chain, and thus in context of entire value chain. This lays down the foundation for this study and explains the need to concentrate on this area of research.

3. GREEN MARKETING LITERATURE

Green marketing is deep rooted in earlier attempts of Lazer (1969) to address societal dimension of marketing in terms of finite environmental sources, societal and environmental impacts of conventional marketing, and greening of the different aspects of traditional marketing (Feldman, 1971). It is identified as one of the new forms of marketing which can play a very important role in the provision of the opportunities for well-being of the society (Prosenak *et al.*, 2008). It takes into consideration ecological sensitivity of natural environment, its constraints, and the laws of nature to ensure improved holistic quality of life, and to strengthen positive influence on natural and social environment (Prosenak *et al.*, 2008).

Since the evolution of the domain, a number of misconceptions associated with green marketing and a variety of terminologies and definitions have made it difficult to define the term (Kinoti, 2011). Polonsky (1994) identified that green marketing, sustainable marketing, environmental marketing and ecological marketing are synonymously used. Dam and Apeldoorn (1996) differentiated green marketing from its simultaneous terms. Green marketing "focuses on market pull and legislative push toward improved, environmentally friendly corporate performance". On the other hand, ecological marketing is related to ecological crisis and marketers' realization of their responsibilities towards the environment; sustainability marketing is related to marketing within sustainable economic development; and ecological, green and sustainable marketing altogether are labeled as environmental marketing.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

From the first definition of green marketing in 1976 to the most recent one in 2011, the term has evolved in its definitions and shifted its focus (Table 2 in the Appendix). It is witnessed that corporate responsibility for pollution prevention and resource conversation was the focus of green marketing definition initially, which shifted to satisfying marketing needs and to meeting organisational goals in later decades. Evolution of the term has improved relationship between sustainability and marketing, and advanced the research work in green marketing (Jones *et al.*, 2008). It has evolved as a philosophy that entails the recognition of effectively using limited available natural resources and taking more responsibility towards the environment. It has emerged as a set of environmentally favorable activities that follows a holistic management process compatible with eco-system (Peattie and Charter, 1994) to satisfy human needs with least impact on environment (Stanton and Futrell, 1987), and to fulfill consumer needs and organisational goals (Fuller, 1999). Having its significance for the 'future' over the 'present', it focuses on ecological sustainability rather than economic efficiency and recognizes intrinsic value of nature (Peattie, 1995). It also focuses on redefining products in the market, eliminating waste in production, usage and post-usage, adequate pricing and profitability (Pride and Ferrell, 2008). It intends to emphasize on environmental benefits from products usage, elaborates on cost over the lifecycle of the products rather than price, informs consumers about environmental aspects of the products rather than to generate sales, and focuses much beyond present consumer needs (Papadopoulos *et al.*, 2010). Thus, it can be seen as an amalgamation of environment management process, marketing activities and product/services for value creation to society, environment and sustainable future. Because this transformation entails a fundamentally different way of looking at the world and marketing's place in it, an expansion of the limits of marketing inquiry is required. This means that the discipline must become more macro in its focus and more multi-disciplinary in its methods.

Addressing demands of green consumers is another perspective of green marketing domain. Green consumers have been in the epicenter of the environmental marketing strategies (Papadopoulos *et al.*, 2010) and a large section of the literature in green marketing has focused on the determinants of their environmental behaviour, green purchase behaviour and post-purchase behaviour. A number of green consumer studies have shown that environmentally conscious consumers respond to environmentally responsible behaviour of the companies and it is exhibited in their purchase behaviour (Papadopoulos *et al.*, 2010; Paco and Raposo, 2009). Green consumer is defined by Strong (1996) as the one "who avoids products that are likely to endanger the health of the consumer or others; cause significant damage to the environment during manufacture, use or disposal; consume a disproportionate amount of energy; cause unnecessary waste; and use materials derived from threatened species or environments". Researchers have observed that green consumers are likely to prefer products manufactured by the companies that follow the practices of eco-friendly product design and processes (Pickett-Baker and Ozaki, 2008; D'Souza *et al.*, 2006). Studies show that behaviour in real life is not always governed by attitude, it is also intervened by the thoughts and feelings of an individual which ultimately influence her/his behaviour (Pickett-Baker and Ozaki, 2008). In marketing, market variables and branding with rational reasons have the power to influence the thoughts and feelings of an individual that result in developing his/her opinion towards green products and help in shifting consumer attitudes to more sustainable consumption (Pickett-Baker and Ozaki, 2008). For example, D'Souza (2004) studied intervening effect of eco-labels on consumer behaviour and argued that environmental information endorsed on labels and ecological attributes, and product efficacy characteristics may result in increase in sales of green products. Similarly, product attributes (health-related concerns, nutrition, taste, size, quality, ingredients,

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

flavor and appearance), reputation of the manufacturer, retail store and associated people, availability of environmental information and knowledge, consumers' past experience, and marketing communication targeted towards the consumers (interpersonal communication, influence of opinion leaders and word-of mouth, etc.) are other market-related variables. They are used to develop green marketing strategies to market their green products and practices so that consumers' attitude, decision making and behaviour can be influenced (Pickett-Baker and Ozaki, 2008).

Thus, green marketing is deeply rooted in understanding the changing consumer behaviour, and influencing their attitude and beliefs in decision making constraints imposed by price, brand and availability, and comprehensive reassessment of product design and development, pricing policies, distribution and marketing communications, and product and packaging disposal (Ko *et al.*, 2013; Jones *et al.*, 2008). It has emerged as a managerial concept to improve corporate reputation and image by displaying the environmentally-friendly manners companies operate which is governed by following ethical standards and undertaking environmental and social responsibilities, and engaging with societal and business stakeholders.

4. DISCUSSION

Green marketing can be described with three fundamental elements i.e. commitment, enrichment and differentiation that serve as guiding factors in developing green marketing mix for a company. First, commitment is facilitated by visionary management that is complementary to organisational values and culture to guide marketing decisions and to ensure coherence of marketing actions. Green marketing managers possess a set of values that develop green marketing practices around environmental vision and mission. They cultivate green marketing philosophy across strategic business functions in the company, to make a consistent commitment of resources for green product development, and to rationalize company processes to deliver a consistent consumer value. Second, differentiation is related to making a unique and robust set of product associations that markets wish to develop and maintain for differentiating their products from those of competitors. The green product associations originate from marketing innovations, incremental or radical, that aim at adding value to the total green product offering and establishing the product in the market. The differential element is communicated in the market to distinguish the product, the corporate culture and environmental commitment of the company, and the relationship of the distinguished product with customers. Further, green marketing managers utilize their skills and intelligence to understand how several features, benefits and attributes may create favourable perception of green products. Third, enrichment is rooted in core environmental values of a company which guide company's efforts on using greater creativity and developing strong unique product entities that create value (utility or added) for its consumers. This is facilitated by cross-functional team-based marketing operations in a holistic and integrative manner rooted in core environmental values. This motivates green marketing managers to use company's assets to create unique competitive products that fulfill consumers' present and future needs, develop a lasting eco-oriented personality, and possess a distinct combination of physical, functional and psychological benefits. This way, the emphasis is laid upon environmental impact and benefits of products, company's values and mission regarding impact on the environment, encouraging environmentally responsible behaviour among consumers, and developing engaging marketer-consumer relationships.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

4.1. Setting Future Research Agenda

Though green marketing is seen as an important sub-domain of marketing over the last five to six decades, only a handful number of studies are witnessed that focus upon developing green marketing strategies and motives of green marketing (i.e. perceived opportunities offered by green marketing to achieve organisational objectives, company's moral obligation, pressure from government bodies and competitors, cost saving, revenue generation and image building). Some of the studies evaluated green marketing strategies (Polonsky and Rosenberger III, 2001; Rivera-Camino, 2007) while others focused on relationship building with stakeholders and consumers (D'Souza *et al.*, 2006; Gurau and Ranchhod, 2005). Others examined relationship between green marketing and marketing professionals such as, Rivera-Camino (2007) developed an understanding of stakeholders' influence on green marketing strategies and stakeholders' prioritization. Further, Gurau and Ranchhod (2005) compared Romanian and British eco-firms for their international green marketing strategies. Thus, the literature addresses either theoretical development of green marketing or concentrated on stakeholders' perspective of green marketing.

Though the literature on green marketing witnessed several perspectives of the domain i.e. environmental, societal, and economical, yet the confusion persists for its appropriate conceptualization, how to measure it (specifically, green marketing orientation), and how it is developed (antecedents of green marketing orientation). Studies in the domain provide little information on what determines green marketing orientation of companies and how green marketing orientation results in developing effective green marketing practices. Further, it is imperative that together with companies putting their best to pursue green marketing efforts to contribute to sustainability, equally important is consumers' willingness to change their behaviour to become more sustainable so as to achieve green marketing objectives (Gordon *et al.*, 2011). So, it is important to understand consumers' perception of the green marketing practices and how they are addressed by innovative green marketing strategies. A need is realized to rethink marketing concept and subsequent marketing strategies so that the effect of green consumerism can be examined on the role of marketing mix (Prothero, 1990). Thus, academic contributions to developing marketing strategies incorporating environmental dimension, and green marketing practices catering to achieve environmental, social and economic goals and objectives in integrated manner are substantially needed.

4.2. Future Research Directions for Green Marketing Orientation

The literature review elaborates how green marketing has moved beyond simply promotion of products with environmental characteristics. So, future research should explore significant efforts for sustaining company's degree of adaptation to the market and a sequence of necessary actions guiding their behaviour. In other words, studies should be aim at developing an understanding on how green marketing-oriented companies move beyond internal marketing activities and include external activities that aims to associate consumers with the company. This will elaborate upon how market-related information is collected and disseminated across a company's functional areas so that a set of shared goals can be developed for guiding business functions for effective product development and marketing. This should further be replicated in developing and validating corporate behaviour and marketing practices that thoroughly incorporates environmental values into the decision-making process with extensive coordination across functional areas. This will develop an understanding of how the new ideas and concepts of green marketing lead to a paradigm shift in marketing theory and practice, and how green marketing orientation offers

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

marketers opportunities to achieve the overall objective of creating and providing value for companies as well as consumers. Exploring the domain as marketing response to the design, production, packaging, use and disposal of products will enrich the knowledge and establish ground for developing solutions to forthcoming challenges in green marketing. From the literature review, it is evident that green marketing now address moral concerns raised in environmental initiatives and handle them through genuine commitment to following tightened ethical standards. So, future work should explore tightening ethical standards, standards of societal and professional ethics beyond legal requirements and morally right marketing practices. This will further provide directions to revise traditional marketing practices, and design strategies and marketing mix for meeting needs of the market.

Studies on green marketing orientation should also explore how customer-oriented marketing decisions are driven by the philosophy and values pertaining to green marketing, and are influenced by the inferences drawn from company's understanding of its market and customers. The findings will be meaningful in developing organisation-wide innovations that help companies to identify chances of innovations required for catering to the present and future needs of the market as well as to make their organisational process and activities effective in the present competitive environment l. Establishing relationships between green marketing practices and consumer trust and satisfaction on effectiveness of company's products and business operations for reduced environmental impact will contribute towards developing managerial solutions to green marketing challenges. Measuring green marketing performance in financial terms (investment profitability, sales profitability, and financial profitability), operational terms (sale volume, sale increase rate, market share, customer retention rate, product quality) and in terms of organisational efficiency may prove other milestones in this direction. Further, measuring value creation (economic such as effectiveness of product and durability, and non-economic such as social image and self-appraisal) as outcomes of green marketing practices may offer meaningful managerial implications. Value creation for consumers can be studied from two perspectives. One perspective includes consumers who are satisfied with their current consumption pattern and lifestyles. For such consumers, they will be attracted towards green products, only if they recognize that the products demand modifications in line with improve their lifestyles. Another perspective includes consumers who are curious to change their current consumption pattern and lifestyles in an environmentally-friendly manner. For such consumers, they will be attracted towards green products if they recognize that the products demand modifications improve their lifestyles. This will enable green marketing managers to understand what green marketing practices can make real contribution to bringing a difference from environmental conservation perspective.

4.3. Future Research Directions for Green Marketing Mix

Though green marketing mix is recognized as fundamental of marketing, it needs to be carefully combined and utilised to produce the most viable mix. Based on the challenges involved in marketing of green products, retail mix and promotion mix are two important building blocks of green retailing. In other words, contributions towards informing consumers about green products and offering them green product exposure are utmost important in academic research. Exploring and developing green retail mix may produce interesting results to explain attempts creating awareness of green products, offering repeated green product exposure in retail stores to enable consumers to recognize and recall green products, and improving their familiarity with green products. Also, the role of retailers as leading actors in green marketing should be explored to understand how they proactively share the responsibilities of providing facilities to consumers to make trials of green products intended to provide personal product-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

related experiences, to make consistent efforts to build long-term relationships with consumers, and to build up strong market position for green products.

From green advertising perspective, the content of the environmental information about their products, processes and practices has gained strategic position in green marketing. So, researchers may be interested to explore the linkage of environmental information with corporate activities, educating consumers about green products and enabling them to make more effective purchase decisions, and their meaningfulness from the aspects of understandability, clarity and convincing. Important managerial implications may be produced by exploring green communication practices and consumer engagement practices so that consumers' misconceptions, confusion, skepticism, and backlash surrounding green product claims and performance can be minimized or prevented, and the likelihood of information sharing, mutual understanding and informed decision-making can be maximized.

It is worth exploring how taking into account the new media and integrated marketing strategies caters to new and constantly changing consumer needs, and how adopting distinct approaches allow green marketing managers to improve communication with consumers in personalized and interactive manner. It may also be related with consumer empowerment and high degree of market transparency. Resulting co-creation marketing strategies that allow consumers to become a part of product development process and wide acceptance of the new product developed may produce important managerial implications. Consumer engagement practices for green products are also meaningful to relate products with personal values and value orientations of consumers, to answer to their curiosities, and to improve comprehension about products. Further, promotional practices enabling consumers to understand their needs and to compare their needs with products available in retail stores for making suitable choice of products are worth exploring. This may have important implications in developing relationships between the customers and green products, between the customers and the companies, between the customers and the green product in use, and among fellow customers. There will develop an understanding of interactions between company and consumers in the market that not only strengthens the relationship between consumers and green marketers but also substantially increases the role of consumers in contributing to product-related innovations. Further, integrating a locus-based perspective of green consumer behaviour (Kalamas *et al.*, 2014) with promotion mix elements may produce interesting implications.

The role of consumer engagement practices, credibility of environmental claims and effectively informing consumers about green products can be further examined to identify the constantly changing needs, to predict market trends early and accurately, to quickly respond to competitive movements, and thus, to understand effectiveness of green marketing practices on company performance. This way, the future research directions contribute towards understanding how green marketing it overcomes the shortcomings of traditional marketing mix, as described by Constantinides (2006), of lack of customer orientation and consumer interactivity by developing solution over products, sharing information over promotion and creating value over sales.

5. CONCLUDING REMARKS

The literature review witnessed the integration of sustainability and marketing. This results in prominence of corporate environmental actions and green marketing practices in businesses wherein importance is accorded to activities such as developing green products, and using innovative pricing and retailing

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

practices to promote them in the consumer market. Marketing managers develop a long term vision for the growth and development of companies as well as for a sustainable future. In result, they intend to develop specific marketing mix for green products and green segments of the market. This way, once limited to the ideology of activists, environmental consciousness has become a matter of market competition (Mostafa, 2009; Follows and Jobber, 2000). Thus, the literature review makes an attempt to propose conceptualisation of green marketing orientation and outlining green marketing mix by relating sustainability and marketing with each other. It further identifies research gaps and provides direction for future research to contribute in green marketing literature. These attempts differentiates this literature review from those of others such as Chamorro *et al.* (2009), Peattie and Crane (2005), Prakash (2002), and Polonsky and Rosenberger III (2001).

It is rational to state that strength of green marketing mix lies in its focus on long-term strategic and rational thinking that lays greater emphasis upon managing their marketing relationship and interactions with suppliers, distributors and retailers, and ensures long-term transactions between marketers and consumers. Thus, a considerable shift in marketing practices from internal orientation of traditional marketing mix to interactive and consumer-oriented is evident. It develops a perspective that supports an integrated approach towards marketing practices taking into account transactional, relational and organisational aspects of marketing activity. The study concludes with the possibility and relevance of developing the mix that serve as a basis of green marketing planning for the highly competitive, dynamic and technology-mediated market. The studies based on future research agenda proposed in the article intend to address issues related to total green product offerings and to adequately deal with new realities of marketing. For practical implications, it will enable companies to make superior contribution to continuously improving consumer value and to gain competitive advantage. Thus, the predominance of four Ps of marketing mix in green marketing perhaps relates to Kotler (2011) which explicitly incorporates each component of marketing involving from product and market intelligence to pricing, distribution, promotion, information credibility and ethics. It is worth theoretically significant to understand whether green marketing mix extends traditional marketing mix and overcomes its shortcomings, or is losing its relevance in green marketing domain.

REFERENCES

Banerjee, S. B. (2002). Corporate environmentalism: The construct and its measurement. *Journal of Business Research*, *55*(3), 177–191. doi:10.1016/S0148-2963(00)00135-1

Banerjee, S. B., Iyer, E. S., & Kashyap, R. K. (2003). Corporate environmentalism: Antecedents and influence of industry type. *Journal of Marketing*, *67*(2), 106–122. doi:10.1509/jmkg.67.2.106.18604

Beamon, B. M. (1999). Designing the green supply chain. *Logistics Information Management*, *12*(4), 332–342. doi:10.1108/09576059910284159

Bergstrom, K., Soler, C., & Shanahan, H. (2005). Professional food purchasers' practice in using environmental information. *British Food Journal*, *107*(5), 306–319. doi:10.1108/00070700510596893

Biloslavo, R., & Trnavcevic, A. (2009). Web sites as tools of communication of a "green" company. *Management Decision*, *47*(7), 1158–1173. doi:10.1108/00251740910978359

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chamorro, A., & Banegil, T. M. (2006). Green marketing philosophy: A study of Spanish firms with ecolabels. *Corporate Social Responsibility and Environmental Management*, *13*(1), 11–24. doi:10.1002/csr.83

Chan, E. S. W. (2013). Managing green marketing: Hong Kong hotel managers' perspective. *International Journal of Hospitality Management*, *34*(September), 442–461. doi:10.1016/j.ijhm.2012.12.007

Chang, N.-J., & Fong, C.-M. (2010). Green product quality, green corporate image, green customer satisfaction, and green customer loyalty. *African Journal of Business Management*, *4*(14), 2836–2844.

Crane, A. (1997). The Dynamics of marketing ethical products: A cultural perspective. *Journal of Marketing Management*, *13*(6), 561–577. doi:10.1080/0267257X.1997.9964493

Crittenden, V. L., Crittenden, W. F., Ferrell, L. K., Ferrell, O. C., & Pinney, C. (2011). Market-oriented sustainability: A conceptual framework and propositions. *Journal of the Academy of Marketing Science*, *39*(1), 71–85. doi:10.100711747-010-0217-2

D'Souza, C. (2004). Ecolabel programmes: A stakeholder (consumer) perspective. *Corporate Communications: An International Journal*, *9*(3), 179–188. doi:10.1108/13563280410551105

D'Souza, C., Taghian, M., & Lamb, P. (2006). An empirical study on the influence of environmental labels on consumers. *Corporate Communications: An International Journal*, *11*(2), 162–173. doi:10.1108/13563280610661697

Dam, Y. (1996). Sustainable Marketing. *Journal of Macromarketing*, *16*(2), 45–56. doi:10.1177/027614679601600204

Deng, S., & Dart, J. (1999). The market orientation of Chinese enterprises during a time of transition. *European Journal of Marketing*, *33*(5/6), 631–654. doi:10.1108/03090569910262279

Deshpande, R., & Webster, F. E. Jr. (1989). Organisational culture and marketing: Defining the research agenda. *Journal of Marketing*, *53*(1), 3–15. doi:10.2307/1251521

do Paco, A., & Raposo, M. (2009). Green segmentation: An application to the Portuguese consumer market. *Marketing Intelligence & Planning*, *27*(3), 364–379. doi:10.1108/02634500910955245

Essoussi, L. H., & Linton, J. D. (2010). New or recycled products: How much are consumers willing to pay? *Journal of Consumer Marketing*, *27*(5), 458–468. doi:10.1108/07363761011063358

Esteban, A., Millan, A., Molina, A., & Martin-Consuegra, D. (2002). Market orientation in service: A review and analysis. *European Journal of Marketing*, *36*(9/10), 1003–1021. doi:10.1108/03090560210437307

Feldman, L. (1971). Societal adaptation: A new challenge for marketing. *Journal of Marketing*, *35*(3), 54–60. doi:10.2307/1249790

Follows, S. B., & Jobber, D. (2000). Environmentally responsible purchase behaviour: A test of a consumer model. *European Journal of Marketing*, *34*(5/6), 723–746. doi:10.1108/03090560010322009

Fuller, D. A. (1999). *Sustainable marketing: managerial-ecological issues*. Thousand Oaks: Sage.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Gam, H. J. (2011). Are fashion-conscious consumers more likely to adopt eco-friendly clothing? *Journal of Fashion Marketing and Management*, *15*(2), 178–193. doi:10.1108/13612021111132627

Gordon, R., Carrigan, M., & Hastings, G. (2011). A framework for sustainable marketing. *Marketing Theory*, *11*(2), 143–163. doi:10.1177/1470593111403218

Greer, C. R., & Lei, D. (2012). Collaborative innovation with customers: A review of the literature and suggestions for future research. *International Journal of Management Reviews*, *14*(1), 63–84. doi:10.1111/j.1468-2370.2011.00310.x

Gupta, S., & Ogden, D. T. (2009). To buy or not to buy? A social dilemma perspective on green buying. *Journal of Consumer Marketing*, *26*(6), 376–391. doi:10.1108/07363760910988201

Gurau, C., & Ranchhod, A. (2005). International green marketing: A comparative study of British and Romanian firms. *International Marketing Review*, *22*(5), 547–561. doi:10.1108/02651330510624381

Hu, A. H., & Hsu, C. (2010). Critical factors for implementing green supply chain management practice: An empirical study of electrical and electronics industries in Taiwan. *Management Research Review*, *33*(6), 586–608. doi:10.1108/01409171011050208

Hult, G. T. M. (2011). Market-focused sustainability: Market orientation plus! *Journal of the Academy of Marketing Science*, *39*(1), 1–6. doi:10.100711747-010-0223-4

Hur, T., Kim, I., & Yamamoto, R. (2004). Measurement of green productivity and its improvement. *Journal of Cleaner Production*, *12*(7), 673–683. doi:10.1016/j.jclepro.2003.08.004

Jansson, J., Marell, A., & Nordlund, A. (2010). Green consumer behaviour: Determinants of curtailment and eco-innovation adoption. *Journal of Consumer Marketing*, *27*(4), 358–370. doi:10.1108/07363761011052396

Jones, P., Clarke-Hill, C., Comfort, D., & Hillier, D. (2008). Marketing and sustainability. *Marketing Intelligence & Planning*, *26*(2), 123–130. doi:10.1108/02634500810860584

Kalamas, M., Cleveland, M., & Laroche, M. (2014). Pro-environmental behaviors for thee but not for me: Green giants, green Gods, and external environmental locus of control. *Journal of Business Research*, *67*(2), 12–22. doi:10.1016/j.jbusres.2013.03.007

Kilbourne, W. E. (1998). Green marketing: A theoretical perspective. *Journal of Marketing Management*, *14*(6), 641–656. doi:10.1362/026725798784867743

Kinoti, M. W. (2011). Green marketing intervention strategies and sustainable development: A conceptual paper. *International Journal of Business and Social Science*, *2*(23), 263–273.

Knights, D., Sturdy, A., & Morgan, G. (1994). The consumer rules? An examination of the rhetoric and reality of marketing financial services. *European Journal of Marketing*, *28*(3), 42–54. doi:10.1108/03090569410057281

Ko, E., Hwang, Y. K., & Kim, E. Y. (2013). Green marketing' functions in building corporate image in the retail setting. *Journal of Business Research*, *66*(10), 1709–1715. doi:10.1016/j.jbusres.2012.11.007

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Kotler, P. (2011). Reinventing marketing to manage the environmental imperative. *Journal of Marketing*, *75*(4), 132–135. doi:10.1509/jmkg.75.4.132

Lazer, W. (1969). Marketing's changing social relationships. *Journal of Marketing*, *33*(1), 3–9. doi:10.2307/1248739

Lecomber, R. (1975). *Economic growth versus the environment*. London: Macmillan.

LeCren, N., & Ozanne, L. K. (2011). Consequences of corporate environmental marketing strategies in New Zealand organisations. *Marketing Intelligence & Planning*, *29*(2), 156–177. doi:10.1108/02634501111117601

Mandaraka, M., & Kormentza, I. (2000). Greece faces up to the EU packaging regulation: Businesses reveal their plans to meet the new legislative environment. *Environmental Management and Health*, *11*(1), 7–19. doi:10.1108/09566160010314143

Matten, D., & Moon, J. (2008). Implicit and explicit CSR: A conceptual framework for a comparative understanding of corporate social responsibility. *Academy of Management Review*, *33*(2), 404–424. doi:10.5465/AMR.2008.31193458

Menon, A., & Menon, A. (1997). Enviropreneurial marketing strategy: The emergence of corporate environmentalism as market strategy. *Journal of Marketing*, *61*(1), 51–67. doi:10.2307/1252189

Mostafa, M. M. (2009). Shades of green: A psychographic segmentation of the green consumer in Kuwait using self-organizing maps. *Expert Systems with Applications*, *36*(8), 11030–11038. doi:10.1016/j.eswa.2009.02.088

Papadopoulos, I., Karagouni, G., Trigkas, M., & Platogianni, E. (2010). Green marketing: The case of Greece in certified and sustainably managed timber products. *Euro Med Journal of Business*, *5*(2), 166–190. doi:10.1108/14502191011065491

Peattie, K. (1995). *Environmental Marketing Management*. London: Pitman.

Peattie, K., & Charter, M. (1994). Green marketing. In M. Baker (Ed.), *The Marketing Book*. Oxford: Butterworth Heinneman.

Peattie, K., & Crane, A. (2005). Green marketing: Legend, myth, farce or prophesy? *Qualitative Market Research: An International Journal*, *8*(4), 357–370. doi:10.1108/13522750510619733

Pickett-Baker, J., & Ozaki, R. (2008). Pro-environmental products: Marketing influence on consumer purchase decision. *Journal of Consumer Marketing*, *25*(5), 281–293. doi:10.1108/07363760810890516

Polonsky, M. J. (1994). An introduction to green marketing. *Electronic Green Journal*, *1*(2), 1–10.

Polonsky, M. J. (1995). A stakeholder theory approach to designing environmental marketing strategy. *Journal of Business and Industrial Marketing*, *10*(3), 29–46. doi:10.1108/08858629510096201

Polonsky, M. J., & Rosenberger, P. J. III. (2001). Re-evaluating green marketing: A strategic approach. *Business Horizons*, *44*(5), 21–30. doi:10.1016/S0007-6813(01)80057-4

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Prakash, A. (2002). Green marketing, public policy and managerial strategies. *Business Strategy and the Environment*, *11*(5), 285–297. doi:10.1002/bse.338

Pride, W. M., & Ferrell, O. C. (2008). *Marketing* (14th ed.). New York: Houghton Mifflin.

Prosenak, D., Mulej, M., & Snoj, B. (2008). A requisitely holistic approach to marketing in terms of social well-being. *Kybernetes*, *37*(9/10), 1508–1529. doi:10.1108/03684920810907832

Prothero, A. (1990). Green consumerism and the societal marketing concept: Marketing strategies for the 1990's. *Journal of Marketing Management*, *6*(2), 87–103. doi:10.1080/0267257X.1990.9964119

Proto, M., Malandrino, O., & Supino, S. (2007). Eco-labels: A sustainability performance in benchmarking? *Management of Environmental Quality: An International Journal*, *18*(6), 669–683. doi:10.1108/14777830710826702

Pujari, D., Wright, G., & Peattie, K. (2003). Green and competitive Influences on environmental new product development performance. *Journal of Business Research*, *56*(8), 657–671. doi:10.1016/S0148-2963(01)00310-1

Rivera-Camino, J. (2007). Re-evaluating green marketing strategy: A stakeholder perspective. *European Journal of Marketing*, *41*(11/12), 1328–1358. doi:10.1108/03090560710821206

Schot, J., Brand, E., & Fischer, K. (1997). The greening of industry for a sustainable future: Building an international research agenda. *Business Strategy and the Environment*, *6*(3), 153–162. doi:10.1002/(SICI)1099-0836(199707)6:3<153::AID-BSE109>3.0.CO;2-Y

Schubert, F., Kandampully, J., Solnet, D., & Kralj, A. (2010). Exploring consumer perceptions of green restaurants in the US. *Tourism and Hospitality Research*, *10*(4), 286–300. doi:10.1057/thr.2010.17

Sharma, A., Iyer, G. R., Mehrotra, A., & Krishnan, R. (2010). Sustainability and business-to-business marketing: A framework and implications. *Industrial Marketing Management*, *39*(2), 330–341. doi:10.1016/j.indmarman.2008.11.005

Shrivastava, P. (1995). The role of corporations in achieving ecological sustainability. *Academy of Management Review*, *20*(4), 936–960.

Srivastava, S. K. (2007). Green supply-chain management: A state-of-the-art literature review. *International Journal of Management Reviews*, *9*(1), 53–80. doi:10.1111/j.1468-2370.2007.00202.x

Stanton, W. J., & Futrell, C. (1987). *Fundamentals of Marketing* (8th ed.). New York, NY: McGraw- Hill.

Strong, C. (1996). Features contributing to the growth of ethical consumerism – A preliminary investigation. *Marketing Intelligence & Planning*, *14*(5), 5–13. doi:10.1108/02634509610127518

Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *British Journal of Management*, *14*(3), 207–222. doi:10.1111/1467-8551.00375

Webster, F. E. Jr. (1992). The changing role of marketing in the corporation. *Journal of Marketing*, *56*(4), 1–17. doi:10.2307/1251983

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Wong, V., Turner, W., & Stoneman, P. (1996). Marketing strategies and market prospects for environmentally-friendly consumer products. *British Journal of Management*, *7*(3), 263–281. doi:10.1111/j.1467-8551.1996.tb00119.x

Zhu, Q., Geng, Y., Fujita, T., & Hashimoto, S. (2010). Green supply chain management in leading manufacturers: Case studies in Japanese large companies. *Management Research Review*, *33*(4), 380–392. doi:10.1108/01409171011030471

Zhu, Q., & Sarkis, J. (2004). Relationships between operational practices and performance among early adopters of green supply chain management practices in Chinese manufacturing enterprises. *Journal of Operations Management*, *22*(3), 265–289. doi:10.1016/j.jom.2004.01.005

Zhu, Q., Sarkis, J., & Geng, Y. (2005). Green supply chain management in China: Pressures, practices and performance. *International Journal of Operations & Production Management*, *25*(5), 449–468. doi:10.1108/01443570510593148

This research was previously published in the International Journal of Asian Business and Information Management (IJABIM), 6(3); edited by Patricia Ordóñez de Pablos, pages 42-59, copyright year 2015 by IGI Publishing (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

APPENDIX

Table 2. List of green marketing definitions

Henion and Kinnear (1976)	"the study of the positive and negative aspects of marketing activities on pollution, energy depletion and non-energy resource depletion."
Stanton and Futrell (1987)	"consists of all activities designed to generate and facilitate any exchanges intended to satisfy human needs or wants, such that the satisfaction of these needs and wants occurs, with minimal detrimental impact on the natural environment."
Herbig and Butler (1994)	"to products and packages that have one or more of the following characteristics; they are less toxic; are more durable; contain reusable materials and/or are made of recyclable materials".
Mintu and Lozada (1993)	"the application of marketing tools to facilitate exchanges that satisfy organisational and individual goals in such a way that the preservation, protection, and conservation of the physical environment are upheld."
Peattie and Charter (1994)	"the holistic management process responsible for identifying, anticipating and satisfying the needs of consumers and society, in a profitable and sustainable way."
Polonsky (1994)	"consisting of all activities designed to generate and facilitate any exchanges intended to satisfy human needs, such that the satisfaction of these needs and wants occurs, with minimal detrimental impact on the natural environment."
Lampe and Gazda (1995)	"the marketing response to the environmental effects of the design, production, packaging, labeling, use, and disposal of goods or services."
van Dam and Apeldoorn (1996)	"focuses on market pull and legislative push towards improved, environmentally friendly corporate performance."
Fuller (1999)	"the process of planning, implementing and controlling the development, pricing, promotion and distribution of products in a manner that satisfies the following three criteria: (1) customer needs are met, (2) organisational goals are attained, and (3) the process is compatible with the ecosystem."
Kotler and Armstrong (2009)	"that meets the present needs of consumers and businesses while also preserving or enhancing the ability of future generations to meet their needs."
Papadopoulos *et al.* (2010)	"referring to the planning, development and promotion of products or services that satisfy the needs of consumers for quality, output, accessible prices and service, without however a negative effect on the environment, with regard to the use of raw material, the consumption of energy etc."
Gordon *et al.* (2011)	"developing and marketing more sustainable products and services while introducing sustainability efforts at the core of the marketing and business process."

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 79
Green Investments and Food Security:
Opportunities and Future Directions in the Context of Sustainable Development

Corina Ene
Petroleum and Gas University of Ploiesti, Romania

Marian Cătălin Voica
Petroleum and Gas University of Ploiesti, Romania

Mirela Panait
Petroleum and Gas University of Ploiesti, Romania

ABSTRACT

Green investments are the perfect tool to generate complex self-regenerating systems in order to achieve a sustainable development. Even if the burden of transition from high polluting economy to a green economy is high, the cost should be split among all that have interest in achieving this goal. The switch to green is an international current that will ultimately force the change if it is not made willingly. All parties have an interest to promote change before the change gets them on the wrong foot. In this regard, the chapter aims to emphasizing the potential benefits of the transition to a green economy in terms of reducing poverty, enhancing food security, nutrition and health on a sustainable basis while promoting ecosystem stability. Thus, increased green investments throughout the food system are imperatively needed so that changing the way food is obtained could become a powerful force for sustainable development.

GREEN INVESTMENTS IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT

Green economy is a new concept related to sustainable development. At Seventh "Environment for Europe" Ministerial Conference held in Astana, 21–23 September 2011, the participants agreed that green economy is a "tool to help achieve sustainable development and eradicate poverty" (UNECE, 2011). Although United Nations member states have not established an agreement on the definition of the green

DOI: 10.4018/978-1-5225-7915-1.ch079

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

economy, UNEP defines it as "one that results in improved human well-being and social equity, while significantly reducing environmental and ecological scarcities" (UNEP, 2011). As an associated concept, green growth refers to growth that "emphasizes environmentally sustainable economic progress to foster low-carbon, socially inclusive development" (UN DESA 2012).

The greening of the economy is complex process and different from country to country because the particularities of each state must be taken in account. The differences are made by factors like: level of development, natural resource endowments, strength of institutions and laws, nature and size of market failures, public awareness on the green economy (stakeholders like consumers, businessmen, professors or students have their role in the transition to the green economy). The green economy ensures the growth, protects earth's ecosystems, contributes to the poverty alleviation and offers the right responses to the climate, food and economic crises. So, the green economy is compatible with the older concept of sustainable development (UN DESA, UNEP & UNCTAD, 2012).

Green investments have benefits on many fields: environmental protection, social inclusiveness and economic development. The main consequences of these investments are presented in the Table 1.

Taking into account the complexity of the phenomenon, the transition to green economy must be supported by public authorities, private sector and civil society. The first step is the identification of the main priorities in each country (Table 2). At the level of European Union, the main priorities have been detected and now, the major challenge is the establishment of the proper measures that must be taken.

The public authorities have the major role in this transition process because they must establish a robust framework available for public and private entities from real economy and civil society. For example, instruments like environmental taxes, charges and fees, carbon pricing and subsidies must be imposed in order to shape the behavior of the business. In addition, the companies must be encouraged

Table 1. The benefits of green investments

Environmental Protection	Social Inclusiveness	Economic Development
• decreased air pollution • decreased water pollution • decreased soil pollution • decreased ghg emissions • decreased biodiversity loss • decreased natural resources depletion • increased energy efficiency • increased water efficiency	• improved access to goods and services • improved affordability of goods and services • improved work safety • increased green jobs • strengthened effective public participation in environmental matters • improved health protection • improved equity	• increased innovation • increased technology transfer • improved infrastructure • removed barriers • improved competition

Source: https://www.unece.org/sustainable-development/green-economy

Table 2. The main priorities for the green economy

Job creation	**GREEN ECONOMY**	Industry
Financing		Agriculture
Education for sustainable development		Water
Sustainable Consumption and Production.		Sustainable and climate-resilient cities
Energy		Green Public Procurement

Source: https://www.unece.org/fileadmin/DAM/env/documents/2011/ece/e.ece.rpm.2011.4.e.pdf

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

to have a social responsible attitude through different tools like voluntary guidelines and information-based instruments. In order to raise public awareness on the green economy, stakeholders like consumers, students and educators are important players. The consumers must to be encouraged to give up to unsustainable consumption patterns and to become more conscious about their role in the transition to green economy. The universities have the mission to offer education for sustainable development. According with Nelson Mandela, "Education is the most powerful weapon you can use to change the world." Taking in account this, a new concept has appeared: education for sustainable development. The promoters of this concept are international political and economic forums like United Nations, OECD, ministries like environment or health minister. Research and innovation are also important in order to create environmentally sustainable technologies that reduce waste and increase resource efficiency. In this context, the integrated collaboration between government, industry, academia and civil participants are essential if we consider the Quadruple Helix Model (Carayannis & Campbell, 2009). In order to make the progress, it is also important to established targets and to measure the results. So, the indicators are essential to evaluate the efforts made by different entities.

INTERNATIONAL INITIATIVES TO MEASURE AND ACHIEVE GREEN AND SUSTAINABLE DEVELOPMENT

Initiatives to measure the achievement of a sustainable development spawn different benchmarks composed by sets of indicators that indicate the completion of different goals of sustainable development. We will present some of the most important of them which had a great influence on sustainable development and sustainable food systems.

Millennium Development Goals and Its Follower: Sustainable Development Goals

Millennium Development Goals is one of the most important initiatives to achieve a sustainable development by setting a set of eight goals in the year 2000 at the Millennium Summit which needs to be accomplished by the end of 2015. The base year for these goals is the year 1990. The United Nations Millennium Declaration was signed by the world leaders, committing their nations to reach the next goals (UN, 2000):

1. Eradicate extreme poverty and hunger
2. Achieve universal primary education
3. Promote gender equality and empower women
4. Reduce child mortality
5. Improve maternal health
6. Combat HIV/AIDS, malaria and other diseases
7. Ensure environmental sustainability
8. Develop a global partnership for development

In order to accomplish these goals, 12 targets had been put in place and 60 indicators have been used to follow the progress for each goal. The most relevant goals for our topic are goals 1 and 7.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

To eradicate extreme poverty and hunger many developments have to be made in the food production and supply systems to reduce the number of people that suffer from hunger and are undernourished.

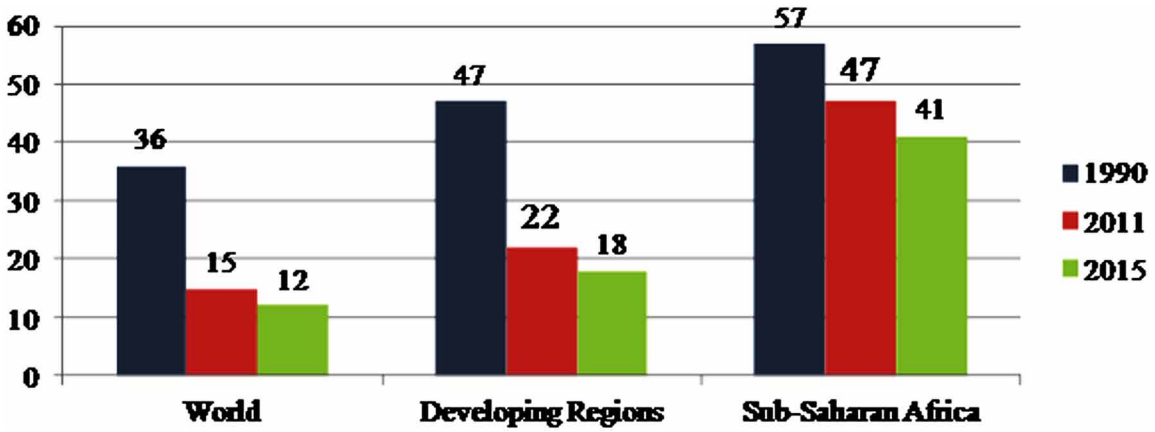
As we can see from Figure 1, the share of people leaving on less than 1.25 USD/day registered an important decrease with 68% in the world and 69% in developing regions. In Sub-Saharan Africa the rate of decrease is slow with only 28% in the analyzed period. As a result of this evolution an excess of 1 billion people left the extreme poverty zone since 1990. Work still needs to continue as a number of 836 million live with less than 1.25 USD/day and the sad fact is that 80% of them live in Southern Asia and Sub-Saharan Africa. As a result, there are 795 million people that are undernourished around the world.

Ensure environmental sustainability is a general desiderate taking into account the influence of climate change on food producing systems. As a result of the acknowledgement of this danger to human kind, the world leaders decided to make the best effort to stop the global warming by reducing the green house gas emissions.

In Figure 2 we can observe that the developed regions registered a decrease of the level of CO_2 emissions, but the developing countries almost tripled their emissions in the analyzed period. As a result, the global emissions of CO_2 increased by 50% since 1990. This opposite trend is generated by the need of developing regions to reach a higher level of development and they argue that developed regions already contributed to the global warming problem before its manifestation through climate change. From this point of view the emission problem can only be resolved by the transition to a green economy of both groups of countries and developing countries should receive some kind of assistance because they lack the necessary funds for this transition. Green investments are the only way forward because if the emissions of green house gases continue the planet will get warmer and warmer with long-lasting changes of climate, endangering people lives and ecosystems with irreversible consequences. These consequences will be felt across the globe and will affect the agriculture which may lead to food shortages.

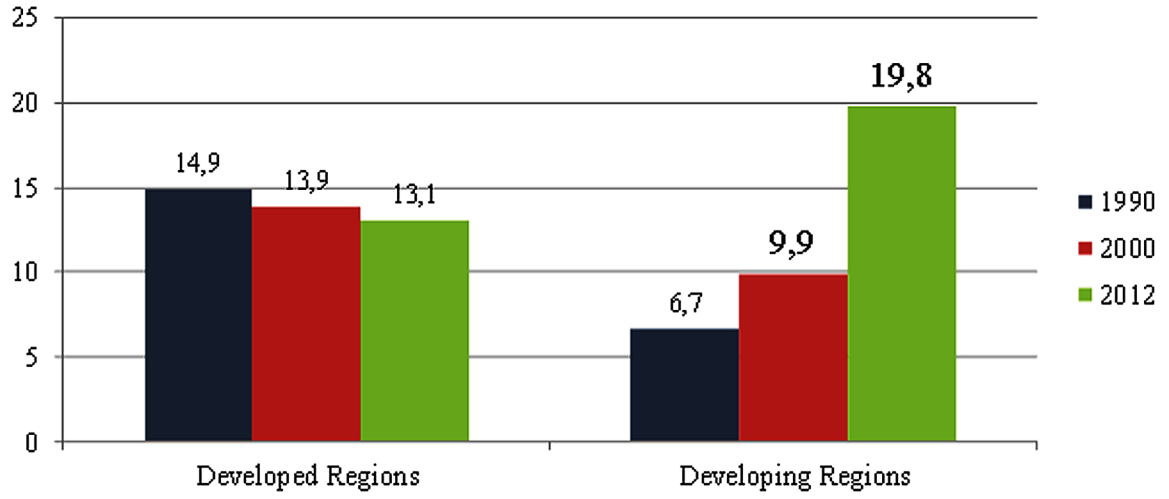
The Millennium Development Goals concentrated the international community towards the accomplishment of eight goals. As a result, the resources were concentrated on these goals and the results showed that fifteen year goals are feasible and eliminates the possibility of being concentrated on too many targets at the same time and miss them. The results were so good that the world leaders decided

Figure 1. Proportion of people living on less than $1.25 a day, 1990, 2011 and 2015 (%)
Source: Based on the data available on Millennium Development Goals Report 2015



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 2. Emissions of carbon dioxide, 1990, 2000 and 2012(billions of metric tons)
Source: Based on the data available on The Millennium Development Goals Report 2015



"to free the human race from the tyranny of poverty" and "to heal and secure our planet" (UN, 2015) and in September, 2015 the General Assembly of United Nations approved the Agenda 2030 as the next level with 17 Sustainable Development Goals and 169 targets as it fallows:

1. End poverty in all its forms everywhere
2. End hunger, achieve food security and improved nutrition, and promote sustainable agriculture
3. Ensure healthy lives and promote well-being for all at all ages
4. Ensure inclusive and equitable quality education and promote life-long learning opportunities for all
5. Achieve gender equality and empower all women and girls
6. Ensure availability and sustainable management of water and sanitation for all
7. Ensure access to affordable, reliable, sustainable, and modern energy for all
8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
10. Reduce inequality within and among countries
11. Make cities and human settlements inclusive, safe, resilient and sustainable
12. Ensure sustainable consumption and production patterns
13. Take urgent action to combat climate change and its impacts
14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development
15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
17. Strengthen the means of implementation and revitalize the global partnership for sustainable development

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

In order to accomplish the Sustainable Development Goals an immense financial effort must be made to develop specific mechanism that allow the efficient way towards the completion of these goals. New legal frameworks must be created in order to implement the Sustainable Development Goals. Also the Global Partnership for Sustainable Development must be strengthened by intensifying the cooperation between governments, private sector and civil society.

The EU Set of Sustainable Development Indicators (SDIs)

Sustainable development is an important objective of the European Union as it is stated in the Article 3 of the Treaty on European Union. The progress towards sustainable development of the EU is measured with the help of Eurostat through the set of sustainable development indicators (EU-SDIs). They are part of the EU Sustainable Development Strategy (EU-SDS) and every two years a report from Eurostat presents the evolution towards sustainable developments.

The first set of EU-SDIs was proposed in 2001 as a result of the EU-SDS adoption and revised in 2006. The EU-SDIs are revised by the Commission under the assistance of a working group formed by statisticians and policy representatives.

The EU-SDIs is composed by ten thematic areas from the economic, social, environmental, global and institutional dimensions (Sustainable development in the European Union — Key messages, 2015): socioeconomic development, sustainable consumption and production, social inclusion, demographic changes, public health, climate change and energy, sustainable transport, natural resources, global partnership, good governance.

Inside each theme there is a three level set of indicators. At the first level we have the headline indicators that are widely used indicators with high communicative power that monitors overall objectives. The second level is composed from indicators related to the operational objectives of the EU-SDS. The third level is composed from indicators that are perfect for progress analysis.

Next we will analyze some indicators with a high impact on the topic of green investments, food security and food systems.

The eco-innovation index is an indicator that wants to depict the eco-innovation performance between EU Member States. It is composed of 16 indicators grouped in five areas: eco-innovation inputs, eco-innovation activities, eco-innovation outputs, resource efficiency and socio-economic outcomes.

As we can see from Figure 3, the highest scores are obtain by the countries from northern Europe, which have a high level of development like Finland, Sweden, Germany, Denmark and United Kingdom with scores of over 120. At the opposite we find former communist countries like, Bulgaria, Poland, Slovakia, Latvia and Croatia with scores of under 60.

The organic farming is promoted and sustained by the European Action Plan for Organic Food and Faming. Between 2007 and 2012 there has been registered an increase of the area cultivated with organic cultures by 42.5%, with an average increase of 7.3% per year, reaching a total of 5.7% of all agricultural area in the EU, generating sales of 22 billion EUR.

In Figure 4 we can see the share of agricultural area used for organic farming in 2012. Austria leads, with a share of 18.5% of its total agricultural area and we cans see that latter members of the EU like Estonia, Latvia, Czech Republic, Slovenia and Slovakia find themselves above the EU average of 5.7%.

In 2014 the European Commission proposed a new regulation on organic farming, the labeling of organic products, and a plan of 18 actions for future of the organic sector up to 2020 (European Commis-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 3. Eco-innovation index 2013 (EU=100)
Source: Based on the data available on Eurostat

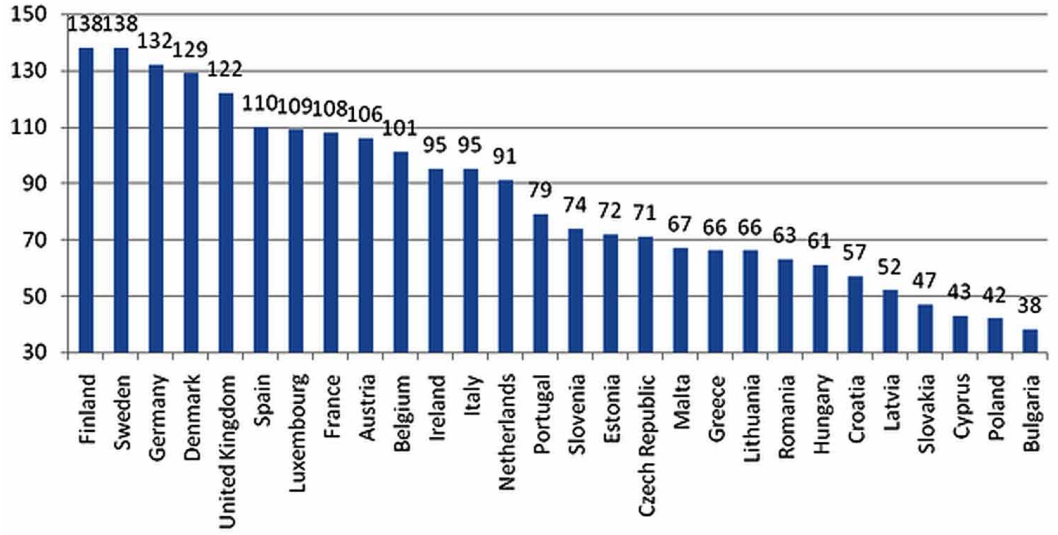
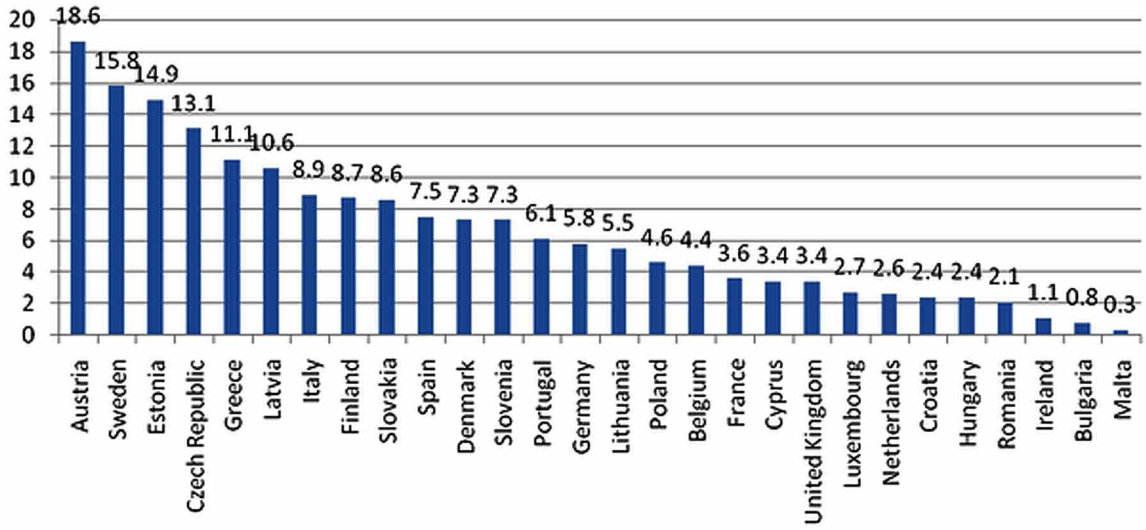


Figure 4. Areas under organic farming 2012 (%)
Source: Based on the data available on Eurostat



sion, 2014). This regulation focuses on two axes, one is to increase the EU organic farmers productivity and the second is to ensure consumer confidence.

The level of annual greenhouse gas emissions is an indicator that includes six gases: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride. The emissions of these gases are transformed in CO_2-equivalent using weighting factors according with the global warming potential each gas has.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

In Figure 5, we observe that the total CO_2-equivalent emissions have increase over time. This increase is not generalized and we can observe that between 1990 and 2000 all the regions registered increases of greenhouse gas emissions except the EU-28. One aspect that needs to be mentioned here is that in the 1990 – 2000 period, many of the Central and Eastern Europe economies passed through the transition process from communism to capitalism system, which generated a painful restructuration of former industry companies, many of them disappearing and so they stop emitting greenhouse gas emissions. This also influenced the decrease registered by the rest of Europe along with the influence of the Yugoslavian Wars, which produce high economic damage, stopping the activity in former Yugoslavia's countries.

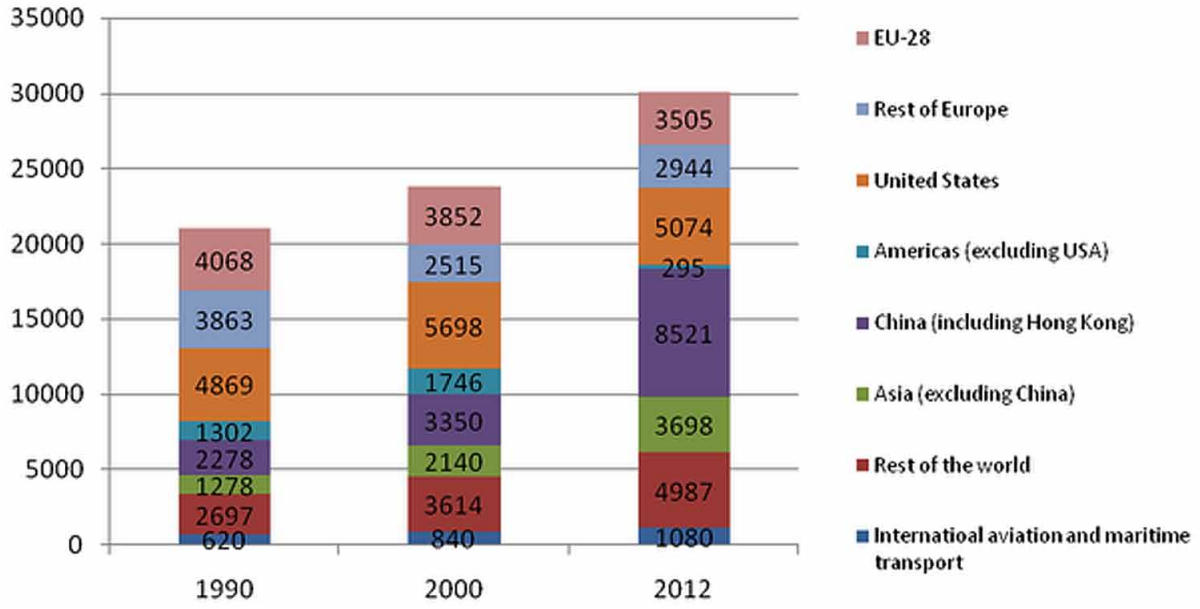
Between 2000 and 2012 we observe that the trend switch for United States, one of the highest generator of greenhouse gas emissions and Americas (excluding USA). EU-28 member states continued their emission reduction mainly due to the European Trading Scheme which is the mechanism used by the EU to implement the Kyoto Protocol stipulations, the success in implementing the national renewable energies promotion in the power sector, creating of building insulation standards, the changes of Common Agriculture Policy etc.

After the transition and the regional conflicts passed, the rest of the Europe group increased their greenhouse gas emissions after revitalizing their industrial and economic activity.

Asia (excluding China) had a steady increase of greenhouse gas emissions along with the rest of the World Group. The development of maritime and aviation sector contributes to the emissions with an important share.

China (including Hong Kong) became in 2012 the largest greenhouse gas emitter in the world surpassing the United States. China based its economic development by ignoring the pollution problem, which now generates important problem for the healthcare system, air and water quality for its citizens.

Figure 5. Greenhouse gas emissions global (million tonnes of CO_2 equivalent)
Source: Based on the data available on Eurostat



**For a more accurate representation see the electronic version.*

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Green Growth Indicators

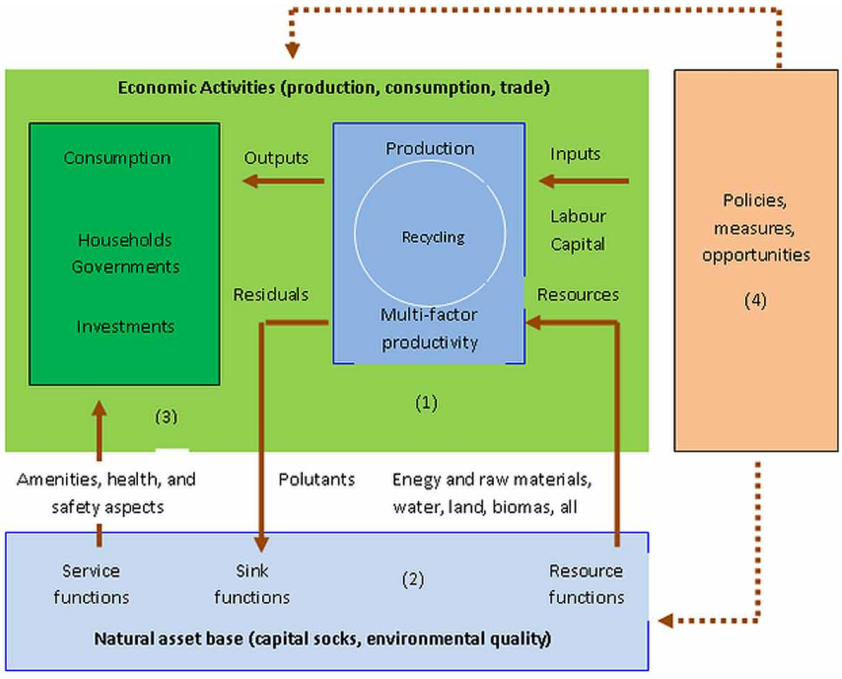
OECD Green Growth Indicators aims to measure the evolution towards a greener economy, to prevent climate change and to protect the natural resources and biodiversity. This set of indicators is in concordance with the international initiatives towards measuring the influence of human activities on the environment and the methods used to minimize it.

Green Growth Indicators are composed of four main areas (OECD, 2014):

1. **Environmental and Resource Productivity:** To capture the need for efficient use of natural capital and to capture aspects of production which are rarely quantified in economic models and accounting frameworks (1 in Figure 6).
2. **Economic and Environmental Asset:** Because sustained growth requires the asset base to be maintained and because a declining asset base presents risks to future growth. Attention is given to natural assets (2 in Figure 6).
3. **Environmental Quality of Life:** To capture how environment conditions and amenities interact with people's lives (3 in Figure 6).
4. **Economic Opportunities and Policy Responses:** To help discern the effectiveness of policy in delivering green growth (4 in Figure 6).

A fifth group of indicator is represented by the indicators that indicate the socio-economic context and the growth characteristics.

Figure 6. Conceptual measurement framework
Source: OECD (2011), Towards Green Growth Monitoring Progress OECD Indicators



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The conceptual framework was presented in Towards Green Growth: Monitoring Progress Report from 2011 which focus on the connection of the principles of green growth, accounting principles and pressure-state-response model for environmental reporting.

Next we will present some of the most relevant indicators to our study.

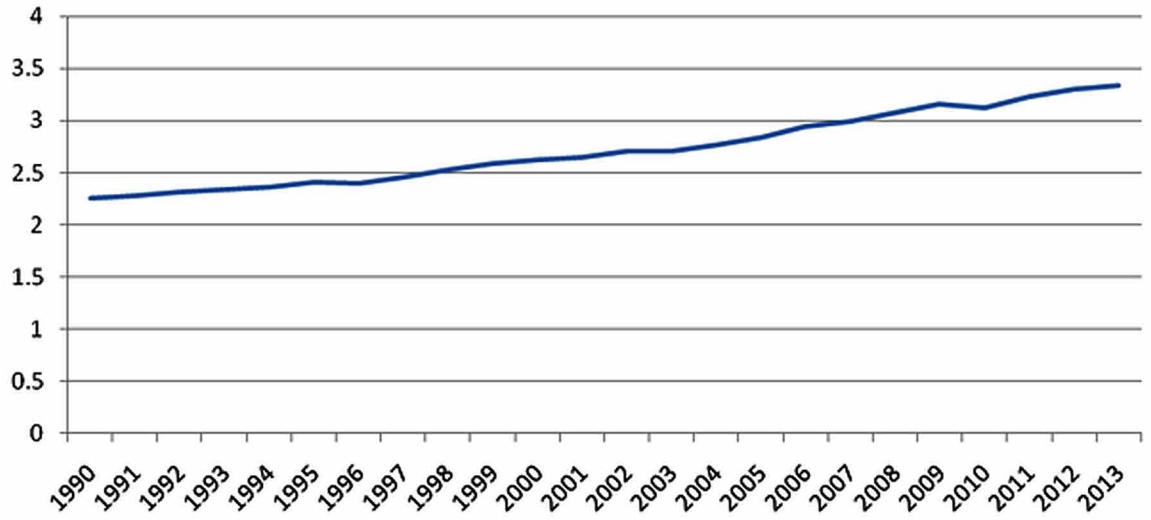
First indicator that we will explore is the productivity of CO_2 production based. As we can see from Figure 7 the productivity of OECD economies registered a steady growth throughout the entire period. At the same time the emissions of greenhouse gases has increased at a lower rate than the GDP, showing signs of decoupling. The financial crisis had an important effect on the reduction of greenhouse gas emissions due to the reduction of the economic activity. The increase of the production based CO_2 productivity may be the result of a switch towards non-fossil fuel energy, the results of environmental policies, the achievement of energy efficiency and the transition of industry away from energy intensive activities. This productivity is not achieved throughout all the sectors, as almost two thirds of emissions are from transport and electricity/heat generation.

Energy productivity increased in the last decade and this was achieved with the decoupling from environmental effects for some countries as a result of structural changes and the promotion of energy conservation policy. However, these results are not enough to achieve the goal of capping the global warming process.

In Figure 8, we can observe the evolution of the share of renewable electricity production from the total produced and we see that the share has increased in the later years. Now, renewable energy accounts for one fifth of the total electric energy generated.

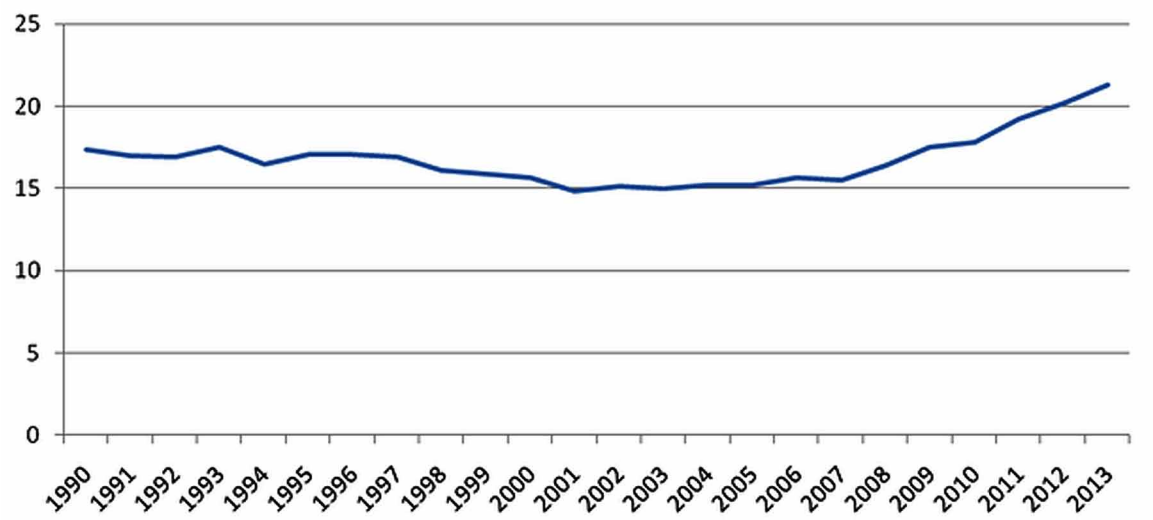
Even though the energy mix changed a lot from 1990, when the oil and coal shares decline in favor of gas and other sources, the OECD countries still rely on fossil fuels in a proportion that exceed 80%. Only a few countries are above the 20% of electricity from renewable sources and the largest share come from biomass and hydropower followed by bioenergy, liquid biofuels, solar and wind.

Figure 7. Production-based CO2 productivity, GDP per unit of energy-related CO2 emissions (US dollars per kilogram)
Source: Based on the data available on OECD, Green Growth Indicators 2014



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 8. Renewable electricity, % total electricity generation
Source: Based on the data available on OECD, Green Growth Indicators 2014

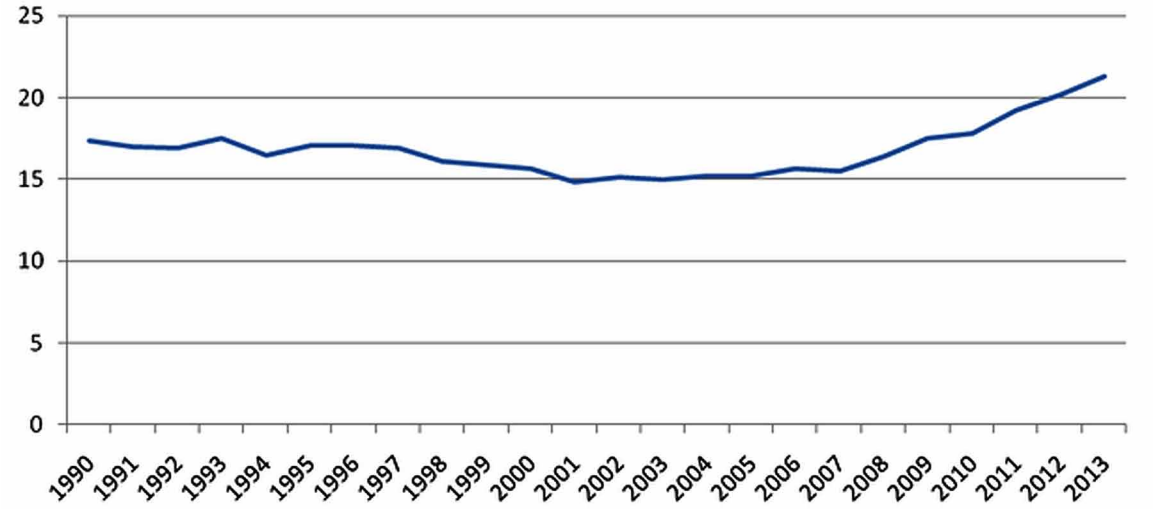


Freshwater is one of the most important resource for environment and the economy, especially the agriculture. The main problem for this resource is represented by the overexploitation, degradation of environment quality. Its quality is influenced by water abstraction, pollution, climate and weather.

The main concern is to provide an adequate management of water sources so that it can be available and at a suitable quality for the use in human activities and to support aquatic and other ecosystems.

In Figure 9, we see that the level of freshwater abstraction registered a steady descending trend throughout the period. This means that there has been a decoupling effect from GDP growth. This trend

Figure 9. Total freshwater abstraction per capita (Cubic metres per capita)
Source: Based on the data available on OECD, Green Growth Indicators 2014



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

has been caused by the efficient use of freshwater in different sectors and the use of alternative water sources like water reuse and desalinization. The agriculture water use increased in many OECD countries, as the irrigated land increased, but the production showed a higher increase.

Another important natural asset base resource is represented by the land and soil. They are critical for the production of food and other biomass, the productivity of ecosystems and preservation of wildlife and plants. In order to ensure a sustainable management, we have to reconcile competing demands for land and soil resources, while keeping its essential ecosystem functions. In order to accomplish this we need territorial planning, appropriate governance and coherence with sectoral policies.

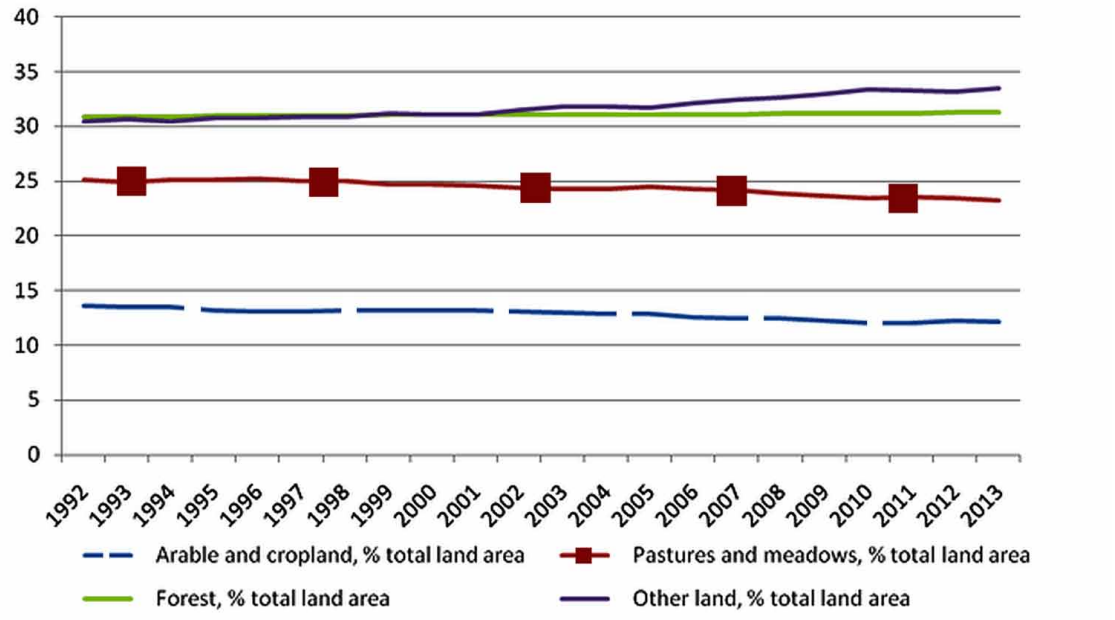
In Figure 10, we see the distribution of land use on the next domains: arable and cropland, forest, pastures and meadows and other land use. The arable and cropland registered a descending trend throughout the period from 13.55% in 1992 to 12.07% in 2013 as the pastures and meadows which decreased from 25.1% in 1992 to 23.22% in 2013.

Forest area registered an increase from 30.88% in 1992 to 31.24% in 2013. The highest increase was registered by the other land from 30.47% in 1992 to 33.47% in 2013. Because of these trends, the biodiversity has declined in OECD countries. The fragmentation, degradation of environment and conversions to other types of land is a phenomenon that needs to be closely watched. Pastures have declined as they have been converted to forests. As of 1990, the agricultural land area registered a decrease of around 0.5% per year as the farmland is converted to forestry and urban development.

Agri-Environmental Indicators

In order to promote sustainable development in agriculture, the Food and Agriculture Organization of the United Nations created a set of Agri-environmental indicators (AEI) with the role to describe and

Figure 10. Distribution of land resources (% of total land area)
Source: Based on the data available on OECD, Green Growth Indicators 2014



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

evaluate the evolution of agricultural environmental performance (Table 3). This has the role to supply scientists and policymakers with the suitable data regarding the environment and the effects and efficiency of policies on the environment. This set of indicators needs to be relevant to the targeted public and, that is why, they are organized to five categories in concordance with the Driving force-Pressure-Stat-Impact-Response (DPSIR) model proposed by the European Environment Agency (EEA, 1999) based on the PSR mode (OECD, 1993).

Next, we will analyze some of the representative of agri-environmental indicators. Ammonia emissions are generated by animal farms and they are responsible for acidification. The main sector with the highest ammonia emissions is the agriculture with shares of 80%-99%. Ammonia contributes to soil and water acidification, and the ammonia from atmosphere can combine with other industrial and transport contributing to secondary particle pollution.

Table 3. Agri-environmental indicators

Domain	Subdomain	Indicator
Air and Climate Change	*Ammonia emissions*	Ammonia (NH_3) emissions from agriculture as a % of total NH_3 emissions
Energy	*Energy use in Agriculture and Forestry*	Agriculture and forestry use as a % of total energy use
	Bioenergy Production	Bioenergy production as a % of total renewable energy production
Fertilizers Consumption	*Nitrogen consumption*	Nitrogen nutrient use on arable and permanent crop area (N tonnes/1000 ha)
	Phosphate consumption	Phosphate nutrient use on arable and permanent crop area (P205 tonnes/1000 ha)
	Nitrogen Phosphate	Nitrogen and Phosphate nutrient use on arable and permanent crop area (N+P205 tonnes/1000 ha)
Land	*Agricultural area*	Agricultural area as a % of land area
	Agricultural area use change	Changes in agricultural area (% per year)
	Area equipped for irrigation	Area equipped for irrigation as a % of agricultural area
	Conservation agriculture	Conservation agriculture area (>30% group cover) as a % of agricultural area
	Cropping patterns	Permanent crops area as a % of agricultural area
	Organic agricultural area	Permanent meadows and pastures area as a % of agricultural area
	Protected land area	Arable land area as a % of agricultural area
Livestock	*Livestock Density*	Livestock total per hectare of agricultural area (livestock total number/ha)
	Cattle and Buffalo	Cattle and Buffalo as a % of total livestock
	Pigs	Pigs as a % of total livestock
	Sheep and goats	Sheep and goats as a % of total livestock
	Poultry birds	Poultry birds as a % of total livestock
Pesticide	*Pesticides Use*	Pesticide use on arable and permanent crop area (tonnes/1000 ha)
Soils	*Soil Erosion - GLASOD*	Average soil erosion expressed in GLASOD erosion degree
	Land degradation - GLASOD	Average land degradation expressed in GLASOD erosion degree
	Carbon in topsoil	Average carbon content in the topsoil as a % in weight
Water	*Water use in agriculture*	Water withdrawal for agricultural use as a % of total water withdrawal

Source: FAO, http://faostat.fao.org/site/674/default.aspx

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

In Figure 11, we observe that the share of ammonia emissions from agriculture in the atmosphere had a steady level of around 60% between 1992 and 2006 when the trend changed and became ascending until 2009 when it surpassed 90%

The mineral fertilizers may poison water and pollute the soil with heavy metals and Persistent Organic Pollutants (POP).

In Figure 12, we can observe the distribution of fertilizers by region, and we see that the highest use of fertilizers can be found in Asia which registered an ascending trend from 129.18 tonnes of nutrients per

Figure 11. Ammonia (NH_3) emissions from agriculture as a % of total NH_3 emissions
Source: Based on the data available on FAO http://faostat3.fao.org/browse/E/EC/E

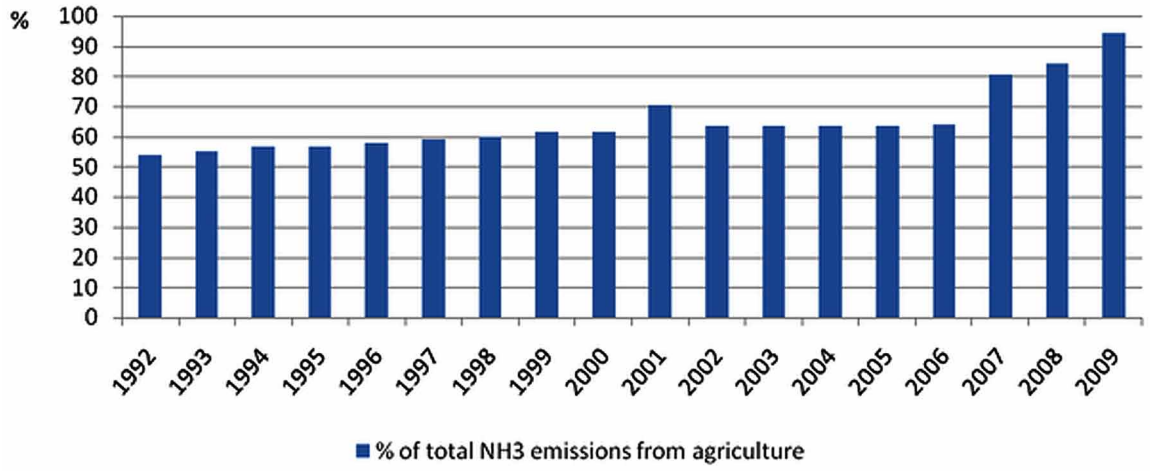
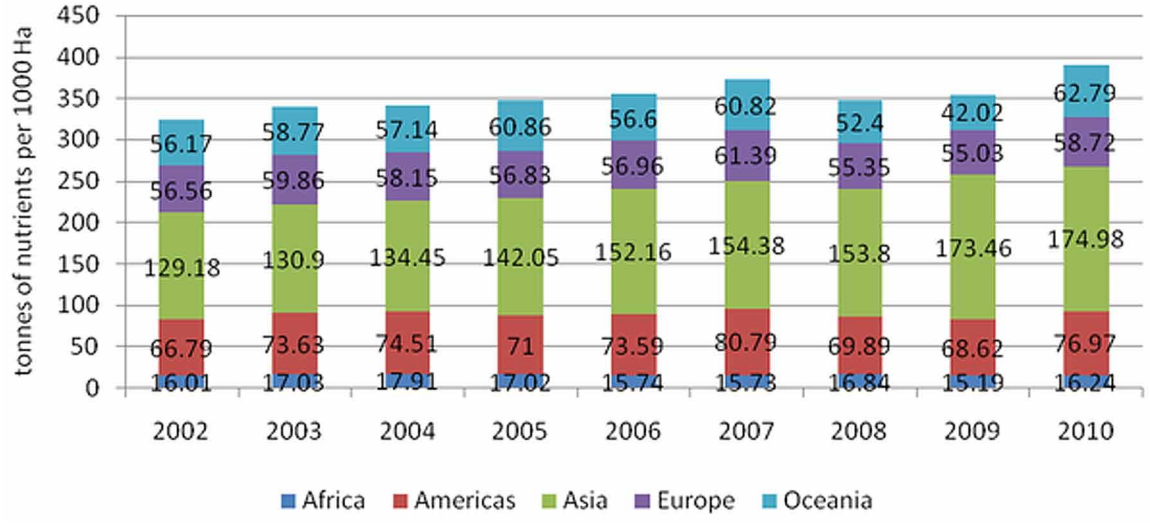


Figure 12. Trend of Nitrogen + Phosphate Fertilizer nutrient use on arable and permanent crop area by continent 2002 – 2010
Source: Based on the data available on FAO, http://faostat3.fao.org/browse/E/EF/E



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

1000 Ha 2002 to 174.98 tonnes in 2010. The second ranking region is the Americas with 76.97 tonnes in 2010 followed by Africa with 62.79 tonnes, Europe with 58.72 tonnes and Oceania with 16.24 tonnes.

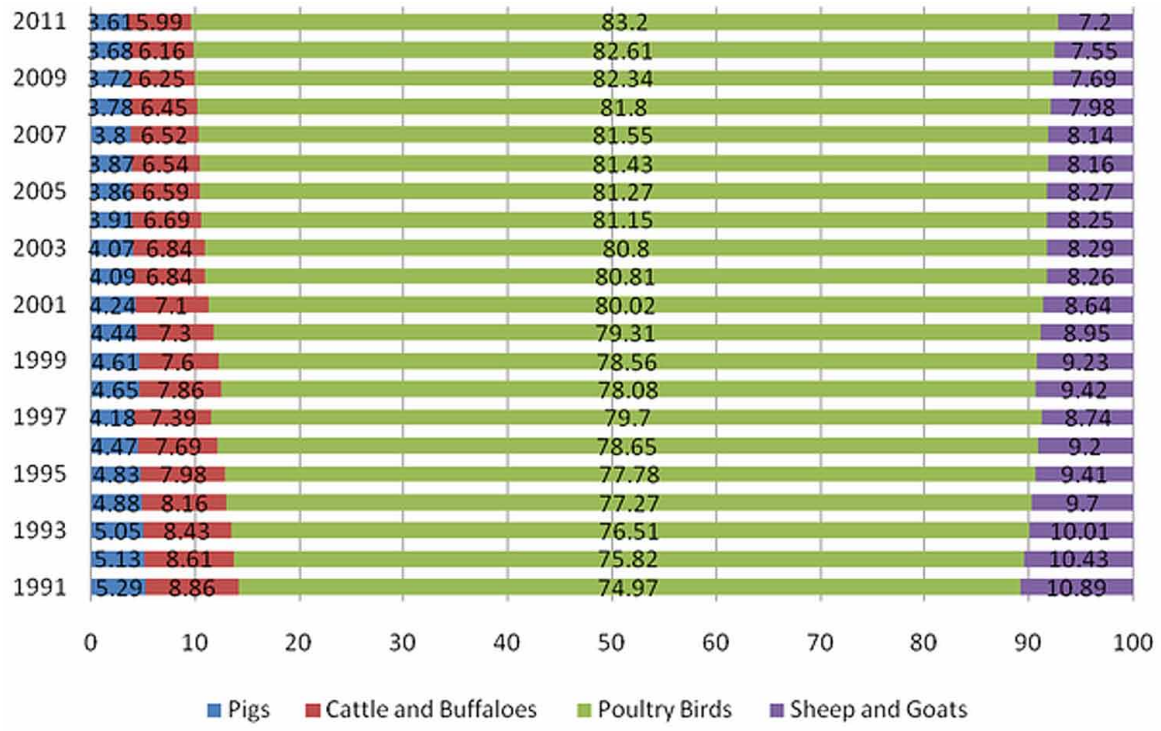
In Figure 13, we can observe the trend of cattle, buffaloes, pigs, sheep, goats, and poultry as a % of total livestock 1991-2011. We observe that the poultry birds increased their share in the analyzed period from 74.97% in 1991 to 83.2% in 2011 based on the reduction of sheep and goats share from 10.89% in 1991 to 7.2% in 2011, cattle and buffaloes from 8.86% in 1991 to 5.99 in 2011 and pigs from 5.29% in 1991 to 3.61 in 2011.

CURRENT DIMENSIONS AND CHALLENGES OF THE WORLD FOOD SECURITY

Humanity is today witnessing startling discrepancies: developed countries have accumulated significant food excess while low income and developing countries face the persistence of malnutrition which cause the death of millions annually, mostly children. In this situation, commendable efforts are made at internationa level, encouraging practical support and long-term involvement of a large number of states in terms of fairness and solidarity.

The concept of food security has dynamically evolved over time, expanding its meanings and connections, so that, at present, in the broadest sense, it encompasses all aspects that allow optimal access of population to food. Beyond any socio-economic, political or cultural differences, everyone has a

Figure 13. Trend of cattle, buffaloes, pigs, sheep, goats, poultry as a % of total livestock 1991-2011
Source: Based on the data available on FAO http://faostat3.fao.org/browse/E/EK/E



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

fundamental right - the right to food - whose materialization is not accomplished everywhere in the best conditions.

The internationally dedicated definition – and the most popular - was established at the World Food Summit (WFS) in 1996 and reaffirmed in 2002, affirming that food security exists "when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life"(World Food Summit, 1996).

The concept of food security, as defined above, was approached and developed on multiple levels during many international meetings on food security worldwide, expressing an essential goal of economic and social development. It is built on three pillars which form its foundation and practical reflections (United States Agency for International Development, 1992; World Health Organization, 2015):

- **Food Availability:** Sufficient quantities of food available on a consistent basis;
- **Food Access:** Sufficient resources to procure adequate foods for a nutritious diet;
- **Food Use:** Appropriate use based on knowledge of basic nutrition and care, as well as adequate water and sanitation.

Food security obviously depends on food availability and food access (Gavrilescu & Giurcă, 2001), but it certainly means addressing extended issues simultaneously, including aspects such as food innocuousness and nutritional balance. Individual food consumption behavior also plays a major role within the food use aspect, due to its complex linkages with personal preferences, dietary habits and traditions (Stancu, 2015) and nutrition education level.

These sides can be covered by right correlation between food and nutrition policies. Food policy aims to ensure the necessary quantity and quality of foods for the entire population at affordable prices, while nutrition policy should effectively approach food and nutrition education (Jukes, McGuire, Method, & Sternberg, 2002).

All these meanings and correlations involve, firstly, ensuring adequate foods obtained either from domestic production, imports or food aid. As a specific type of measure, the motivation of international agricultural interventions assumes that generating income at family level is an effective means to reduce poverty and ensure food security (Bonnard, 1999). Thus, achieving food security is synonymous with dealing with many facets of the food problem - globally, regionally and nationally (Gavrilescu & Giurcă, 2001).

At the moment, the world food situation is not reassuring, since widening disparities between rich and poor countries continuously add new dimensions to the food problem. Inequality and inequity in foods distribution lead to absurd situations that are hardly conceivable for the contemporary civilization.

In this context, international cooperation is becoming more geared towards tackling the food issue and its related aspects - of systemic nature - that humanity is facing today.

Being an essential starting point at global level, the WFS in 1996 set the target of halving the number of undernourished people by 2015 compared to the period 1990-1992. Four years later, the same objective was reaffirmed by the Millennium Development Goals (MDG) proposing two related goals: halving both the proportion of people suffering from hunger and the proportion of those living on less than $ 1.25/day (United Nations, 2000; United Nations Development Programme, 2002). On this theme, the Food and Agriculture Organization of the United Nations (FAO) report entitled "The State of Food Insecurity in the World" (SOFI) is drafted each year as a result of the continuous efforts of FAO and other international partners to monitor nutritional status and to analyze the vulnerability of worldwide

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

population facing the food problem. All editions of SOFI report provide the latest estimates of the number of chronically undernourished people at global level as well as reports on global and national efforts made to achieve the WFS and MDG goals.

A common element of SOFI reports of recent years until 2010 was the indication that, globally, the pace of reduction in population suffering from hunger was so slow that, if it persisted, it would not allow the accomplishments of WFS and MDG commitments. Yet, each successive report starting 2011 pointed out that in several countries and regions significant progress have been made in reducing the number of undernourished people. In this regard, the SOFI 2014 report outlines essential estimates and accomplishments, as follows(Food and Agriculture Organization of the United Nations [FAO], International Fund for Agricultural Development [IFAD] & United Nations World Food Programme [WFP], 2014):

- Even if global hunger reduction continued, in the period 2012–2014 about 805 million people were still chronically undernourished, while the prevalence of undernourishment has fallen from 18.7% to 11.3% globally and from 23.4% to 13.5% for developing countries;
- Regarding the comparison with WFS and MDG goals, since 1990-1992, 63 countries have reached the hunger target of MDG and 25 countries have achieved the WFS target, while undernourishment level fell below 5% for 11 of the 63 developing countries, proving that the hunger target of the MDG still was within reach;
- Even though overall progress in increasing food security was obvious, significant differences persist across regions: while Latin America and the Caribbean have made the most visible overall progress – by strengthening political commitment to food security and nutrition, modest progress were reported for sub-Saharan Africa and Western Asia - afflicted by conflict and natural disasters;
- Hunger eradication should rely on sustained political commitment at the highest level, considering food security and nutrition as top priorities, as it requires an integrated approach including: investments for enhancing agricultural productivity; access to inputs and markets; measures for rural development; social protection; specific nutrition programmes.

Marking the moment of final balance from the perspective of the MDG monitoring period, the SOFI 2015 report highlights a series of facts revealing global and regional dates and facts (FAO, IFAD & WFP 2015):

- Over the last ten years, global hunger has continued to gradually decline, with a reduction of 167 million hungry people, to an estimated 795 million undernourished people (especially in developing countries);
- The MDG hunger target was missed by a small margin, considering the developing regions, while some regions (Latin America, the eastern and south-eastern regions of Asia, the Caucasus and Central Asia, and the northern and western regions of Africa) have reached the target due to their fast progress in reducing undernourishment;
- Out of 129 developing countries, 72 have reached the MDG hunger target due to economic growth, stable political conditions and adequate social protection policies;
- Inclusive economic growth is a key factor of success in reducing undernourishment, providing real opportunities for the poor to improve their livelihoods: raising the productivity of family farmers, strengthening social protection mechanisms, well-functioning markets and equitable governance;

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- Protracted crises caused by conflict, political instability or natural disasters had a heavy impact on vulnerability and food insecurity, imposing the need for strong political commitment, and the integration of humanitarian and development.

Yet, despite the progress made by some countries and regions, the food global problem is far from being resolved in a definitive and durable manner.

Every edition of SOFI report reveals several factors hindering the growth of food production in some parts of the world, the most common being:

- Reducing the areas of agricultural land due to desertification, erosion, floods, waste deposit, use for various construction;
- Lack of irrigation water during the crops growing season;
- Application of primitive technologies;
- Poor availability of permanent pastures for the whole livestock;
- Low level of agricultural yields;
- Insufficient financial resources allocated for agricultural production and food industry compared to other branches of the economy;
- Population growing faster than agricultural production.

Also, most SOFI reports insist that a healthy agricultural sector could be the way out of the crisis, especially in low-income countries, and a possible decline in investment in the sector should be avoided (FAO, 2009), so that agriculture plays its role as an engine of resuming growth, poverty reduction – being a long-term pillar in the fight against hunger.

COULD GREEN AGRICULTURAL PRACTICES BECOME THE KEY TO FOOD SECURITY?

In order to analyze the food issue as a global problem of humanity and to identify possible eradication ways it is necessary to start with a systematic approach to economic phenomena and processes. Currently, this complex array includes a number of trends, contradictions and paradoxes, of particular concern being the danger of environmental degradation, with serious implications for the future of humanity.

The Key Role of Agriculture in Ensuring Food Security

As a primary field of activity, agriculture has known over time stages that have strengthened its economic and strategic importance, its results being closely linked with the very existence and development of mankind. Agriculture has always been and remains the main source of food for a growing population, especially considering the demographic explosion in low-income countries.

For these reasons, it is clear that agriculture plays a decisive role for the rapid economic progress, the industry development and raising living standards depend on it; for that matter, agriculture ultimately enables access to food security.

World's experience shows that before reaching their actual level, industrialized countries went through an agriculture-based development, and that, at present, a modern economy is inconceivable without an

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

advanced agriculture. Everywhere in the civilized world, food production is considered of high priority, agriculture representing a main branch of economy, while food security is considered to be a key element in any project for agricultural development.

This approach involves prioritizing and according facilities to increase the capacity of agriculture to feed the population, based on the rational use of natural resources and on specific opportunities that support the development of numerous upstream and downstream activities, revitalizing and improving the attractiveness of rural areas (Zahiu, 1999), using a complex set of instruments (Figure 14).

Specifically, a number of national and sectoral policies and measures could support the role of agriculture in solving the food problem (Bulgaru, 1996; Chivu, 2002; Gavrilescu &Giurcă, 2001):

- **Fiscal Policy:** It aims to create fiscal incentives for farmers to enhance their ability to be profitable and to obtain loans for investment. This policy accompanies and guides the transformation dynamics of farmers from households scale farms (created for subsistence) to investment-oriented commercial farms, implying a gradual adjustment of fiscal policies;
- **Agriculture Support Policies:** These aim to create the necessary support structures so that farming becomes a profitable branch: investments in rural infrastructure (electrification, road maintenance, irrigation); support for agricultural research and development – focusing on family farms; support for the development of agriculture extension and advisory services;
- **Food Production Development Support Policies:** Measures to facilitate investment in research etc.
- **Support Measures for the Development and Operation of Agriculture:** Input/output market, market transparency, exports support
- **Support Policies for Quality:** Their objective is to ensure that foodstuffs (local or imported) comply with accepted international standards. This involves defining standards for quality and safety, establishment and operation of control bodies which operate according to internationally accepted standards.

Another aspect of food security lies in the adequacy of food intake, which implies a permanent balance between body's physiological needs and the amount of nutrients consumed. An important fact is that not all agricultural projects that have a potential nutritional impact aim to explicit nutritional purposes. Often, the nutritional impact appears as an unplanned, indirect effect. In this case, it is not monitored within the projects, even if it exists (Bonnard, 1999).

At present, there is a strong orientation trend towards sustainable agriculture based on organic fertilizers and pest control measures derived from nature, which could constitute the key to environmental protection and to solving food problem in the same time.

Figure 14. Instruments for agri-food policies



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The Need for Green Agriculture: Present and Perspectives

In many countries, global economic and environmental developments lie in the core of growing concerns, intensified by prolonged global crises (including energy, financial and food crises) and underscored by scientists warning about the effects of exceeding environmental limits.

In these conditions, green economy (in its various forms) has been proposed as a means of supporting sustainable development by catalyzing national policy development and international cooperation (United Nations Department of Economic and Social Affairs [UN DESA], 2012).

During the last years, these preoccupations continuously amplified, but a series of setbacks have slowed the development in this field: confusion or lack of consensus on terminology; a lack of clarity regarding specific policy measures and their integration within national priorities and objectives, a lack of experience in designing, implementing and reviewing the costs and benefits of green economy policies (UN DESA, 2012).

A series of recent publications regarding green economy or green growth show the growing interest in this approach which is regarded as a possible solution, a necessary way to go and as an integrated manner of addressing current and future local and global stringent issues. the most important contributions in the field belong to the following organizations: UNEP, UN DESA, the United Nations Conference on Trade and Development (UNCTAD), the International Labour Organisation (ILO), the World Bank, the Organisation for Economic Cooperation and Development (OECD), the Global Green Growth Institute (GGGI), the Green Economy Coalition, Stakeholder Forum, the Green Growth Leaders etc. (UN DESA, 2012).

A decisive set of discussions on the green economy held place within the United Nations Conference on Sustainable Development at Rio de Janeiro in June 2012 (also referred to as Rio+20), which covered two themes: (a) a green economy in the context of sustainable development and poverty eradication; and (b) the institutional framework for sustainable development. FAO's contribution to the Rio+20 agenda included an initiative aiming to shaping the definition and implementation of the green economy, named The Greening the Economy with Agriculture (GEA), with a particular emphasis on food security (FAO, 2012).

The "Green Economy" approach of UNEP to sustainable development is based on the need to catalyze sustained economic development through the regeneration of life-sustaining natural resources by re-focusing the global economy towards investments and expenditures in specific economic sectors, including agriculture.

Food security and nutrition as a global issue is also a major preoccupation of the Group of Twenty (G20) agenda, which turns to an integrated and sustainable "food systems" approach. In this direction, G20 actual Food Security and Nutrition Framework drafted in 2014 sets out three integrated priority objectives, as follows (G20, 2014):

1. Increase responsible investment in food systems
2. Increase incomes and quality employment in food systems
3. Increase productivity sustainably to expand the food supply

Unfortunately, agriculture itself is a part of the range of human activities that generate pollution effects of air, water and soil (Iacovoiu, 2009) due both to massive deforestation and to the use of pesticides, fertilizers and genetically modified organisms. Because of unsuitable management practices, agriculture

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

is a significant contributor to climate change; crop and livestock production is responsible for 13.5% of global greenhouse gas emissions. Its considerable ecological impact stimulates increasing global concern.

The perspective of increasing environment degradation gradually acquired new dimensions since, in the context of increased globalization, the setting of permissive environment countries in developing countries facilitated the transfer of highly polluting activities through foreign direct investment made by developed countries (Iacovoiu, 2009).

While the Green Revolution was the right solution for the food crisis fifty years ago, FAO appreciates that today the world needs an innovative way forward that responds to actual needs, as challenges are different (FAO, 2014).

In the context of global concern for food security of recent years, the concept of sustainable agri-food development was formulated - inextricably linked to the global development process. Within this frame, food availability is derived from domestic agricultural output resulting from the use of sustainable natural resources (Webb & Rogers, 2003).

In the same line, The Committee on World Food Security (CFS) which acts as an intergovernmental body for review food security policies approved in October 2014, during its Committee on World Food Security 41st Session, the Principles for Responsible Investment in Agriculture and Food Systems, applicable to all types and sizes of agricultural investments. These principles promote sustainable and inclusive economic development, supporting the conservation and sustainable management of natural resources, diversity, innovation for safe and healthy agriculture and food systems (CFS, 2014).

The global problem of future food security rises from the challenge of feeding a population of 9 billion by 2050 (FAO, 2009; UN DESA 2011), which decisively depends on higher agricultural output.

UNEP's 2011 report, Towards a Green Economy, drafted by Green Economy Initiative in collaboration with economists and experts worldwide contains essential clarifications about greening the global economy, and consistently assist policy makers on reforms needed in order to fructify the full potential of a green economy.

The report contains relevant key messages regarding the role of sustainable agriculture in this context (UNEP, 2011), showing that actual concerns regarding the growing population, poverty, undernourishment, climate change, depletion of natural capital (deforestation, loss of biodiversity, excessive quantities of pollutants), waste and losses could be addressed by investments and policy reforms aimed at greening agriculture, which could ensure food security on a sustainable basis by providing better employment and higher nutritional levels.

In this context, in 2011, FAO also recognized that agriculture based on the intensive use of inputs for the past fifty years led to increased global food production and average per capita food consumption but also created the premises of jeopardizing future productivity by depleting natural resources of agro-ecosystems, and adding to many factors responsible for climate change. As a result, FAO proposed a new paradigm – named "Save and grow" (FAO, 2014) based on sustainable food management for obtaining of intensive crop production that is both highly productive and environmentally sustainable.

This ecosystem-based approach, suitable for small-scale producers is assimilated to a "greening of the Green Revolution" and combines traditional knowledge with modern technologies. It encourages the use of conservation agriculture, soil organic matter, water flow regulation, pollination, biocontrol of insect pests and diseases, judicious use of mineral fertilizer etc (FAO, 2014). Though, its success depends on

tangible advantages for farmers – who should be compensated for generating environmental benefits – such as higher incomes, reduced costs and sustainable livelihoods.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The need for innovation in family farming is highlighted in SOFA 2014 report, which shows that over 500 million family farms manage the majority of the world's agricultural land and produce most of the world's food – thus playing a key role in ensuring global food security. The need to feed a growing global population requires solutions adapted to local conditions, providing productivity growth only through sustainable intensification (FAO, 2014), by protecting and enhancing natural resources and ecosystems.

Despite difficulties and crisis, significant achievements were made in the agricultural sector regarding the increased global crop production, opportunities for employment and livelihoods and the shift to organic farming, which proved to be economically profitable (UNEP, 2009). Research show that this new approach in the agricultural sector brought various benefits (UNEP 2009, UNEP 2011) in terms of:

- **Environmental Protection:** Sustainable farm management results in: higher soil fertility, equivalent or higher yields than conventional farming, energy efficiency, lower greenhouse gas emissions than conventional farms, higher carbon sequestration efficiency, higher levels of biodiversity as, as a long-term soil fertility and therefore healthy ecosystems;
- **Food Security:** Increased yields and productivity, sustainable jobs creation – thus supporting community development.

In order to benefit from the economic, social and environmental advantages associated to greener and sustainable agriculture, governments and businesses should follow existing investment opportunities in this field, including: storage and transport infrastructure, green processing, production, marketing and trade of green inputs (e.g. organic fertilizers, biological/ integrated pest control methods), irrigation infrastructure; loans programmes for farmers (UNEP, 2009).

This commitment towards greening agriculture requires national and international policy reforms, innovation and technology transfer (G20, 2014), backed by investment, research and capacity building (UNEP, 2011).

On the same note, in order to minimize adverse impacts of biofuels production on global food security, there is a need to intensify efforts for the development of technologies for second-generation biofuels produced from non-food biomass feedstock (UNEP, 2011).

The transition to green and more sustainable farming practices is expected to enhance agricultural production and improve the quality and quantity of food supplies (Herren, Bassi, Tan, & Binns, 2012). In terms of job creation, transitioning to a green economy is expected to create more employment – over 200 million fulltime jobs by 2050 (FAO 2012; Herren at el., 2012) – and many more over the long term across the entire food production and related systems. (Herren et al., 2012; Fan, Ringler, Nkonya, & Stein, 2012).

This shift towards more sustainable practices will require substantial changes in policy interventions:

- Fiscal measures (such as subsidies, taxes, public R&D);
- Regulatory actions (such as standards, mandates and certification procedures);
- Public and international funding, especially for interventions in developing countries, due to their limited access to financial capital and foreign exchange;
- Public information and awareness campaigns.

This shift towards green agriculture should be sustained by governments and stakeholders focus efforts in creating and maintaining the appropriate framework involving subsidies, fiscal and monetary

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

instruments, trade measures, agricultural research, personnel training, building partnership, waste reduction, sustainable choices, health and environment requirements, institutions and entrepreneurial skills (UNEP, 2009).

Large corporations in the field will play a major role in supporting the transition to greener agriculture (UNEP, 2011), as they have the capacity to develop specific strategies and support sustainably oriented investments.

Investments in Agriculture: Under the Sign of Sustainability

The agricultural sector has an important role in the transition process to the green economy. This transition must have an ecosystem approach because the agriculture has the role:

- To ensure the right to adequate food, food and nutrition security (food availability, access, stability and utilization)
- To meliorate the quality of rural livelihoods
- To manage efficiently natural resources
- To improve resilience and equity throughout the food supply chain

At international level, there are many initiatives that focused on o sustainable agriculture and are interesting for many stakeholders implicated in this field (like states, inter-governmental and regional organizations, financing institutions, donors, foundations, research organizations, universities, smallholders, business enterprises, including farmers, civil society organizations, workers and their organizations, communities, consumer organizations):

- UNCTAD, FAO, IFAD and World Bank promote the Principles for Responsible Agricultural Investment
- The Committee on World Food Security (CFS) endorsed the Principles for Responsible Investment in Agriculture and Food Systems

In addition, FAO launched The Greening the Economy with Agriculture (GEA) Initiative. The main objective of this initiative is to increase the stability and resilience of food systems. Factors like extreme weather events, energy scarcity, economic and social disruption, malfunctioning of global markets are threats to the stability of food systems. (FAO, 2012).

The process of transition to green agriculture must take in account:

- The importance of agriculture in the national economies and the numerous stakeholders implicated
- The negative impact of agriculture on environment (loss of biodiversity and degradation of ecosystem services, depletion and erosion of top soil nutrients, an increasing scarcity of freshwater, aggravated water pollution)
- The existence of two types of agriculture:
    - Conventional/industrial agriculture that are energy-intensive, highly mechanized, has high productivity relies on the extensive use of chemical fertilizers, herbicides, pesticides, fuel, water, determined the shrinking the agricultural labor force and request continuous new investments in different types equipment and seeds

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- Traditional (subsistence) smallholder agriculture based on older farming practices and characterized by low productivity

In fact, the specialists proposed a mix of the farming practices and technologies used for the greening of agriculture inspired by these types of agriculture. The purposes of the green investments in agriculture are the increase of farm productivity, the assurance of provision of food, the generation of positive externalities, the reconstruction of ecological resources, the more efficient use of natural resources and reduction of pollution.

The transition to green agriculture (Table 4) is a complex process that implicates public and private efforts. The activity of international organizations is essential in this process because they have the role to support the national authorities and to endorse guidelines or principles that are voluntary used by private actors.

FUTURE RESEARCH DIRECTIONS

In order to ensure good nutrition, in addition to the policy of ensuring the food availability (through production, distribution, international trade) to cover the consumption needs of the whole population, there is a strong need for a policy regarding the responsible resources utilization. The more so as, in the food chain of industrialized countries, the amount of energy consumed for processing, preparation, packaging, transport, distribution and storage of food is much higher than for agricultural production itself, further research is needed in order to design and promote both new concepts on the cost and value of food consumption and calculations for determining its effectiveness.

As a result, the objective of food security - to ensure for all, at any time, effective access to the food they need at a reasonable cost - must be doubled by optimizing the energy and nutritious cost of food up to the final consumption stage.

Other possible direction for research aims to establish a set of indicators of food security regulation, which include eco-investment in agriculture as an administrative tool to harmonize supply and demand of agricultural products, to increase employment level and to fulfill the requirements of sustainable development at the same time.

Table 4. Potential indicators for measuring progress towards green agriculture (UNEP 2011)

Action Indicators	Outcome Indicators
number of enacted and implemented policy measures and officially approved plans that promote sustainable agriculture	percentage and amount of land under different forms of green agriculture
level of governmental support to encourage farmers to invest in conversion to green agriculture and get the farm and the product certified	decline in use of agro-chemicals as a result of conversion to green agriculture; and the number and percentage of farmers converting to green agriculture
percentage of agricultural budget that is earmarked for environmental objectives	increasing proportion of payments for environmental services as a percentage of total farm income
proportion of available producer support used for environmental objectives as a percentage of total agricultural producer support	number of agriculture extension officers trained in green agriculture practices
approved measures that reduce or eliminate barriers to trade in technologies and services needed for a transition to a green agriculture	number of enterprises set up in rural areas, especially those that produce local natural agricultural inputs, to offer off-farm employment opportunities.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

CONCLUSION

During the last decade, several concurrent crises – including food crisis – have unfolded, putting the livelihoods of billions at risk, affecting food security and consequently human health. Current economic approach based on sustainable development requirements are closely related to the recent orientation towards green economy, which could be a new engine of growth and a strategy for the elimination of persistent poverty and food insecurity. The efforts to achieve the goals of sustainable development are huge and suppose private initiative and public actions. The stakeholders like the private companies and individuals, governments, foundations, civil society organizations, development banks, governments, research and academic institutions response individually to the challenges of greening, but collective efforts are better and synergetic.

Sustainability is a desiderate that must be achieved in agriculture field too. Taking in account the importance of this sector in some national economies, the process of greening the economy is lead by agriculture. Even in the developed countries, the promotion of green agriculture is essential because the agriculture has many negative impacts on environment like land conversion and habitat loss, wasteful water consumption, soil erosion and degradation, pollution.

Agricultural sector is the focus of national and international efforts to ensure food security, remaining the engine of development of most low-income countries. Food security is an inalienable human right, an essential component of life safety, national security, and a supreme obligation of governments. The categories facing difficulties in terms of food security can fit in a wide variety of situations or typologies:

- Countries having significant agricultural potential in terms of natural and human resources (e.g. Asia, Latin America)
- Countries with low natural potential in terms of soil quality, climate, infrastructure, institutions (e.g. Africa)
- Countries with imbalances between forms of habitat, improper nutritional status of the population in rural areas, seasonal malnutrition, harvest instability due to climate and weather conditions (e.g. drought, floods)
- Conflict and political instability as major obstacles to development;
- Outdated agrarian structures
- Inadequate agricultural policies

Solving the food security issue should be addressed in a systematic and differentiated manner, both globally and nationally by:

- Reducing malnutrition
- Demographic growth regulation
- Ensuring food availability by developing agricultural production as a matter of priority, in accordance with the natural resources available in each country, avoiding depletion of nonrenewable natural resources
- Redesigning and improving food production in developing countries by industrialization, changing agricultural structures and introduction of green technologies and techniques that would simultaneously solve the problem of unemployment, increasing population incomes and purchasing power

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- Obtaining clean and safe food, reducing food overconsumption and excess and malnutrition in industrialized countries, as it calls forth severe health implications of some categories of population
- Saving food resources, reducing costs and wastage, better utilization of resources in the food chain from the farm to the final consumer, in order to get affordable products with high nutritional value

Food access and use directly depends on the purchasing power of the population – which can be increased by creating jobs through investment policies that help reducing unemployment, increase income, thus enabling effective acquiring of necessary livelihood.

Emergency aid or imports do not provide a reliable basis for reducing the frequency and scale of food crises, so this doesn't provide a solution for sustainable agricultural development in poor countries to improve food consumption for the starving population.

Thus, the goal to ensure food security requires the reconsideration of the importance of agriculture by promoting its strategic role of utmost importance to the overall success of food policies. In this respect, it is necessary to establish several strategies to foster green investments directed towards specific areas like:

- Small farms production or farms that use extensive workforce
- Raising agricultural productivity
- Encouraging local processing of raw materials
- Enriching food resources by reconsidering certain plant and animal species

Addressing the food-population equation cannot occur by chance but by economic and social restructuring measures of agriculture in developing countries and by the systematic support of the international community, particularly through the facilities of green investment and technology transfer.

To ensure food security in the decades ahead, the focus will be on developing specific food security programs in each country, which will include orientation towards green agriculture and attracting the necessary investments in this area.

At present, agriculture stands as a key sector for greening economies, having a high potential to generate trade opportunities while contributing to the transition to a green economy. Food security and sustainable agriculture are placed at the center of the green economy and represent top priorities for many international meetings (e.g. Rio 20+).

In agriculture field, a new challenge is the production of the biofuels. The problem is that the land, the water and other resources are not used to produce foods. So, the food security could be affected. Because of that, the public authorities must have correlate the food security policy and biofuel policy and the main priority should be food security and the right to food. Taking in account the efforts made at international level to promote social responsibility in agriculture sector, the Principles for Responsible Investment in Agriculture and Food Systems should be implemented and monitored in the case of investments for biofuel production. The implications of foreign investors in the land acquisitions in developing countries raise an additional problem. The purchases of lands, often characterized as "land grabs", have implications on the local agricultural production and on the availability of foods for the local population.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

REFERENCES

Andrei, J. V. (2013). Multifunctional Agriculture and the Green Economy. In I. Subic & D. Dusmanescu (Eds.), *Sustainable Technologies, Policies, and Constraints in the Green Economy*. doi:0.4018/978-1-4666-4098-6

Bonnard, P. (1999). *Increasing the Nutritional Impact of Agricultural Interventions*. Presented in The Greater Horn of Africa Regional Workshop: Agricultural Policy, Resource Access and Human Nutrition, Ethiopia. Retrieved from http://www.eldis.org/vfile/upload/1/document/0708/DOC7724.pdf

Bulgaru, M. (1996). *Dreptul de a mânca- Disparităţi mondiale si realităti româneşti*. Bucharest: Economic Publishing House.

Carayannis, E. G., & Campbell, D. F. (2009). Mode 3andQuadruple Helix: Toward a 21st century fractal innovation ecosystem. *International Journal of Technology Management*, *46*(3-4), 201–234. doi:10.1504/IJTM.2009.023374

Chivu, L. (2002). *Competitivitatea în agricultură – analize şi comparaţii europene*. Bucharest: Expert Publishing House.

Committee on World Food Security. (2014). *Global Strategic Framework for Food Security & Nutrition* (3rd ed.). Retrieved from http://www.fao.org/cfs/cfs-home/global-strategic-framework/en/

Committee on World Food Security. (2014). *Principles for Responsible Investment in Agriculture and Food Systems*. International Agreement on Responsible Investment in Agriculture and Food Systems. Retrieved from http://www.fao.org/cfs/cfs-home-old/resaginv/en/

European Commission. (2014). *Action Plan for the future of Organic Production in the European Union*. COM(2014) 179 final. Author.

Eurostat. (2015). *Sustainable development in the European Union – 2015 monitoring report of the EU Sustainable Development Strategy*. Luxembourg: Publications Office of the European Union.

Fan, S., Ringler, C., Nkonya, E., & Stein, A. J. (2012). *Ensuring Food and Nutrition Security in a Green Economy*. IFPRI Policy Brief 21. Retrieved from http://www.ifpri.org/publication/ensuring-food-and-nutrition-security-green-economy

FAO Statistical Pocketbook. (2015). *Food and Agriculture Organization of the United Nations, Rome*. Retrieved from www.fao.org/3/a-i4691e.pdf

Food and Agriculture Organization of the United Nations. (2009). *Investing in food security*. Rome: FAO. Retrieved from https://www.responsibleagroinvestment.org/sites/responsibleagroinvestment.org/files/FAO_Investing%20in%20FS_2009.pdf

Food and Agriculture Organization of the United Nations. (2012). *Greening the Economy with Agriculture*. Swiss Confederation, FAO. Retrieved from www.fao.org/docrep/015/i2745e/i2745e00.pdf

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Food and Agriculture Organization of the United Nations, International Fund for Agricultural Development, & United Nations World Food Programme. (2014). *The State of Food Insecurity in the World 2014. Strengthening the enabling environment for food security and nutrition.* Rome: FAO. Retrieved from http://www.fao.org/3/a-i4030e.pdf

Food and Agriculture Organization of the United Nations. (2014). *The State of Food and Agriculture 2014*. Rome: FAO. Retrieved from http://www.fao.org/3/a-i4036e.pdf

Food and Agriculture Organization of the United Nations, International Fund for Agricultural Development, & United Nations World Food Programme. (2015). *The State of Food Insecurity in the World 2015. Meeting the 2015 international hunger targets: taking stock of uneven progress.* Rome: FAO. Retrieved from http://www.fao.org/3/a-i4646e.pdf

Food and Agriculture Organization of the United Nations & United Nations World Food Programme. (2009). *The State of Food Insecurity in the World 2009, Econmic crises – impacts and lessons lerned*. Rome: FAO. Retrieved from http://www.fao.org/docrep/012/i0876e/i0876e00.htm

Gavrilescu, D., & Giurcă, D. (Eds.). (2001). Economie agroalimentară. Expert Publishing House.

Group of Twenty (G20). (2014). *Food Security and Nutrition Framework*. Retrieved from https://g20.org/wp-content/uploads/2014/12/g20_food_security_nutrition_framework.pdf

Herren, H. R., Bassi, A. M., Tan, Z., & Binns, W. P. (2012). *Green Jobs for a Revitalized Food and Agriculture Sector*. Natural Resources Management and Environment Department, FAO. Retrieved from http://www.fao.org/fileadmin/user_upload/suistainability/pdf/FAO_green_jobs_paper_March_31.pdf. http://ec.europa.eu/eurostat http://faostat3.fao.org/

Iacovoiu, V. (2009). *Investiţiile străine directe între teorie şi practică economică. Analize comparative*. Bucharest: ASE Publishing House.

Jukes, M., McGuire, J., Method, F., & Sternberg, R. (2002). Nutrition and Education. In *Nutrition: A Foundation for Development*. Geneva: ACC/SCN. Retrieved from http://www.unscn.org/layout/modules/resources/files/Brief1-12EN.pdf

Organisation for Economic Co-operation and Development. (2011). *Towards Green Growth, OECD Green Growth Studies*. Paris: OECD Publishing; doi:10.1787/9789264111318-en

Organisation for Economic Co-operation and Development. (2014). *Green Growth Indicators 2014, OECD Green Growth Studies*. OECD Publishing.

Stancu, A. (2015). An Analysis of the Relation Between Wine Consumption and Cultural Models. *Economics of Agriculture*, *62*(1), 207-227. Retrieved from http://www.ea.bg.ac.rs/index.php/home/2-uncategorised/39-archive-2015-1

United Nations. (2000). *Millennium Development Declaration, Resolution No. 55/2*. Retrieved from http://www.un.org/millennium/declaration/ares552e.htm

United Nations. (2015). *The Millennium Development Goals Report*. Retrieved from http://www.un.org/millenniumgoals/reports.shtml

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

United Nations Department of Economic and Social Affairs. (2011). *World Population Prospects: The 2010 Revision*. Retrieved from https://dl.vecnet.org/files/xs55mc11m

United Nations Department of Economic and Social Affairs. (2012). *A guidebook to the Green Economy*. Retrieved from www.uncsd2012.org

United Nations Department of Economic and Social Affairs, United Nations Development Programme, United Nations Conference on Trade and Development. (2012). *The Transition to a Green Economy: Benefits, Challenges and Risks from a Sustainable Development Perspective*. Retrieved from http://www.unep.org/greeneconomy/Portals/88/documents/research_products/UN-DESA,%20UNCTAD%20Transition%20GE.pdf

United Nations Development Programme. (2002). *Millennium Development Goals: Goals and Indicators*. UNDP. Retrieved from http://mdgs.un.org/unsd/mdg/host.aspx?Content=indicators/officiallist.htm

United Nations Economic and Social Council, Economic Commission for Europe (UNECE). (2011). *A green economy in the context of sustainable development and poverty eradication.* Retrieved from http://www.unece.org/fileadmin/DAM/env/documents/2011/ece/e.ece.rpm.2011.4.e.pdf

United Nations Environment Programme. (2009). *Agriculture: A Catalyst for Transitioning to a Green Economy: A UNEP Brief*. Retrieved from www. unep.org/greeneconomy

United Nations Environment Programme. (2011). *Green Economy. Agriculture. Investing in natural capital*. Retrieved from http://www.unep.org/greeneconomy/Portals/88/documents/ger/2.0_Agriculture.pdf

United Nations Environment Programme. (2011). *Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication*. Retrieved from www.unep.org/greeneconomy

United Nations Environment Programme. (2013). *Green Economy and Trade. Agriculture*. Retrieved from http://www.unep.org/greeneconomy/portals/88/getreport/pdf/chapitre%202%20agriculture.pdf

United States Agency for International Development. (1992). *Policy Determination, Definition of food security*. USAID. Retrieved from http://pdf.usaid.gov/pdf_docs/Pnaav468.pdf

Webb, P., & Rogers, B. (2003). *Adressing the "in" in Food Security*. USAID Office of Food for Peace, Occasional Paper no.1. Retrieved from http://www.fantaproject.org/focus-areas/food-security/addressing-in-food-insecurity-ffp-op1

World Food Summit. (1996). *Declaration on World Food Security*. Retrieved from http://www.fao.org/docrep/003/w3613e/w3613e00.htm

World Health Organization. (2015). *Food Security.* Retrieved from http://www.who.int/trade/glossary/story028/en/

ADDITIONAL READING

Constantini, A. M., Cannella, C., & Tomassi, G. (1999). *Fondamenti di Nutrizione Umana*. Roma: Il Pensiero Scientifico.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Federal Ministry of Food and Agriculture (BMEL). (2015), *Global Forum for Food and Agriculture, Summary of Results.* Retrieved from http://www.bmel.de/EN/Agriculture/Global-Food-Situation-FAO/_Texte/GFFA-2015.html

Fidanza, F. (Coord.). (1996). Alimentazione e Nutrizione Umana: Alimente: caratteristiche nutrizionali, analisi, controllo, Napoli: Idelson.

Fidanza, F., & Liguori, G. (1995). *Nutrizione Umana*. Napoli: Idelson.

Food and Agriculture Organization of the United Nations. (2015). *The State of Food and Agriculture 2015*, Rome, FAO. Retrieved from http://www.fao.org/3/a-i4953e.pdf

Lipper, L. (2014). *Stability of food security in a green economy environment*, presentation at FAO/OECD Expert Meeting on Greening the Economy with Agriculture, Paris, 5 – 7 September 2011. Retrieved from http://www.fao.org/fileadmin/user_upload/suistainability/Presentations/Stability.pdf

Naqvi, A. (2011). *Informal seminar for FAO permanent representations*, UNEP - Green Economy Team, Green Economy and Agriculture, Rome, 4 November. Retrieved from http://www.fao.org/fileadmin/user_upload/suistainability/Presentations/Naqvi.pdf

Sirbu, R. M., Draghici, A., Lobont, O. R., & Sirbu, A. (2015). *Debate on the decision making process for green investments in sustainable development context*, MakeLearn & TIIM 2015, Bari, Italy; 05/2015, pp. 1187-1194. Retrieved from http://www.toknowpress.net/ISBN/978-961-6914-13-0/MakeLearn2015.pdf

Zahiu, L. (1999). Funcţia alimentară a agriculturii, in Tribuna Economică, n0. 12/24 Mar.

KEY TERMS AND DEFINITIONS

Carbon Sequestration: Capturing anthropogenic or atmosphere carbon dioxide (CO2) before it is released to the atmosphere.

Food Insecurity: Lack of secure access to sufficient amounts of safe and nutritious food for a normal and healthy life.

Food Intake: An amount of food taken into the body as nourishment.

Greenhouse Gas: Gases whose absorption of solar radiation is responsible for the greenhouse effect.

Undernourishment: A state of inability to acquire enough food resulting in insufficient food intake to meet dietary energy requirements.

This research was previously published in Measuring Sustainable Development and Green Investments in Contemporary Economies edited by Mihai Mieila, pages 163-200, copyright year 2017 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Chapter 80
Green Performance Strategies in Romanian Economy in the View of EU 2020 Strategy

Violeta Sima
Petroleum-Gas University of Ploiesti, Romania

Ileana Georgiana Gheorghe
Petroleum-Gas University of Ploiesti, Romania

ABSTRACT

This chapter aimed to investigate green performance strategies in the Romanian economy. In the first part, authors exposed specific definitions and concepts related to the green economy, as they appear in the literature in the field. The European context and the main ways of implementation of the green economy are presented as they result from the objectives of The Agenda 2020 UE and The Agenda 2030 UNO. Green Performance in Romania during 2010-2014 is assessed by analyzing the environmental protection expenditures, environmental taxes, greenhouse gasses emissions, green jobs roles, and Environmental Performance Index. The sustainable economic growth effects are materializing in a major growth of the ecological productivity, an increased amount of energy derived from renewable sources, emissions reduction, improved air and water quality, widened access to the benefits of civilization - education, water sanitation. Thus, this green growth "can fight" against climate change. Also, green growth provides opportunities for creating new jobs requiring new skills.

INTRODUCTION

Ecological concern began to become apparent in the early 70s. It has gained consistency after summits in Rio (1992) and Johannesburg (2002) and especially after the signing of the Kyoto Protocol, becoming an important element in defining organizational culture. Thus, "Green Revolution, environmental protection, turning in "green", sustainable lifestyles, sustainable development, planet protection and many such manifestations have become a phenomenon increasingly evident in our current life" (Sima & Gheorghe, 2014). Businesses have started to be reshaped on the one hand to meet the legislative pressures on the environment, and on the other hand to take advantage of new trends.

DOI: 10.4018/978-1-5225-7915-1.ch080

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

The transition to the green economy involves implementing social investment policies and addressing concepts like economic development, green marketing, biodiversity, ecosystems preservation, climate change, health and welfare for the medium and long term. Green buildings, green products, eco-friendly companies - all these words have become increasingly used in recent years. People around the world are striving to keep the Earth healthy by driving hybrid cars or electric cars, using solar and wind energy, recycling.

The green economy is a model of economic development or an economy based on sustainable development and knowledge of the green economy. Karl Burkart (2012) defines green economy as being based on six main areas:

1. Renewable energy (solar, wind etc.);
2. Green Buildings (ex. Construction LEED - Leadership in Energy and Environmental Design);
3. Alternative fuels (hybrid electric vehicles etc.);
4. Water management (water treatment systems, rainwater collection, etc.);
5. Waste management (recycling, etc.);
6. Land management.

A 7th category can be identified. This is represented by "green markets", including green banking and financial investment services; carbon trading etc.

BACKGROUND

Specific Definitions and Concepts Related to Green Economy

The concept of "green economy" began to become increasingly more present in the topics for debate of researchers across the world on sustainable development.

Reducing the level of non-renewable resources, climate change and, not least, the recent economic recession constitute challenges for academics, but especially for practitioners in economics. Thus, the tone was given by the UN Conference on the Human Environment (Stockholm, 1972), when The Environmental Programme of the United Nations (UNEP) was created. As a global player, the EU is in the forefront in international efforts to promote sustainable development, the EU applying some of the most advanced environmental standards in the world. Thus a UNEP Report in February 2011 released the following definition: "The green economy is defined as an economy that results in reducing environmental risks and ecological scarcities, and that aims for sustainable development without degrading the environment. It is closely related with ecological economics, but has a more politically applied focus."

The green economy can be a means to achieve sustainable development, representing an adaptation of the socio-economic system to the multiple challenges of the current period.

The transition to a green economy cannot be done instantly, but gradually through the elaboration and implementation of development policies and investments having as main goal to disconnect economic growth from increased consumption of raw materials and energy. Also, performances following the implementation of this model have proved that green economy was a good response to the global crisis of recent years, especially in managing social and environmental issues.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

According to Andersen and Massa (2000) the economic growth and a sustainable use of resources do not exclude each other. Green economy implies the adoption of specific environmental policies. This should lead to structural changes of the production and consumption patterns for the long term.

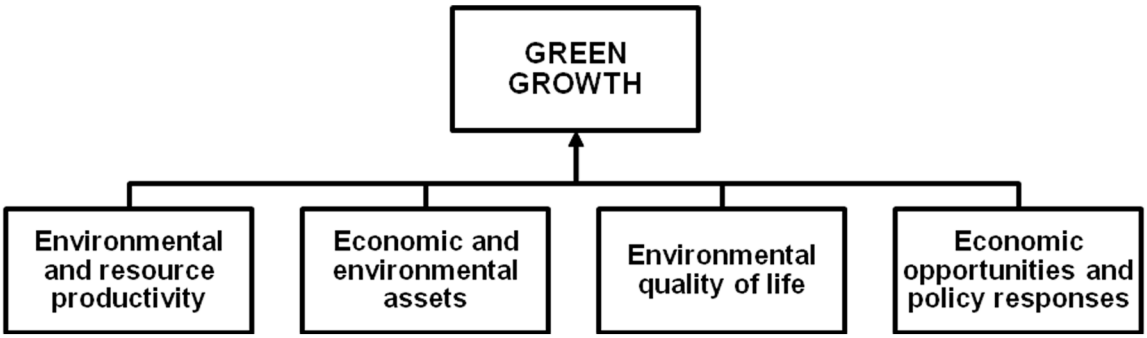
Specific concepts have been defined in the literature. According to Loiseau et al. (2015), seven main concepts are associated with green economy. They are: Bioeconomy or Biobased economy, Cleaner Production, Waste hierarchy approach, Nature-based solutions, Industrial ecology, Circular economy, and Servicising, functional economy.

1. Bioeconomy or biobased economy was defined as the economy involving the development and use of biological products and processes. In Europe, this concept takes into account in especially the use of renewable resources, innovation, sustainable growth and creation of added value (OECD, 2009; Brunori, 2013; EC 2012).
2. Cleaner production is a concept introduced by The United Nations Environment Programme in 1990, as "the continuous application of an integrated preventative environmental strategy to processes, products and services to increase efficiency and reduce risks to humans and the environment."
3. Waste hierarchy approach. The Directive 2008/98/EC set out a priority order five stages in waste prevention and management legislation and policy, as follows: prevention, preparing for re-use, recycling, recovery and finally disposal.
4. Nature-based solutions (NBS) refer to the sustainable management of the natural environment to address current challenges in order to ensure public health and risk management in case of disaster (EC, 2015, p. 5).
5. Industrial ecology has been defined by Brad (2006) as a "systems-based, multidisciplinary discourse that seeks to understand emergent behaviour of complex integrated human/natural systems". This concept assumes that sustainable industrial systems design should be based on the analogy with natural systems (Frosch & Gallopoulos, 1989).
6. Circular economy represents a restorative or regenerative system by intention and design, aiming to design out waste. It replaces the end-of-life concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse and return to the biosphere, and aims for the elimination of waste through the superior design of materials, products, systems and business models.
7. Servicising, functional economy was defined as one that optimizes the use of goods and services, aiming to create the highest possible use value for the longest possible time while consuming as few material resources and energy as possible (to create the highest possible use value for the longest possible time while consuming as few material resources and energy as possible (to create the highest possible use value for the longest possible time while consuming as few material Stahel, 1986).

In 2011 OECD has formulated a comprehensive definition for Green Growth, stating that: "Green growth is about fostering economic growth and development while ensuring that the natural assets continue to provide the resources and environmental services on which our well-being relies. To do this it must catalyse investment and innovation which will underpin sustained growth and give rise to new economic opportunities." According this definition, four main areas have been identified as representing landmarks in achieving green growth (Figure 1). These areas can be assessed by specific indicators.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 1. The main determinants of Green Growth
Source: Based on OECD approach



European Context

All human activities may cause in some way environmental degradation. Ecosystems provide resources and services for human socio-economic system. Their use must be made within the limits of the supporting and self-regulating capacity of the ecosystems, their overcoming generating environmental degradation.

The Europe 2020 Strategy emphasizes increased competitiveness generated by a development model characterized by low emissions of greenhouse gases, effectively used resources and new technologies for environmentally friendly production and biodiversity.

The Europe 2020 emphasizes the opportunities and the role which SMEs can play in shaping a sustainable European economy.

Those companies that will be able to have an innovative and proactive management are those that will gain the winning positions at the 2020 horizon. The challenges are related to globalization, demographic change, natural resource depletion, climate change and acceleration of the use of new technologies. To maximize business contribution to the Europe 2020 targets and to strengthen its competitive advantages, the most important European network of social responsibility (CSR Europe) launched the Enterprise Strategy 2020 dedicated to business environment.

Green Economy is about using of natural resources, energy and new technologies together with new cleaner production methods, in order to promote economic growth and create new jobs. In this respect we need to communicate about sustainability of the enterprises, in order to respond to consumer demands for greener products and for more information about these products.

According classical economic approach, the entrepreneurship' role in society is to create new jobs and to pay more taxes, which leads to the emergence of new incomes, determining economic and social development and finally, increasing the welfare of the human society.

At the next level the entrepreneurs should have in sight social aspects by including of the social responsibility practices into their businesses.

The issue of Green Performance Strategies have become a topic of general concern for researchers worldwide. In implementing the performance management process the social and the environmental components hold important roles. Sustainable development and the fulfilment of the sustainable development indicators are dependent on how the refurbishment is designed, this substantiating the eco-performance. Thus, the eco-performance can be considered a multifaceted concept.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Ways of Implementation of Green Economy

Green economy, as it was cited above, is resulting in an increased level of "well-being and social equity, while significantly reducing environmental risks and ecological scarcity" (UNEP, Green Economy Reports: A Preview, 2010, p. 4-5). In order to achieve the specific objectives of the green economy specific policies and investments are required, able to decouple economic growth from increasing of current intensive consumption of raw materials and energy. In short, a green economy can be characterized by some main features as the Figure 2 shows.

The role of government occurs in both the public and in the private sector. Thus, in both cases, specific legislative regulations can constitute very effective tools, aiming to stimulate commercialization organic products with low environmental impact. Specifically, this can be achieved, as Gheorghe and Sima stated (2014), by "eliminating outdated subsidies, reforming policies and providing new incentives, strengthening market infrastructure and market-based mechanisms, redirecting public investment, and greening public procurement".

As shown in Table 1, the Agenda 2020 and The Agenda 2030 aim at common goals, so that certain correlations can be highlighted between specific objectives undertaken in the two documents (Figure 3). Raising the employment rate leads obviously to an increase of human welfare. All countries must cooperate to ensure labor mobility, which should contribute to a decrease of the disparities between countries in terms of employment. Investment in research and development is an important element.

Figure 2. The main features of Green Economy
Source: Based on UNEP approach

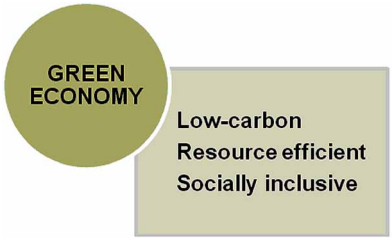


Table 1. Ways for the implementation of the green economy

Ways of Implementation	Objectives of The Agenda 2020 UE	Objectives of The Agenda 2030 UNO
Green jobs Green politics	1. Employment	1. People
Green jobs Green politics Green energy Green transport	2. Research and Development	2. Planet
Green jobs Green politics Green energy	3. Climate changes and sustainable energy use	3. Prosperity
Green jobs	4. Education	4. Peace
Green politics	5. The fight against poverty and social exclusion	5. Partnership

Source: Authors' own analysis based on literature survey

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 3. Correlations between objectives of the agenda 2020 UE and objectives of the 2030 UNO
Source: Proposed by the Authors



This area was affected in the period of economic crisis. Allocate a significant percentage of GDP is needed for this purpose. This is smart growth through the development of an economy based on knowledge and innovation which is able to ensure the protection of the planet, ensuring the prosperity of its people, which can be achieved only in peace. Achieving the objective of "20/20/20" in terms of energy and climate change is also important. This leads to sustainable growth by promoting globally, a green economy that is efficient and competitive. Education plays an important role in decreasing early school leaving among young people, helping to increase social welfare. Globally consistent policies are needed. These can lead to the implementation of social programs in this regard. Promoting an economy with high employment of labor is necessary in order to reduce social exclusion.

According to the latest documents adopted by the EU (Agenda 2020) and UN (Agenda 2030), the green economy aims to increase social welfare and the role of human capital by reducing environmental risks and ecological issues in order to achieve sustainable development. A highly ambitious UN goal is the eradication of poverty. The green economy, according to United Nations experts, providing an environment with fewer adverse environmental effects and substantial benefits on society and each person can contribute to achieving this objective. A new opportunity is represented by redesigning through greening of the national strategies, in terms of creating new green jobs, as a result of the expansion of green industries, which demand specific skills and competencies (Figure 4).

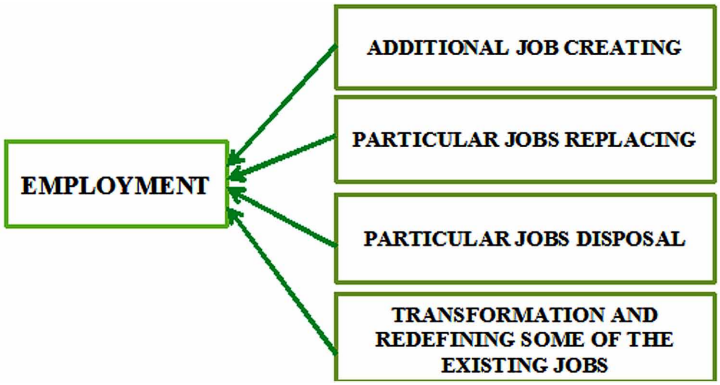
EU 2020 STRATEGY IMPLEMENTATION IN ROMANIA

Context

An extreme dynamics represents the essential feature of the current socio-economic environment. In this context, in 2010 the "Europe 2020" was launched, which represents the EU's growth strategy for the period 2010-2020. This strategy emerged in the context of a deep economic crisis and intensifica-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 4. Effects on employment of the orientation towards sustainable economic
Source: Sima and Gheorghe, 2014, p.117



tion of long-term challenges such as globalization, pressures on resources use and an aging population. The strategy "Europe 2020" has taken into account the peculiarities of each Member State, at the same time aiming a consistent reform program which had as a general goal to increase the competitiveness of Europe, based on the strengths of the EU - single market, common currency, and common policies. Through this strategy, the EU aimed to become a smart, sustainable and inclusive economy. These three stated priorities are converging, supporting each other and being able to "help the EU and the Member States deliver high levels of employment, productivity and social cohesion" (José Manuel Durão Barroso, former Chairman European Commission). These priorities are:

- **Smart Growth:** Developing an economy based on knowledge and innovation.
- **Sustainable Growth:** Promoting a more resource efficient, greener and more competitive economy.
- **Inclusive Growth:** Fostering a high-employment economy delivering social and territorial cohesion (COMMUNICATION FROM THE COMMISSION EUROPE 2020, A strategy for smart, sustainable and inclusive growth, p.5).

The Headline Targets of "Europe 2020"

This strategy has targeted five areas considered as the biggest challenges for the contemporary world:

1. **Employment:** Ensuring an employment rate of 75% for people aged 20 to 64 years;
2. **The Role of Research and Development:** An increase of the investment in R&D to 3% of the EU GDP;
3. **Climate Change:**
   a. Limiting the emissions of greenhouse gas by at least 20% compared to 1990;
   b. Providing of 20% of the demanded energy by using renewable resources;
   c. Improving the energy efficiency by 20%;
4. **Education:**
   a. Reducing early school leaving to below 10%;

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

   b. An increased share of population with higher education, for people with ages between 30 and 34 years;
5. **Fight Against Poverty and Social Exclusion:** Reducing the number of Europeans suffering or being at risk to suffer from poverty and social exclusion with 25% (reducing the number of people at risk of poverty by 20 million).

In developing the Europe 2020 objectives, the EU Commission took into account the heterogeneity of its members so that objectives were relevant to all 27 states, as were in 2010 and 28 today. For this purpose a flexible approach has been chosen, the European objectives being translated into national targets, reflecting the peculiarities of each country.

In March 2010, Romania established the National 2020 targets, under the coordination of the Department for European Affairs of the Romanian Government, based on the conclusions of the European Council. The main fields of action targeted by Romania are:

1. **An Increase in the Employment:** In order to achieve this, a reform of the legal framework is required to encourage employment and continuous training of the labor force considered being relevant instruments in this field. Romania has assumed only an increase of up to 70%, given that, in 2008, the employment rate was 64.4%.
2. **The Allocation of 2% of GDP for Research and Development:** This is a target difficult to attain in Romania because the current structures of research and development in our country show a very low intensity of the field. The share of expenditures for research and development in Romania's GDP in 2008 was 0.45%, but the economic crisis has reduced it to 0.30% in 2009 and 2010, which has caused significant damage to ongoing research projects.
3. **A Reducing of the Greenhouse Gasses (GHG) Emissions:** In this field, Romania has assumed, realistically, only a decrease of 19% compared to 2005, due to the current possibilities compared with the value stipulated by the European standards (30%).
4. **An Increase by 24% in the Share of Renewable Energy in Final Consumption**: For Romania, the target means 6.2% more than in 2005 (when the share of this category in final energy consumption was 17.8%).
5. **An Increase of the Energy Efficiency by 10%:** Romania's objective in this area aimed at reducing the primary energy consumption, this sector having a great potential for saving.
6. **A Reducing of the Early School Leaving**: In this field, Romania has assumed a decrease of 11.3%. Some progress has been made, in part due to the implementation of social programs (reducing the school leaving rate from 22.9% in 2000 to 15.9% in 2008, but the indicator rose again in 2009 to 16.6%, due to the economic crisis).
7. **An Increase in the Share of Population under 30 Years Old Having Completed Tertiary Education to 26.7%:** For this purpose, reforms are needed, not only in education but also in the economy designed to support education expenditure.
8. **Increasing the Social Inclusion**: This objective envisages primarily the ensuring of the social and territorial cohesion. Romania has assumed to reduce the number of people at risk of poverty by 580 000 persons. For this purpose, Romania is expected to increase funds for social assistance and to continue the healthcare reform.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Stage of Implementation of the Europe 2020 Strategy in Romania

Regarding the employment rate, as it has been shown above, for people aged 20-64 years, the proposed EU target is 70%. In 2015 Romania reached 70.8%, higher than in 2014 when the employment rate was 70.4% (Figure 5). This trend confirms that Romania has made progress in this area, the assumed goal being practically achieved. This was due to the fact that the National Plan on Stimulating Youth Employment was implemented. An ongoing project is important to mention, namely, related to the Development of Local Economies and New Jobs Creation.

This project has the following objectives:

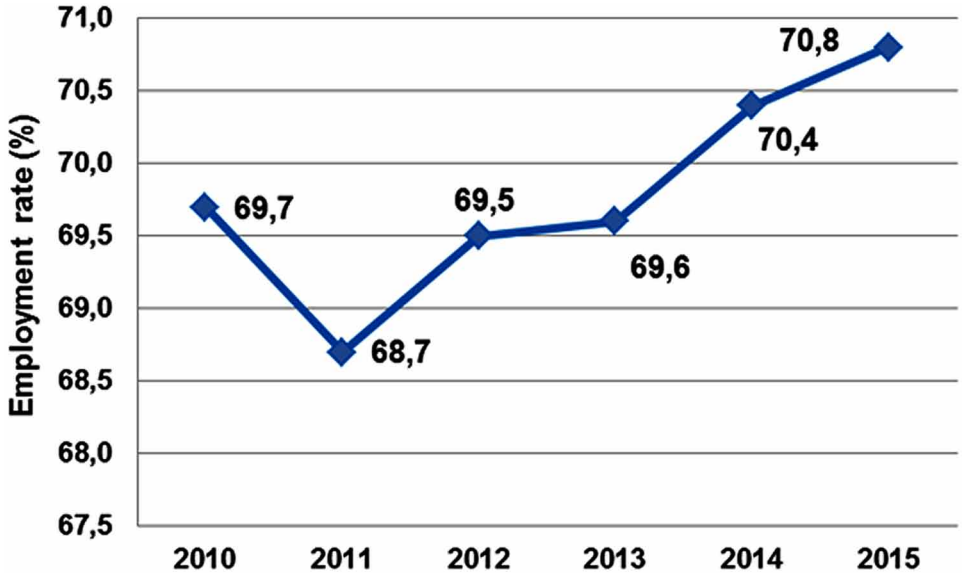
- To decrease undeclared work (undeclared);
- To decrease youth unemployment and increasing employment.

To achieve these objectives, three directions are envisaged:

- A continuous training of young people, especially those in rural areas;
- The development of micro-enterprises, both in the non-agricultural sector, but especially in agriculture;
- The integration of people who left school early by recognizing their skills.

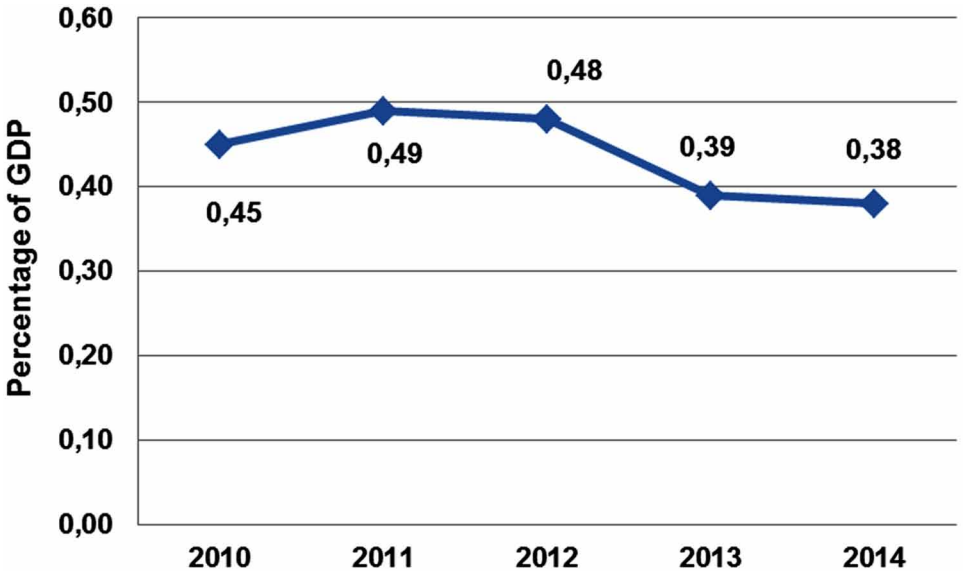
Regarding Total intramural R & D Expenditure - the target assumed by Romania was to reach 2% of GDP. In this area, Romania registered a growth of 0.39% in 2013 and 0.38% in 2014. There is a downward trend in values (Figure 6), even if over 750 projects were with Romanian and international participation were supported in this domain. The public sector was the one where cuts in expenditure were higher

Figure 5. Employment rate, 2010-2015
Source: Data provided by EUROSTAT (t2020_10)



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 6. Total intramural R&D expenditure, 2010-2014
Source: Data provided by EUROSTAT (rd_e_gerdtot)



Thus, to achieve the objective, Romania will have to increase R & D Expenditure on average by 31.7% per year between 2015 and 2020.

To increase on average by 31.7% per year between 2015 and 2020 in the future two main issues are taken into account:

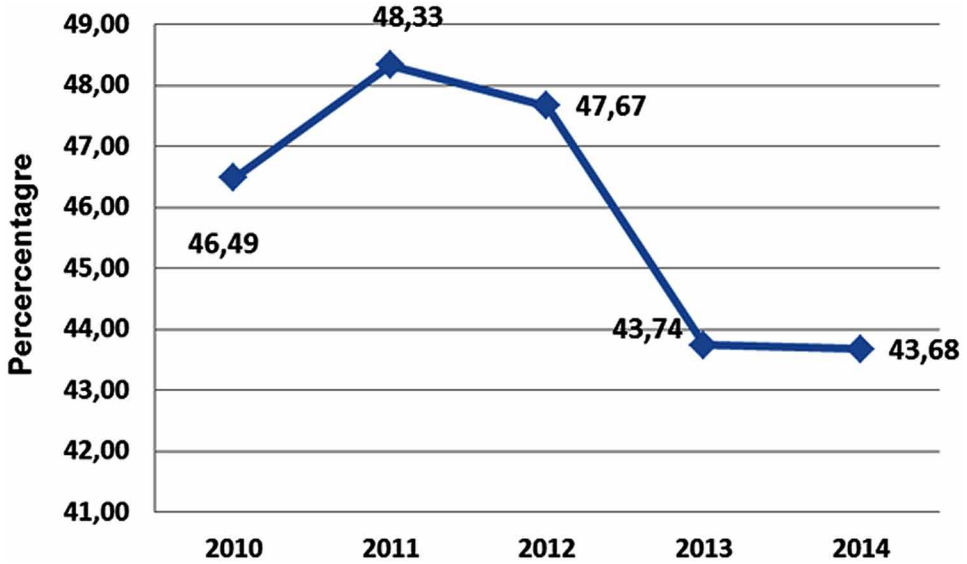
- To develop the relationship between theory (research) and practice (businesses) by promoting R & D activities in economic sectors with growth potential and public importance;
- To upgrade the national R & D investments to increase efficiency in administration.

Regarding Greenhouse gas emissions reduction the target assumed by Romania is 19%. Figure 7 shows the evolution of Greenhouse Gas Emissions. Thus, after 2005, the highest value of Greenhouse Gas Emissions was recorded in 2011 (48.33%), followed by a continuous decrease. The lowest value was being recorded in 2014 (43.68%). The contraction of the national economy has essentially contributed to this decline, due to the economic crisis. On fields, the causes of this trend are:

- **In the Energy Sector:** The following issues are to be mentioned: increasing the share of energy from alternative sources, upgrading of major combustion plants and stimulate energy production from clean sources - Program for increasing energy production from renewable sources, Program "Green House."
- **In the Transport Sector:** A determinant factor was the stimulation of the national car park renewal and monitoring of the road transport vehicles clean and efficient energy - Program Rabla.
- **The Increase of the Afforested Areas:** Program for improvement of the environment quality through afforestation of degraded lands, ecological restoration and sustainable management of forests.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 7. Greenhouse gas emissions, base year 1990, 2010-2014
Source: Data provided by EUROSTAT (t2020_30)



- **Expansion of Green Areas in Towns:** National Programme for improvement of the environment quality by creating green spaces in cities.

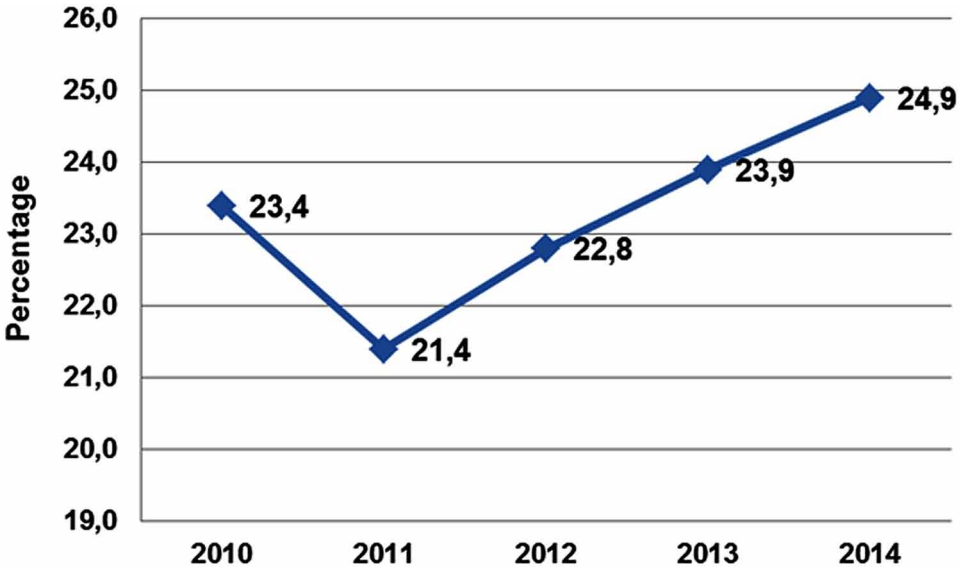
Some national programs are to be mentioned here, namely: Green House, Rabla, accreditation of The International Airport Henri Coanda Bucharest according to the standard of certification of the CO2 emissions management.

Regarding Share of renewable energy in gross final energy consumption (Figure 8), the target assumed by Romania is to cover 24% from the necessary of energy using renewable resources. A share of 23.9% was reached in 2013 and in 2014 one of 24.9%. Thus, we can affirm that Romania has already exceeded the target for 2020, although, from a legislative point of view, there still may be emphasized certain vulnerabilities. The economic crisis had a major contribution also in this domain but the implementation of some energy efficiency measures is also to be mentioned. The most important are:

- SRE promotion by means of green certificates;
- Modernization and achievement of new capacities of producing electric and thermic energy;
- SRE promotion by means of Medium Fund, the program regarding the installing of the heating systems which use renewable energy, inclusively the replacement and the completion of standard heating systems (Green House);
- Elaboration of some equivalent certification systems or qualification systems for the electricians working in the SRE domain, introducing 4 new qualifications in the Romanian Professions' Classification (fitter for heating pumps, geothermal systems, PV solar systems and for thermic solar systems) and the elaboration of 2 new occupational standards (fitter for systems of thermic use of SRE and fitter for PV systems);

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 8. Share of renewable energy in gross final energy consumption, 2010-2014
Source: Data provided by EUROSTAT (t2020_31)



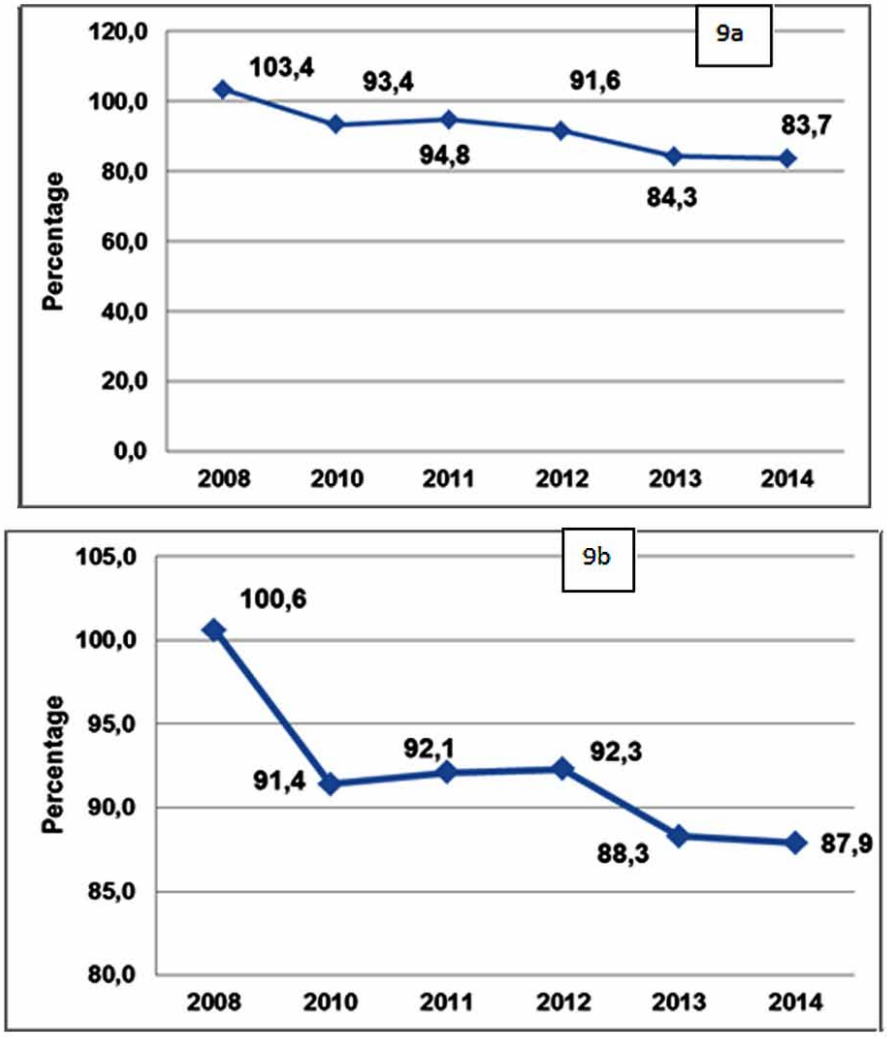
- Modification of the support scheme regarding the promotion of the energy resulting from renewable energy in order to avoid overcompensation;
- Supporting the measures aiming at the modernization and rehabilitation of the transport and distribution network in order to obtain a better take over in the network of the energy produced from renewable energy sources.

Regarding Primary energy consumption, Romania target for energy effectiveness in 2020 is of 43 Mtep, expressed in primary energy consumption (30.3 Mtep expressed in the final energy consumption). In Romania, after 2008, there may be noticed a constant lowering of the primary energy consumption (Figure 9a). This lowering was the result of some measures:

- The implementation of the state support scheme for the promotion of the high efficiency cogeneration;
- Popularizing campaign to inform the population and business medium regarding the importance of the increasing of the energy efficiency; there were organized eight seminaries in six towns, with a total of above 370 participants;
- The Program "Heating, Heat and Comfort";
- The modernization and realizing of some units and new equipment in the industry plants;
- Thermic of the buildings;
- The improvement of the energy efficiency in the communities with low income from Romania;
- Promotion of some projects regarding the intelligent counting at the level of the electric energy distribution systems.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 9. (a) Primary energy consumption, base year 2005, 2010-2014; (b) Final energy consumption, base year 2005, 2010-2014
Source: Data provided by EUROSTAT (t2020_33)

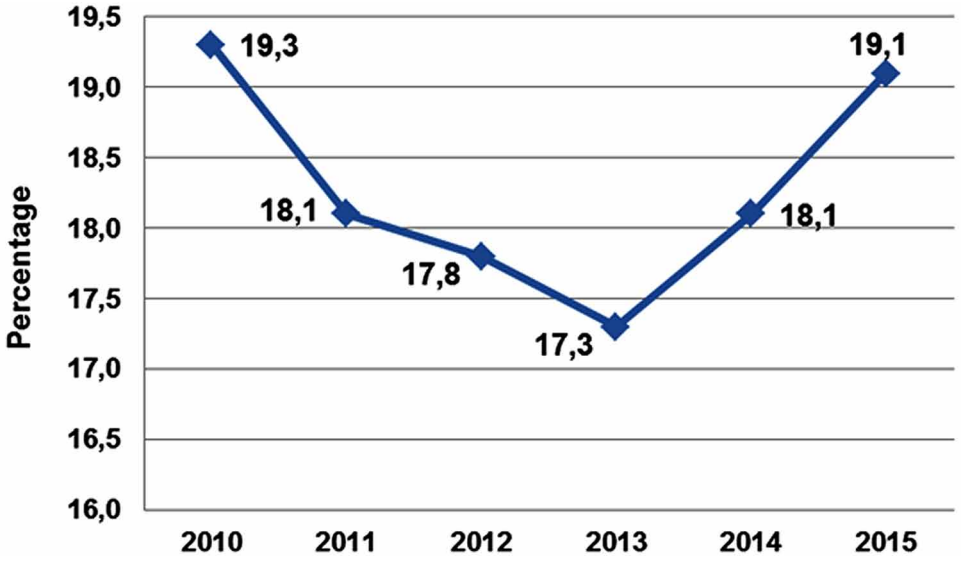


As concerns Final energy consumption there is to be noticed approximately the same evolution (Figure 9b). The highest level was registered in 2008 (100.6%), and the lowest in 2014 (87.9%).

As concerns Early leavers from education and training status, after a relatively linear decrease during the period 2010-2013, starting with 2014, an increase tendency may be ascertained (Figure 10). Therefore early leaving school rate, increased at a level of 18.1% in 2014 and, respectively, at 19.1% in 2015, in spite of the measures approved by the government (the implementing of the social programmes in order to support the pupils from the disadvantaged regions – School Supplies, Money for High School, Euro 200, and Roll and Milk, Honey and fruits, Refunding of the Transport Money and School Buses, implementing of some programmes, stipulated in the National Education Law for the support of the coming back to school and the increasing of the liquidation of illiteracy level for population.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 10. Early leavers from education and training status, 2010-2015
Source: Data provided by EUROSTAT [edat_lfse_14]



The second chance, School after school, the liquidation of illiteracy programmes, assurance of the educational process quality within the secondary school education, the development of the vocational education, high school education (technological type) and college education. This evolution situates Romania among the countries with the highest rates of early school leaving in EU, Romania being moved away from its target. It also has to be mentioned the fact that there are gender and residence discrepancies (a higher rate among boys and in the rural area compared to girls and urban area).

Regarding Population by tertiary education (levels 5-8) attainment, Romania registered progress and an increasing tendency of this index may be noticed (Figure 11), the value of this index substantially improved, reaching the quota of 25.6% in 2015. Therefore, Romania is on its way to reach the assumed target.

The measures which contributed to this evolution:

- Adapting the academic education to the labour market demands by means of elaborating an analysis of the indexes reported by the universities and the implementing of specific projects;
- The Management of the correlation of the educational system with the labour market and public policies inserted in the academic education: a necessary premise for Romania development;
- Implementing of the social programmes for the students;
- The development of the national systems of qualifications for the academic education in Romania by means of the operationalization of the National Academic Education Qualifications Register (RNCIS) and adopting The National Qualifications Framework.

Concerning Reduction of the number of people at risk of poverty or social exclusion, in Figure 12, it may be noticed that the target has already been surpassed. This important progress was possible due to:

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 11. Population by tertiary education (levels 5-8) attainment, 2010-2015
Source: Data provided by EUROSTAT [edat_lfse_03]

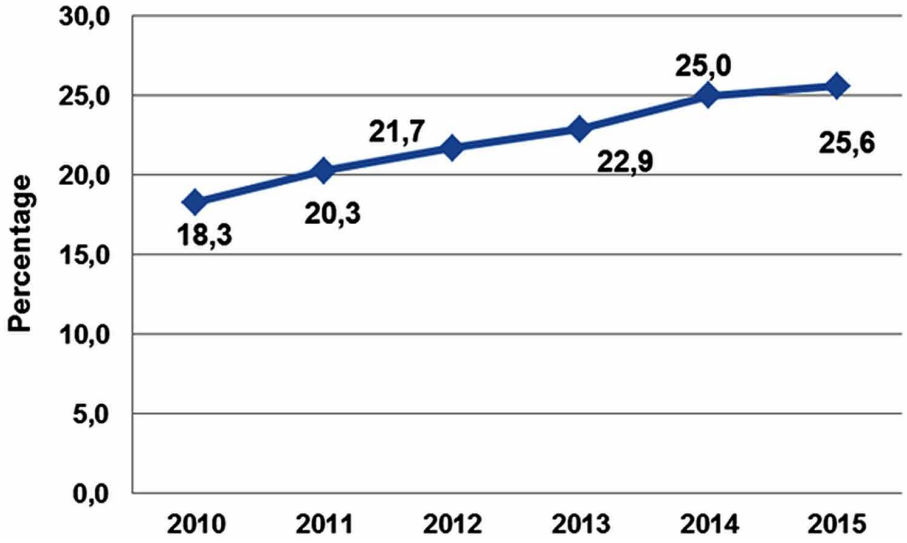
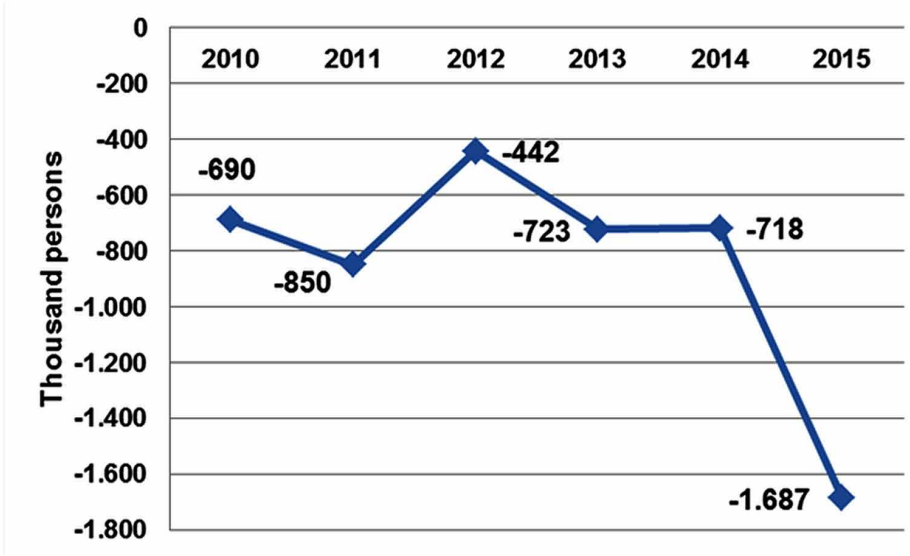


Figure 12. Reduction of the number of people at risk of poverty or social exclusion, 2010-2015
Source: Data provided by EUROSTAT [ilc_peps01]



- The support of the poorest families with children;
- **The Assurance of the Social Protection and of the Most Vulnerable Population Categories:** Granting of an allowance for the support of the family, insurance of a minimum guaranteed income;
- **Social Protection Measures for the Vulnerable Consumers and for the Diminishing of the Energy Poverty Risks**: Support for the heating with natural gases and for the heating with electric energy;

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- **Increasing of the Children Social Services Quality**: Improvement of the care services, closing of the old institutions and founding recovery centers and houses of family type;
- **Facilitating the Access and Participation of the Individuals Taking Part in Vulnerable Groups on the Labour Market**: Implementing some qualification/re-qualification;
- The development of the social substructure and education substructure;
- **The Improvement of the Access for the Vulnerable Persons to Health Services**: Implementing health national programmes (Screening Programme for the early active identification of the col cancer), the assurance of the access to the medicaments ambulatory provided to the pensioners with low income;
- **Economic Efficiency of the Health System**: Computerization of the health system by implementing the National Health Framework and of the programme the Electronic Card of the patient.

GREEN PERFORMANCE IN ROMANIA

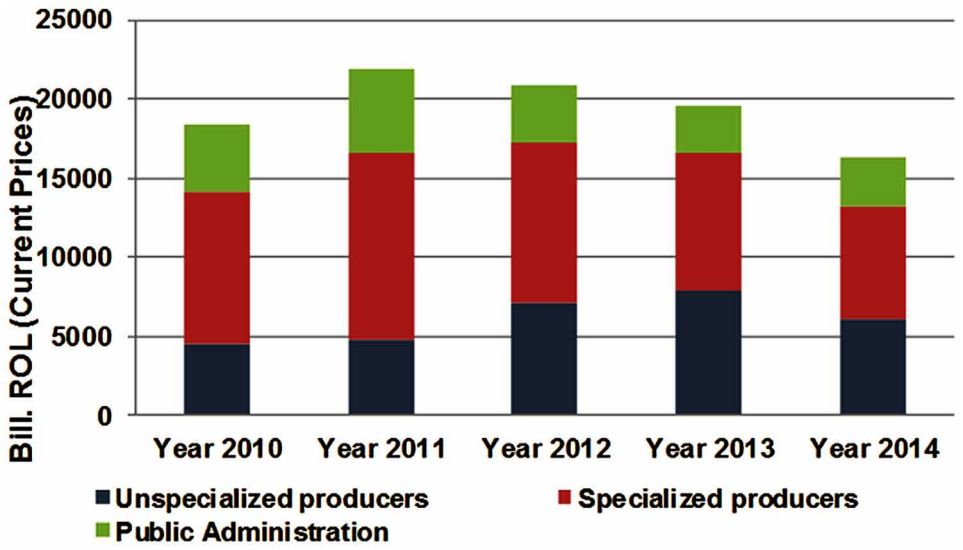
Environmental Protection Expenditures Evolution During 2010-2014

As concerns the expenses for the medium protection in Romania, it may be noticed that, taking into account the activity sectors, the specialized producers own the highest quota which records, generally, over 50% of the total environmental expenditures (Figure 13).

This category is followed by the category of the specialized producers in public administration. It has to be mentioned that, starting from 2012, the percentage represented by the public sector was drastically reduced.

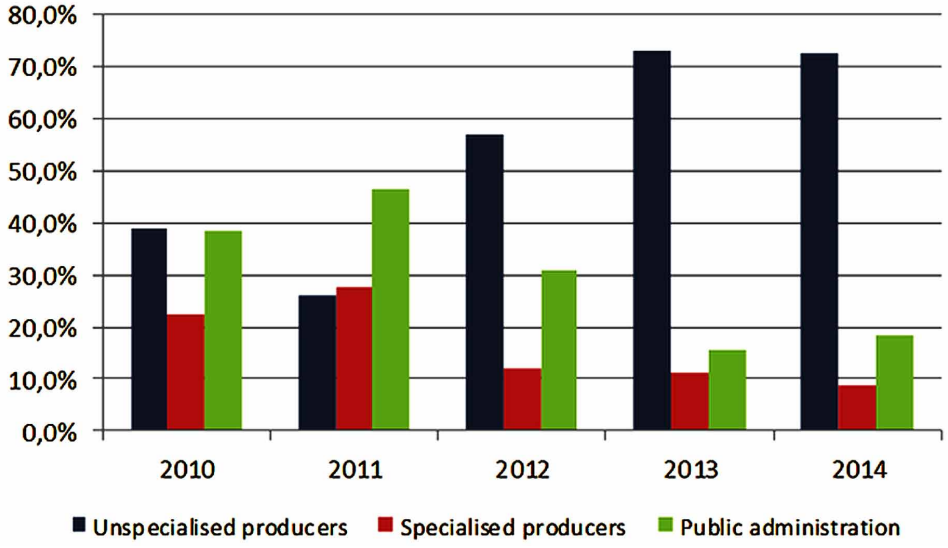
From the total of these expenses, the amounts assigned to the investments have a different evolution (Figure 14). In this respect, the nonspecialized producers are the one who assign the highest percent-

Figure 13. Environmental protection expenditures, by activities, 2010-2014
Source: Data provided by National Institute of Statistics (TEMPO_PMI105A_16_9_2016)



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 14. Environmental protection expenditures for investment, by activity sector, 2010-2014
Source: Data provided by National Institute of Statistics



age for investments in medium protection, excepting 2011. Starting with 2012 the figures have become increasingly higher, showing an increased concern for the environment. As for manufacturing, in the 2010-2013, it represented about a half of environment protection expenditure of unspecialized producers.

After 2013 their share decreased, to 25.3% in 2014. Specialized producers assigned for the investments the highest quota in 2011 (25.9%). Starting with 2012 their assignments for the investments continually decreased reaching 8.8%, in 2014. The public sector manifested similar trends.

By environment field, the highest share of expenditure was recorded for waste management, more than 50%. It was followed by water protection expenditure (Figure 15).

Environmental Taxes Evolution in Romania and Efficiency of Revenue Generated by Them During 2010-2014

Romania has an inefficient economy from the energy point of view. Energy has among the lowest cashing obtained from environmental taxes as PIB percentage both at general and activity sectors levels (energy taxes, transport taxes and environmental and pollution taxes). The Table 2 shows the evolution of the energy taxes in Romania compared to EU. A first observation is that the level is under 2.5% from PIB, being under the European media. In 2011 (the year when in Romania manifested the strongest economic crisis in all activity domains) registered the lowest value for the analyzed period, namely 1.69% from PIB, and in 2014, the highest value, namely 2.16% from PIB. In the case of the transport taxes and environmental and pollution taxes the value is under 1% from PIB.

This situation may be explained by the intention of the state to maintain the taxes and excise duties at minimum duties. Moreover, in the case of the pollution and use of the resources taxes, the collecting capacity for the majority of taxes is diminished in comparison to the charging potential basis. This thing is even more serious as the pollution and use of the resources taxes are, in fact collected in order to finance projects meant to diminish the negative effects of the human activities against the environment.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 15. Environmental protection expenditures, by environmental domains, 2010-2014
Source: Data provided by National Institute of Statistics (TEMPO_PMI105B_16_9_2016)

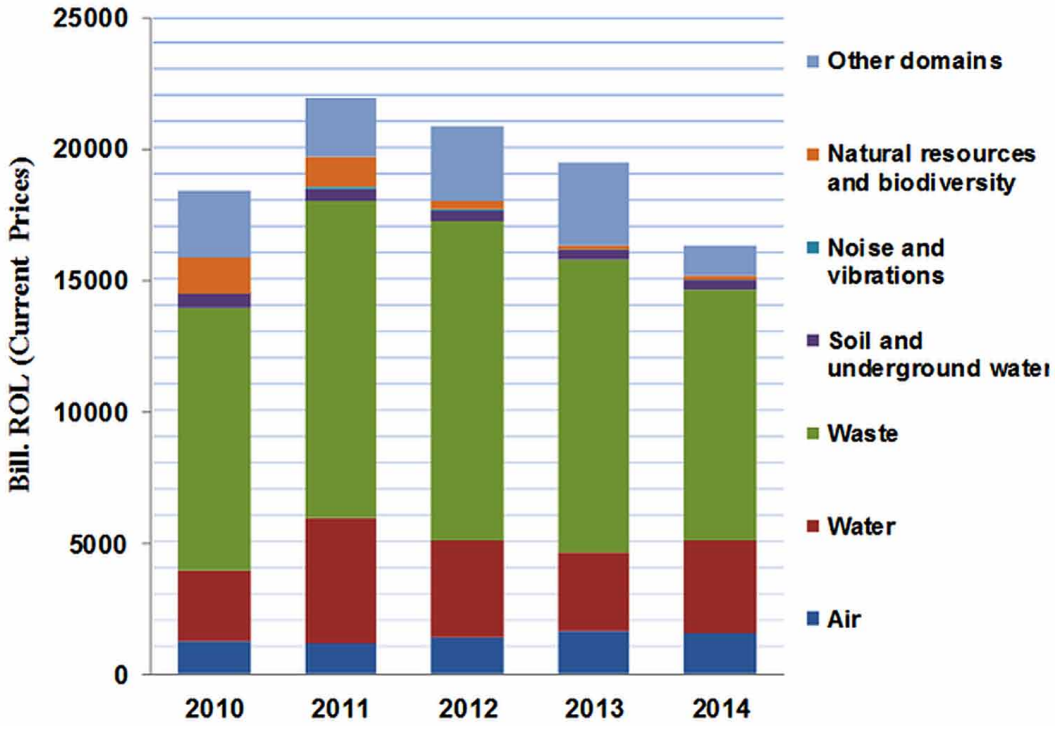


Table 2. Environmental taxes by economic activities, 2010-2014 (% of GDP)

Year	2010		2011		2012		2013		2014	
	Mil. €	(% of GDP)	Mil. €	(% of GDP)	Mil. €	(% of GDP)	Mil. €	(% of GDP)	Mil. €	(% of GDP)
Energy taxes	2235.53	1.76	2247.69	1.69	2272.76	1.7	2545.73	1.76	3237.75	2.16
Transport taxes	400.03	0.01	314.19	0.00	351.58	0.01	397.67	0.00	393.52	0.00
Pollution taxes	7.72	0.32	6.37	0.24	8.77	0.26	6.11	0.28	5.24	0.26
Resource taxes	7.53	0.01	5.28	0.00	4.33	0.00	5.00	0.00	4.23	0.00

Source: Processed by authors using data provided by EUROSTAT [env_ac_tax]

The competitive advantage offered by a low level of the charging is not exploited in Romania at all. As a matter of fact European Union recommends a change of the accent from the work charging (where Romania emphasizes a high fiscality level) to the charging of the consumption and pollution.

Within this context it may be noticed that the evolution of the taxes and contributions in Romania has an increasing tendencies and the registered values are over the European mean of 6%. It may be also emphasized the year 2011 with minimum values. As concerns the Energy taxes, it registered an increasing tendency during the studied period, reaching in 2014, at the level of 7.79%, which surpasses the European mean (Table 3).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Figure 16. Total environmental taxes, 2010-2014
Source: Data provided by EUROSTAT [env_ac_tax]

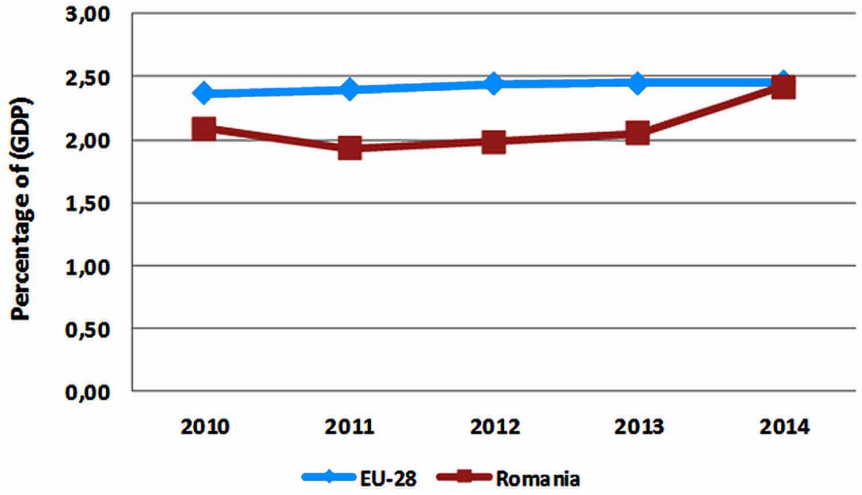


Figure 17. Environmental taxes revenues (% of Total Revenues), 2010-2014
Source: Data provided by EUROSTAT [env_ac_tax]

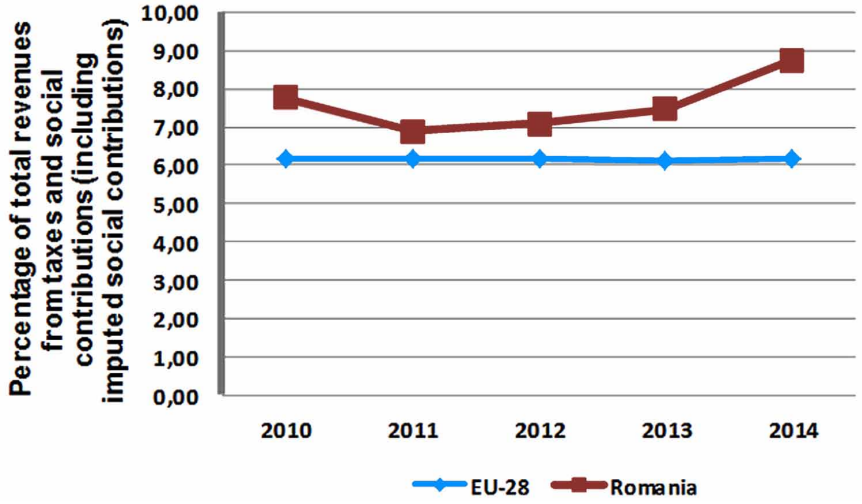


Table 3. Percentage of total revenues from taxes and social contributions (including imputed social contributions), 2010-2014

Year	2010	2011	2012	2013	2014
Energy taxes	6,56	6,01	6,1	6,44	7,79
Transport taxes	1,17	0,84	0,94	1,01	0,95
Pollution taxes	0,02	0,02	0,02	0,02	0,01
Resource taxes	0,02	0,01	0,01	0,01	0,01

Source: Processed by authors using data provided by EUROSTAT [env_ac_tax]

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Evolutions of Greenhouse Gas Emissions

According to The European Environment Agency (EEA), the five main emission source sectors of greenhouse gasses include:

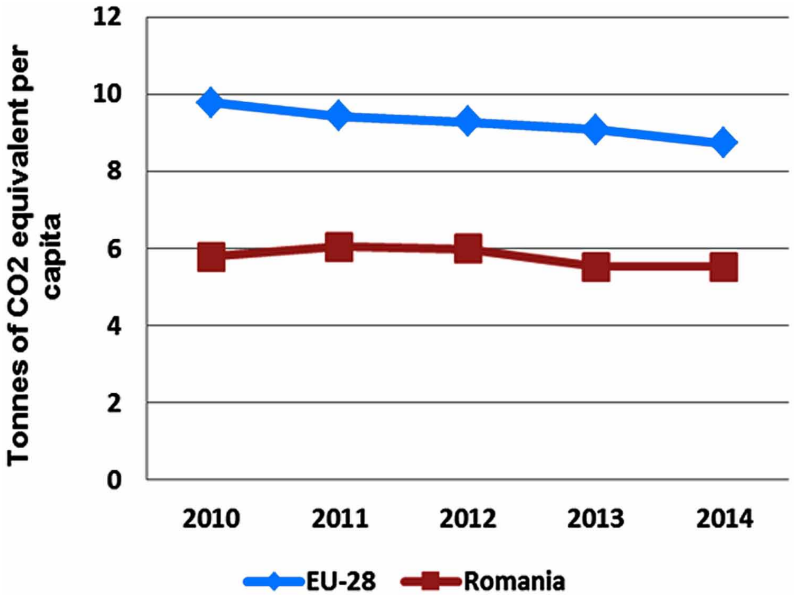
- Energy (fuel combustion and fugitive emissions from fuels), which also includes transport;
- Industrial processes and product use;
- Agriculture;
- Land use, land use change and forestry (LULUCF);
- Waste management.

According to European Environment Agency (EEA), emissions of greenhouse gas in Europe declined by 19% from 1990 to the present, despite a 45% increase in economic output. European Environment Agency (EEA) published a report in 2014 that evaluated the greenhouse gas emissions in the European Union from 1990 to 2012. It showed that the commitments of the EU countries to reduce the amount of greenhouse gas emissions in 2020 was close to being met (Figure 18). It is expected that, by the deadline, they can be overcome. Romania has reduced its emissions of greenhouse gasses, especially after 2012.

The main reasons that led to these changes are:

- Decrease of CO2 emissions in road transport;
- The economic crisis and the economy contraction. Emissions have decreased primarily in countries most affected by the economic recession: Italy, Spain, and Greece;

Figure 18. Greenhouse gas emissions per capita, 2010-2014
Source: Data provided by EUROSTAT (t2020_rd300)



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- The drop in CO2 in manufacturing and cement production. The drop was 11 million tons, representing 3% compared to 1990. The countries with the biggest reductions were Italy, Germany, Britain, Spain, and Portugal;
- The reduction in the production of solid fuel.

But there were sectors where the amount of GHG emission increased. The most important are related to electricity consumption in public space and heating plants, which led to an increase of 3%. The highest increases were in Germany, Great Britain, and Spain. Another significant increase was recorded in consumption in households and services, bringing a plus 4%. Experts claim that winters are becoming colder so that the increasing demand for heating could represent an explanation of these changes.

"In Europe, supply and use of energy is the most important source of GHGs emissions (80%). Agriculture has a sectorial share around 9%. So, impact of agriculture on climate change is modest" (Matei, Stancu & Vuković, 2009).

In Romania, more than 13% of the greenhouse gas emissions come from the transport sector, and 96% of them are caused by road transport. According to Greenpeace (2014), 18% of greenhouse gas emissions in Romania come effect of coal power plants.

As a result of the economic downturn after 1989, in Romania, a significant reduction in GHG emissions was recorded. Total emissions of CO2 equivalent (without LULUCF) for Romania accounted for 2.61% of total EU emissions. Table 4 shows the sectoral contributions to GHG emissions in 2014. Table 3 shows the sectoral contributions to GHG emissions in 2014. Thus, in 2014, the energy sector contributed about 83% of GHG emissions representing a priority for reduction. The transport sector has grown rapidly - by over 35% compared to 1990. This trend is likely to continue, indicating that this sector, especially road transport, deserves attention in terms of limiting the increase in GHG emissions.

In urban areas, 56% of the population lives and most of the economic activities are conducted. This is a diverse and complex sector, with a wide range of opportunities to reduce the GHG emissions by

Table 4. Greenhouse gas emissions by source sector, 2010-2014

	Year	2010	2011	2012	2013	2014
Energy	**EU-28**	3794960.92	3646230.22	3599940.98	3515317.95	3323934.71
	Romania	82881.97	87745.92	86548.74	76996.24	76302.13
Industrial Processes and Product Use	**EU-28**	386605.76	382432.12	369807.85	368676.97	373403.9
	Romania	12260.33	12504.39	11551.79	10376.58	10856.15
Agriculture	**EU-28**	426939.07	426945.64	424392.67	428068.7	434937.7
	Romania	16271.06	16425.64	16446.56	16860.21	16844.63
Land Use, Land Use Change, and Forestry (LULUCF)	**EU-28**	-317274.89	-316224.63	-311686	-316262.36	-302559.77
	Romania	-18496.75	-18805.03	-17937.19	-18232.47	-18258.18
Waste Management	**EU-28**	169196.44	163352.68	158454.28	150743.02	145701.36
	Romania	5584.37	5015.4	5519.73	5798.94	5756.73
Other Sectors	**EU-28**	15.69	15.23	12.92	13.19	14.02
	Romania	:	:	:	:	:

Source: Processed by authors using data provided by EUROSTAT (source: EEA) [env_air_gge]

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

improving energy efficiency in buildings, a more efficient urban transport, and implementation of waste management. Agriculture is responsible for over 18% of total GHG emissions. It is worth mentioning that net absorption of CO2 from the atmosphere by forestry offsets about 20% of emissions in other sectors at the national level. It offers a wide range of mitigation measures - conservation and enhancement of existing C deposits, improvement of the absorption rate of atmospheric CO2 and land use change.

Green Jobs in Romania

Millions of green jobs could occur if the green economy were more emphasized.

In Europe, there are over 20 million jobs linked to the green sector.

In our country, the number of "green" jobs is becoming increasingly higher in the following areas:

- Renewable Energies;
- Ecological Agriculture;
- Food Industry;
- Transport.

In this context, a revolution takes place in the labor market, "green" jobs representing a lifebelt. People trained in fields concerned with the environment are beneficiaries of some extra employment opportunities. Romania has a potential for growth, particularly in the non-renewable energy sources - the wind and solar energy: environmental consultant, environment manager, energy buyer, technical operator, responsible for maintaining and wind turbines and solar panels. Also, in 2014, in Romania, there were over 2,000 companies in the recycling and waste management field, and their number is growing.

EU 2020 strategy includes the increasing employment rate among its objectives. Green sector has a clear upward trend, which requires new training programs and an adaptation of sustainable business practices. Green products are increasingly requested. These changes contribute to an increase in the number of green jobs. In specialty literature, the concept of "green collar" has appeared. In this context, green jobs can be a way to support the economy. They can contribute to economic growth.

Environmental Performance Index (EPI) in Romania

Environmental Performance Index (EPI) measures the performance of countries in terms of human health protection from harm and protection of the environmental ecosystems, using 25 indicators grouped into ten categories as follows:

- Health Impacts;
- Air Quality;
- Water and Sanitation;
- Water Resources;
- Agriculture;
- Forests;
- Fisheries;
- Biodiversity and Habitat;
- Climate and Energy.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

In 2014 Romania was ranked 86. Figure 19 shows that the best result for Romania had been registered in the field of Health Impacts, with a score of approx. 85 and the weakest one, in the field of Water Resources, with a score of approx. 13, despite the government's efforts, demonstrated by the increasing expenditures in this area. According to Sima and Gheorghe (2014), the value of the correlation coefficient (0.74) confirms a moderate direct link between the environmental performance index and the GDP /capita, a better air quality, etc.

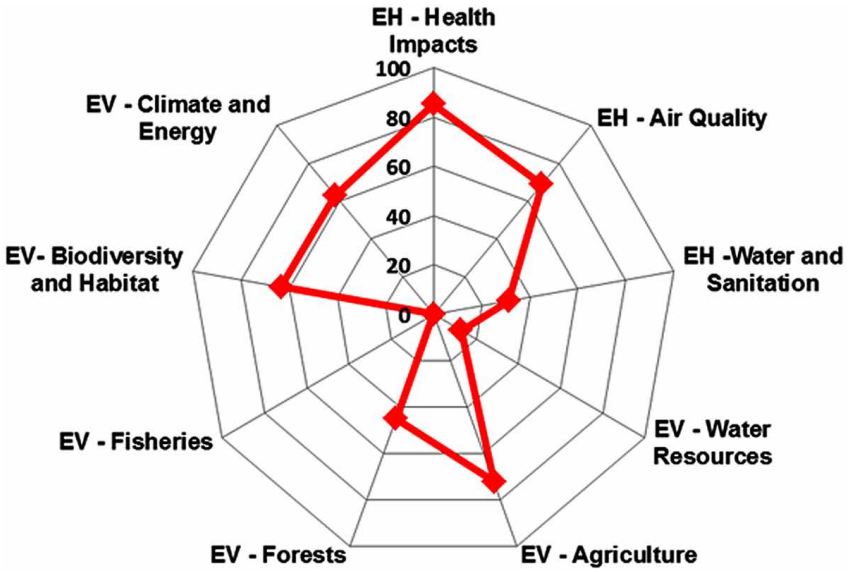
CONCLUSION

Specific indicators are designed to measure sustainable economic growth. Its effects are materializing in a major growth of the ecological productivity, an increased amount of energy derived from renewable sources, emissions reduction, improved air and water quality, widened access to the benefits of civilization - education, water sanitation. Thus, this green growth "can fight" against climate change. Also, green growth provides opportunities for creating new jobs requiring new skills. Romania has the chance to be among the EU countries that will practice this social model based on these new skills that could lead to an improved quality of life.

In the latest statistics, there are some fields in which Romania holds honorable positions, as follows:

- According to the European Wind Energy Association, in 2014 Romania ranked 9 in the EU depending on the capacity of wind farms with an installed capacity of 2,952.9 MW. Germany ranked first with 39,127.9 MW.

Figure 19. Environmental Performance Index in Romania, 2014
Source: http://www.epi.yale.edu/epi/country-profile



EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

- According Eurostat data, in 2014 Romania ranked 10 in the EU depending on the amount of carbon dioxide emissions in the energy sector. Germany, the leader, emitted 12 times more pollutants than Romania.

There are also fields in which Romania is at the end of the list, as follows:

- After the amount of municipal waste generated by population, Romania ranks 22 in the EU, with 389 kg per capita, in a ranking led by Denmark with 668 kg per person.
- In terms of recycling, Romania ranks last in the EU. Romania recycles only 1% of its waste, while Germany recycles 65%.

There is a close relationship between environmental taxes and efforts to protect the environment. Romania has low energy taxes. However, paradoxically, Romania is a country with low CO2 emissions. Despite the fact that the environmental taxes have lower levels than the EU average, and the capacity to collect these fees is quite limited, Romania is in a very good situation in terms of the overall level of CO2 emissions. Deindustrialization, the economy contraction, a decrease of the synthetic fertilizer use, the drop in growing areas could explain this.

REFERENCES

Alexander, M. (2013). Management Planning for Nature Conservation, A Theoretical Basis & Practical Guide (2nd ed.). Springer eBooks.

Allenby, B. (2006). The ontologies of industrial ecology? *Progress in Industrial Ecology-An International Journal*, *3*(1/2), 28–40. doi:10.1504/PIE.2006.010039

Andersen, M. S., & Massa, I. (2000). Ecological modernization — origins, dilemmas and future directions. Journal of Environmental Policy & Planning. *Journal of Environmental Policy and Planning*, *2*(4), 337–345. doi:10.1080/714852820

Bell, S., McGillivray, D., & Pedersen, O. W. (2013). *Environmental law* (8th ed.). Oxford, UK: Oxford University Press. doi:10.1093/he/9780199583805.001.0001

Brunori, G. (2013). Biomass, Biovalue and Sustainability: Some Thoughts on the Definition of the Bioeconomy. *EuroChoices*, *12*(1), 48–52. doi:10.1111/1746-692X.12020

Burkart, K. (2012). *How to define the green economy*. Available at: http://www.mnn.com/green-tech/researchinnovations/blogs/how-do-you-define-the-green-economy

Carter, N. (2007). *The politics of the environment: Ideas, activism, policy* (2nd ed.). Cambridge, UK: Cambridge University Press. doi:10.1017/CBO9780511819179

Cato, M. S. (2009). *Green Economics: An Introduction to Theory, Policy and Practice*. London: Earthscan.

Deanna, J. R. (Ed.), *(n.d.). The Industrial Green Game: Implications for Environmental Design and Management*. Washington, DC: The National Academies Press; doi:10.17226/4982

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Dobson, A. (2007). Environmental citizenship: Towards sustainable development. *Journal of Sustainable Development*, *15*(5), 282–283.

Frosch, R. A., & Gallopoulos, N. E. (1989). Strategies for Manufacturing. *Strategies for Manufacturing Scientific American.*, *261*(3), 144–152. doi:10.1038cientificamerican0989-144

Gheorghe, I. G., & Sima, V. (2014). Transition to Green Economy in Romania. *Annals of the Constantin Brâncuşi, 3*, 32-39. Retrieved from http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32008L0098&from=RO http://www.unep.fr/scp/cp/

Loiseau, E., Saikku, L., Antikainen, R., Leskinen, P., & Pitkänen, K. (2015). Conceptual framework and methodological tools used by green economy. In *Implementing the green economy in a European context – lessons learned from theories, concepts and case studies*. PEER Report. Helsinki: Partnership for European Environmental Research, Juvenes Print. Available at http://www.peer.eu/fileadmin/user_upload/publications/PEERreport_ImplementingTheGreenEconomy.pdf

Matei, M., Stancu, A., & Vukovic, P. (2009). *The interdependence between agriculture and climate change-a European perspective.* Paper presentato al 113th EAAE Seminar, Belgrado.

Sima, V., & Gheorghe, I. (2009). *Eco-Efficiency – A Romanian Perspective*. The 12th IBIMA Conference, "Creating Global Economies through Innovation and Knowledge Management", Kuala Lumpur, Malaysia.

Sima, V., & Gheorghe, I. G. (2014). Analyze of environmental performance in Romania based on environmental performance index. *Annals of the Constantin Brâncuşi, 3*, 101-104.

Sima, V., & Gheorghe, I. G. (2014). Labour market trends in România in the context of green economy. *Annals of the Constantin Brâncuşi*, 116-123. Retrieved from http://www.utgjiu.ro/revista/ec/pdf/2014-04.Special/22_Sima,%20Gheorghe.pdf

Stahel, W. R. (1997). The Functional Economy: Cultural and Organizational Change. In Cultura civică şi dreptul antreprenorial. Editura Lumina Lex.

Wind in Power. (2015). *European Statistics: The European Wind Energy Association*. Retrieved May 24 2016 from https://windeurope.org/wp-content/uploads/files/about-wind/statistics/EWEA-Annual-Statistics-2015.pdf

ADDITIONAL READING

European Commission. (2015). *Towards an EU Research and innovation agenda for nature-based solutions and re-naturing cities*. Brussels: CEC.

OECD. (2009). The Bioeconomy to 2030: designing a policy agenda. OECD Publishing, Paris.EC (European Commission), 2012. Communication from the Commission of the European Parliament, the Council, the European economic and social Committee and the Committee of the Regions: "Innovating for Sustainable Growth: A Bioeconomy for Europe." Brussels.

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

OECD. (2011). *Towards Green Growth: Monitoring Progress. OECD Indicators, OECD Green Growth Studies* (p. 9). Paris: OECD Publishing.

Towards the Circular Economy 1: Economic and Business Rationale for an Accelerated Transition; January 2012, Cowes, Isle of Wight: Ellen MacArthur Foundation. Towards the Circular Economy 2: Opportunities for the consumer goods sector; January 2013, Cowes, Isle of Wight: Ellen MacArthur Foundation. 'Hidden innovation' in: Science & Public Policy, London, vol. 13 no. 4, August 1986.

UNDP (United Nations Development Program). (2010). Green Economy Report: A Preview

KEY TERMS AND DEFINITIONS

Environmental Performance Index: It measures the performance of countries in terms of human health protection from harm and protection of environmental ecosystems, using 25 performance indicators grouped into ten categories including: Health Impacts, Air Quality, Water and Sanitation, Water Resources, Agriculture, Forests, Fisheries, Biodiversity and Habitat, and Climate and Energy.

Environmental Protection Expenditures: "Statistics on environmental protection expenditure present data on the economic resources devoted by resident units to environmental protection" (Eurostat).

Environmental Quality: A state of environmental conditions, expressed in terms of indicators or indices, which measures environmental health, referring to air and water purity or pollution, noise, resources, flora and fauna.

Environmental Tax: A tax whose base is a physical unit (or a proxy of a physical unit) of something that has a proven, specific negative impact on the environment. Environmental tax statistics present data on taxes in the following areas: Energy, Transport, Pollution, and Resource (Eurostat).

Green Economy: A means to achieve sustainable development, representing an adaptation of the socio-economic system to the multiple challenges of the current period.

Green Growth: "Green growth is about fostering economic growth and development while ensuring that the natural assets continue to provide the resources and environmental services on which our well-being relies. To do this it must catalyse investment and innovation which will underpin sustained growth and give rise to new economic opportunities." (OECD, 2011).

Greenhouse Gasses Emissions: A group of compounds which are able of absorbing infrared radiation to trap heat, keeping the Earth's surface warmer than it would be if they were not present.

Green Jobs: A "work in agricultural, manufacturing, research and development (R&D), administrative, and service activities that contribute(s) substantially to preserving or restoring environmental quality. Specifically, but not exclusively, this includes jobs that help to protect ecosystems and biodiversity; reduce energy, materials, and water consumption through high efficiency strategies; de-carbonize the economy; and minimize or altogether avoid generation of all forms of waste and pollution" (2008).

This research was previously published in Measuring Sustainable Development and Green Investments in Contemporary Economies edited by Mihai Mieila, pages 76-108, copyright year 2017 by Business Science Reference (an imprint of IGI Global).

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Index

3PL 1420, 1425-1426, 1435

A

Acceptance 5, 51, 53, 55, 57, 66, 186, 188, 247, 256, 259, 405, 421, 512, 587, 646, 709, 713, 739, 742, 785, 792, 842, 909-911, 913-914, 917-919, 990, 1007, 1050-1051, 1053, 1072-1074, 1077, 1086, 1093, 1139-1141, 1300, 1371, 1373, 1396, 1408, 1615, 1622
Agile Development Life Cycle 641
Air Conditioning 338-339, 520, 633, 668, 684, 753, 839, 1021, 1025-1029
Alliance Performance 291-293, 296-297, 300, 302-304

B

Bangalore 671, 838, 846, 852-853, 1250
Bangladesh 50-55, 58-59, 63, 66, 255, 257-258, 268-269, 781-788, 790-794, 1071-1076, 1079, 1084-1086, 1119
Banking Sector 54, 783-786, 791-793, 1072, 1084, 1086
Banks 50-53, 55, 58, 258, 605, 781-787, 791-793, 1002, 1005, 1071-1077, 1079, 1084-1086, 1344, 1654
Barriers 20, 26, 28, 36, 45, 76, 168, 279, 350, 421-422, 425, 484, 490, 503, 518, 531, 533, 535, 572, 893, 912, 1001, 1003-1004, 1007, 1042, 1180, 1209-1210, 1244-1245, 1252-1258, 1260-1261, 1263-1265, 1280, 1336, 1465, 1489, 1491-1492, 1500, 1559
base station 1020, 1022-1023, 1025-1028
Behavioral View 691, 694, 698-701, 703, 706
Bharti 1020, 1022, 1026
Brand 42, 146-147, 155, 160, 204, 211, 223, 285, 314, 349, 475, 480-482, 496, 503, 521, 570, 672, 732, 736, 792, 810, 813, 823, 831, 865, 951-954, 959, 973, 1033, 1035, 1037, 1049, 1123, 1140, 1163, 1169, 1235, 1250, 1310, 1330, 1336, 1425, 1450, 1468, 1497-1498, 1513, 1530, 1532, 1537, 1544, 1580-1581, 1619
Branding 319, 413, 492, 999, 1513, 1618
Built to Order 390, 394
Business Ethics 933, 1274, 1276, 1396-1398, 1546
Business Intelligence 572, 579
Business Models 5, 40, 316, 423-424, 428, 430-431, 440-443, 449-455, 464, 566, 608-609, 907-911, 913, 917-919, 923, 930-931, 933, 949, 1042, 1109, 1114-1115, 1119, 1122, 1126, 1138, 1277-1278, 1280, 1428
Business Process Outsourcing Industry 88
Buyer-Supplier Relationship (BSR) 899

C

Capacity 5, 23, 168, 197, 259, 321, 330-331, 335, 420, 429, 521, 572, 628, 647, 709, 815, 823, 860, 873, 910, 917, 924, 972-974, 991, 1025, 1027-1028, 1119, 1124, 1126, 1167, 1180, 1206, 1279, 1299, 1310, 1388, 1425, 1428, 1438, 1467, 1511, 1516, 1578, 1582, 1595, 1648, 1651-1652, 1663, 1676, 1683
Car Manufacturer 232, 248
Carbon Dioxide Emission 1427-1429
Carbon Emission 140, 256-257, 365, 571, 666, 678, 753, 757, 822, 1112, 1250, 1307, 1312-1313, 1360-1361, 1363, 1365, 1367, 1398, 1425-1426, 1428, 1433, 1436, 1439, 1489, 1493, 1498-1499, 1593, 1609
Carbon Emissions 74, 88, 91, 100, 104, 141, 143, 145-146, 233, 366, 368, 397, 417-418, 490, 571, 593, 633, 679, 708, 713, 760, 1093, 1287, 1295, 1306-1307, 1332, 1334-1336, 1420, 1425-1428, 1430, 1433, 1436-1437, 1498, 1544
Carbon Sequestration 1580, 1659

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Carbon-Free Computing 677
Circular Economy 1-2, 5-11, 16, 35-39, 41-46, 511, 1169, 1662
Clean Technology 512, 1348, 1359, 1525
Cloud Computing 91, 100, 395-399, 401, 403-405, 412-414, 568, 572, 633-634, 664, 708-709, 768, 1102, 1360-1363, 1365-1367, 1591-1600, 1603-1605, 1609
CO2 Emissions 89, 248, 285, 490-491, 593, 625, 627, 629-630, 685, 694, 703, 706, 733, 840, 907, 916, 918, 1020, 1025, 1027-1028, 1033, 1092, 1233-1235, 1334, 1336, 1360, 1437-1440, 1633, 1639, 1670, 1683
Collaboration 40, 45, 88, 96-98, 100-103, 106, 145, 247-248, 274, 276, 284-285, 292, 346-348, 350, 357-358, 424, 440, 503, 533-534, 573, 593, 603-604, 607, 757, 760, 768, 773, 866, 870, 885, 889, 911, 919, 1114, 1117, 1120, 1123-1124, 1126, 1219, 1246, 1272, 1277-1281, 1287-1288, 1298, 1331, 1425, 1464-1468, 1470, 1476, 1479, 1487, 1552, 1560, 1581, 1596, 1632, 1650
Collective Creativity 415-416, 420, 426-432, 438
Collective Exchange 432
Commercial Bank 791, 795
Competitive Advantage 27, 92, 101, 126, 131, 182, 223, 275, 278-279, 284-286, 292-293, 320, 357, 385, 423, 425, 428-429, 432, 477, 491, 494-496, 498, 518, 522-523, 534, 732, 734-737, 740, 742, 797, 812, 822-823, 831, 860, 863, 870, 950, 953, 967-968, 970, 991-993, 997, 1007, 1010, 1014, 1016, 1033, 1043, 1049, 1092, 1105-1106, 1109, 1112, 1114-1115, 1119, 1125, 1137, 1141, 1217-1218, 1220, 1246, 1250-1251, 1272-1274, 1280, 1310, 1330, 1373, 1421, 1425, 1456, 1493, 1499-1500, 1529-1530, 1612, 1615, 1617, 1623, 1677
Competitive Pressure 133, 196, 812, 815, 1445
Composites 643-657, 663
Conceptual Design 643-648, 652-657, 663
Conceptual Model 737, 755, 793, 907, 916-917, 919, 1022, 1032, 1036, 1094-1095, 1236, 1373, 1476, 1478-1479
Concurrent Design 643-645, 648-651, 663
Construction Industry 74, 338, 490-496, 501-503, 1306-1309, 1312, 1315, 1317-1319, 1321-1322
Construction Project Management 491, 493, 495, 498
Construction Supply Chain 492, 503, 511, 1308, 1312
Consumer Attitudes 170, 785, 842, 1036, 1182, 1544, 1618
Consumer Awareness 27, 165, 573, 823, 831, 1177, 1371, 1376, 1450
Consumer Behavior 17, 34, 153, 158, 160, 207, 209-210, 212, 220, 222, 472, 642, 736, 823, 826, 832, 842, 911, 1035, 1161, 1167, 1169, 1206, 1208, 1210, 1447-1448, 1525, 1544
Consumer Buying Decision 822
Consumer Perceptions 524, 1036, 1052, 1527, 1532
Consumer Purchasing Behavior 1544
Consumer Social Responsibility (CSR) 187, 193, 310-312, 314-322, 367, 428, 493, 496, 502, 511, 568, 732, 736, 976, 1105-1116, 1120, 1122-1123, 1125, 1127, 1235, 1272-1281, 1544, 1663
Consumerism 6, 11, 156, 160, 182, 990, 1033, 1035, 1048, 1164, 1168, 1522, 1527, 1535, 1537, 1544, 1620
Contextual Open Innovation 2.0 441, 454
Contingency of Fit 234-235, 239
Cooperation 10, 17-18, 26, 28, 35, 40, 202, 278, 292, 346-350, 357-358, 441, 443, 454, 582, 592, 603, 703, 732, 757, 806, 815, 865, 869-870, 885, 894, 1037, 1180, 1248, 1254, 1261, 1307, 1331-1332, 1336, 1428, 1446, 1464-1465, 1467-1470, 1476, 1479, 1487, 1584, 1635, 1645, 1649
Coordination 96-97, 278, 281, 297, 346-350, 357-358, 382, 604, 737, 755, 757, 760, 784, 864, 885, 889, 911-912, 930-931, 1011, 1015, 1329, 1464-1465, 1467-1469, 1476, 1479, 1487, 1620, 1667
Corporate Governance 931, 943, 1009-1010, 1015, 1017, 1112, 1123
Corporate Image 97, 187, 223, 280, 303, 492, 494, 496, 501, 503, 566, 731-732, 734, 736-737, 740, 742-743, 840, 843, 860, 870-871, 1032, 1217-1218, 1220, 1250, 1252, 1286, 1316, 1421, 1425
Corporate Social Responsibility 164, 193, 280, 316-317, 320, 322, 365, 428, 492, 501, 511, 518, 534, 568, 588-589, 736, 758, 765, 811, 965, 976, 1035, 1105-1106, 1109, 1111, 1135, 1176, 1272-1274, 1310, 1421, 1536-1537
Corporation 204, 285, 342, 398, 681, 927-929, 931-932, 934-935, 938-939, 943-944, 958, 964-965, 971-972, 975-976, 1022, 1119-1120, 1125, 1142, 1388, 1393, 1495, 1498, 1535, 1575, 1580-1581
Coverage 232, 1025, 1027-1029, 1371, 1476, 1479, 1514, 1535
Created Shared Value 1105, 1108-1109, 1112, 1114, 1116, 1120, 1126-1127, 1135, 1272-1274, 1280
Creative Problem-Solving (CPS) 422
Creativity 9, 260, 415-416, 418-433, 438-439, 587, 884, 889, 891-893, 899, 1619
criticisms 1105, 1107-1108, 1119-1120
cross-sector collaboration 1272, 1277-1278, 1280-1281

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Crowd-Driven Ecosystem Business Model Framework 441-442, 452, 454
Crowd-Driven Ecosystems 441-443, 447, 451-452, 454-455
Crowd-Driven IoT Ecosystems 440-443, 447-448, 451, 453-455
Customer Pressure 285, 810, 1331-1332, 1536

D

Delphi Technique 365-366, 369
DEMATEL 359, 530-531, 535-536, 548, 555, 558, 1328, 1338, 1340, 1344, 1348, 1547-1548, 1552, 1559-1561, 1571
Demographics 23, 211, 845, 889, 1094, 1096, 1102, 1233, 1236, 1241, 1337
Deregulation 971, 1009-1010, 1013-1014, 1016
Design for manufacturing and assembly (dfma) 861
Developing Countries 18, 42, 50, 52, 88-90, 93-94, 126, 163, 328, 380, 417, 531, 533-534, 628, 671-673, 680, 752-753, 766, 768, 781-782, 793, 824, 839, 971, 989-990, 1048, 1086, 1105, 1107-1108, 1111, 1116, 1119, 1123-1127, 1141-1142, 1153-1154, 1167, 1169, 1171, 1174, 1180, 1247, 1253-1255, 1286, 1300, 1380, 1421, 1425, 1523-1525, 1527, 1531, 1536-1537, 1633, 1644, 1650, 1655
Developing Country 90, 107, 329, 342, 773, 781-782, 791, 793, 866, 870, 1048, 1065, 1251, 1285-1286, 1453, 1463, 1519

E

Eco Friendly Products 185
Eco-Brand 1537, 1544
Eco–Consumer 1199, 1215
Eco-Efficiency 93, 153, 158, 170, 180, 275-276, 279, 469, 500, 608, 610, 613-614, 625, 684, 693, 702, 705, 990, 998, 1161, 1166, 1182, 1194, 1288, 1526, 1544, 1615-1616
Eco-Friendly 20-21, 38, 50, 53, 130, 156-157, 170, 189, 192, 200, 207, 209, 221, 274-276, 279, 284-285, 347-348, 365, 404, 427, 431-432, 489, 514-515, 517-519, 521-522, 529-531, 533, 571, 583, 648, 672, 679, 702, 708-709, 713, 726, 756-757, 762-765, 773, 782-783, 791, 824, 840-842, 848, 875, 885, 959, 1033, 1038-1039, 1049, 1071, 1146, 1164-1166, 1182, 1211, 1247, 1249, 1308, 1360-1362, 1372, 1423, 1447, 1449, 1456, 1465, 1468, 1491, 1493, 1497, 1507, 1513, 1526, 1532, 1535-1536, 1580-1581, 1593, 1615, 1618, 1661
Eco-friendly environment 1361-1362
Eco-Innovation 379-382, 384-388, 390-391, 394, 415-416, 419, 424, 426-433, 439, 463, 734-736, 1022, 1635-1636
Eco-Labeling 367, 822, 1200, 1613
Eco-Labels 26, 34, 365, 368, 520, 821, 824, 826, 828-829, 831-833, 841, 1206, 1511, 1517, 1519, 1522, 1537, 1613, 1618
Ecological Behavior 2, 220, 1199
ecological citizenship 1197, 1215
Ecological Conscious Consumer Behavior (ECCB) 34
ecological consciousness 1175-1176
Ecological Marketing 192-193, 202, 204, 1445, 1525, 1617
Ecological modernization theory 127, 277, 283
Ecological Product 180, 1194, 1215
Ecological Responsibility 1-2, 4, 10-11, 16, 568, 1138
Economia Aziendale 925, 927, 930, 938, 943-944, 949
economic agenda 1105, 1127
Economic Growth 5-6, 36, 39, 51-52, 73, 94, 153, 158, 232, 328, 337, 390, 464, 633, 733, 784, 798, 802, 932, 1074, 1105, 1107, 1109, 1123-1124, 1127, 1161, 1166, 1527, 1580, 1593, 1611, 1660-1664, 1681-1682, 1685
Economic Sustainability 295, 521, 568, 579, 802, 1273, 1279, 1389-1390, 1527
Economics 11, 38, 73, 127, 208, 257, 349, 386, 418, 813, 1143, 1153, 1167, 1234, 1469, 1512, 1661
Eco-Sustainability 89, 262, 565, 579
Educated Young Consumers (EYCs) 824
Egypt 1119, 1125, 1244-1249, 1251, 1256, 1261, 1265
Egyptian companies 1244, 1256-1258, 1260-1261, 1263
Ekol Logistics 1426-1428
ELECTRE 652, 1547-1548, 1556-1557, 1559-1561, 1571
Emerging Economies 21, 49-51, 54, 66, 385, 1048, 1072, 1085, 1421
Emerging Market 17-18, 22, 28, 390, 1336
Employment Generation 328-329, 336-338, 341-342, 430
Energy Conservation 34, 72, 78, 385, 394, 571, 627, 974, 978, 983, 1028, 1034, 1198, 1248, 1498-1499, 1501, 1507, 1515, 1584, 1639
Energy Consumption 72, 89, 91, 93, 98, 100, 104, 161-163, 234, 276, 284-285, 295, 337-339, 366-367, 396-397, 401, 490, 521, 571, 589, 625, 631, 633-634, 641-642, 664, 667-669, 674, 676, 678, 684-685, 694, 708-711, 713, 722, 726, 733, 753, 760, 768, 815, 859-860, 865, 869-870, 990, 1003, 1020-1021, 1025, 1027-1029, 1038, 1049, 1051, 1065, 1092-1093, 1097, 1137, 1140, 1170, 1172-

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

1173, 1219-1220, 1234-1235, 1237, 1239-1240, 1247-1248, 1294, 1296, 1298, 1307, 1313, 1316, 1334, 1336-1337, 1360-1365, 1367, 1424-1425, 1430, 1507, 1670-1672
Energy Efficiency 36, 43, 93, 97-98, 100, 147, 168, 233, 257-258, 330, 337, 339, 342, 367, 396-397, 405, 410, 514, 568, 581, 627, 633, 641, 702, 708, 756, 782, 831, 840, 1003, 1038-1039, 1092, 1152, 1180, 1200, 1234-1235, 1248-1249, 1362-1363, 1365-1366, 1430, 1499-1500, 1530, 1579, 1594, 1639, 1670, 1681
Energy Star 367, 407, 523, 665-666, 668, 679, 844, 1092, 1200, 1241
Enterprise 36-37, 42, 45, 72, 93, 96, 293, 311, 313-314, 317-319, 322, 367, 395, 409, 592, 597, 607-609, 624, 635, 637, 755, 773, 865, 894, 929, 932, 971, 1093, 1122, 1137, 1139-1141, 1143, 1146-1147, 1153, 1247, 1286, 1288-1289, 1299-1300, 1544, 1580, 1593, 1663
Environment Protection 96-97, 160, 163, 172, 274, 279, 625, 629, 632, 634, 641, 1051, 1169, 1174, 1184, 1248, 1514, 1676
Environmental Advertising 206-208, 211, 215, 217, 219, 221-223, 230, 732, 1174
Environmental Attitude 211, 221, 533, 757, 841, 1510-1512, 1514-1519, 1522
Environmental Awareness 19, 132, 182, 223, 368, 385, 646, 764, 993, 1001-1002, 1004, 1032, 1034, 1092-1093, 1175, 1249, 1253, 1311, 1329, 1370-1371, 1374-1376, 1379, 1426, 1429, 1431, 1436, 1446, 1510-1511, 1513-1514, 1518-1519, 1525, 1527, 1573-1574, 1582
environmental belief 853
Environmental Concerns 18-20, 22, 24-26, 28, 34, 49-51, 53-55, 57, 59, 62-63, 158, 233, 235, 238, 243, 247-248, 284, 295, 472, 590, 679, 707-708, 802, 807, 810, 828, 840, 842, 852, 871, 968, 984, 1010, 1015, 1041, 1050, 1166, 1174, 1370-1372, 1387, 1420-1421, 1467, 1489, 1491, 1493-1495, 1498-1499, 1546, 1548, 1615-1616
Environmental Degradation 50-52, 54, 71, 158, 200, 206, 493, 733, 753, 756, 781, 783, 799, 802, 853, 989, 1002, 1006, 1048, 1071, 1084, 1137, 1166, 1396, 1489, 1494, 1511, 1523, 1532, 1647, 1663
Environmental Education 45, 72, 74, 86, 96, 157, 223, 822-823, 1005, 1042, 1165, 1180, 1209, 1254, 1585, 1616
Environmental Footprint 72, 92, 97, 99-101, 106-107, 237, 284, 490-493, 496, 501-503, 511, 566, 762, 1429-1430
Environmental Innovation 732-735, 1009, 1248, 1319, 1530
Environmental Knowledge 156, 206, 208-209, 212, 215, 217, 220, 223, 230, 531, 823, 1164, 1174, 1254
Environmental Management 50, 96-97, 100, 106, 131, 133, 140, 143, 145, 276, 280, 284-286, 292, 295, 302, 350, 379, 465, 548-549, 555, 557-558, 581-582, 596-597, 732-733, 753-754, 757-759, 783, 839, 841, 844, 860, 868, 967, 969, 977, 990-994, 996, 1000, 1003, 1219, 1250-1251, 1255, 1261, 1286, 1308, 1312, 1319, 1322, 1329, 1331-1332, 1336, 1338, 1387, 1407, 1424-1425, 1429, 1431, 1446, 1448, 1467, 1469, 1500, 1613, 1616
Environmental Objectives 314, 565, 579, 583, 811, 966, 1115, 1457, 1616
Environmental Performance Index 275, 280, 822, 1335, 1512, 1514, 1516, 1522, 1660, 1681-1682, 1685
Environmental Pollution 52, 196, 204, 257, 520, 625, 727, 733, 800, 814, 839, 974, 1033, 1049, 1136, 1306-1307, 1334, 1348, 1420, 1445, 1527
Environmental Protection Agency 71, 367, 572, 579, 665, 670, 673, 679, 1093, 1233-1234, 1251, 1438, 1500
Environmental Protection Expenditures 1660, 1675-1677, 1685
Environmental Quality 19, 37, 277, 283, 465, 522, 595, 888, 1510, 1512-1519, 1522, 1612, 1685
Environmental Quality Awareness 1510, 1512-1519, 1522
Environmental Responsibility 1, 204, 292, 515, 593, 642, 782, 799, 811, 847, 1010-1011, 1273-1275, 1310, 1449, 1456, 1537, 1585, 1613, 1616
Environmental Sustainability 17, 50, 53-54, 88-89, 93, 157, 257-258, 292, 295, 381, 390, 521, 568, 573, 579, 624, 633, 756-757, 759, 766, 772-773, 791, 800, 823, 832, 989, 1092-1093, 1098, 1165, 1169, 1250, 1272-1273, 1276-1277, 1279-1281, 1286, 1362, 1387-1388, 1390-1391, 1397, 1403, 1407, 1421, 1429-1430, 1490, 1526-1527, 1580, 1612, 1617, 1633
Environmental Taxes 1631, 1660, 1676, 1678, 1683, 1685
Environmental Values 841-842, 853, 1041-1042, 1310, 1421, 1456, 1619-1620
Environmental-Friendly 49, 53, 631, 760, 762, 792, 795-796, 1072
Environmentally Conscious Consumer Behaviour 19
Environmentally Friendly Consumer Behavior 34
EPA 572, 579, 673, 1004-1005, 1093, 1233-1234, 1315, 1438, 1500

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

EPCglobal 605-606, 610
E-S-QUAL 1072-1075, 1077, 1086
Ethical Decision 885-886, 889, 899
ethical investment 1197, 1215
Ethical Responsibility 2, 4, 887, 889, 1032-1033, 1035-1037, 1039-1042
Ethics 2, 195, 285, 347, 469-470, 489, 781, 853, 884-886, 888-891, 893, 925-926, 932-933, 935, 967, 1037, 1042, 1122, 1274, 1276, 1396-1398, 1407, 1465, 1546, 1621, 1623
Exploratory Factor Analysis 59, 147, 786, 821, 827, 884, 891-892, 899, 1037, 1039, 1052, 1057, 1370, 1375
External Regulations 259-261, 268-269, 273

F

Finance 101, 127, 258, 310, 329, 335, 407, 431, 569, 585, 588, 781, 783, 785, 796, 937, 1003, 1005, 1107, 1344, 1423, 1599, 1676
Financial Cost 49, 51, 54-55, 57, 59, 62-63
Food Insecurity 1645, 1654, 1659
Food Intake 1648, 1659
Food Security 1630, 1635, 1644-1645, 1647-1651, 1653-1655
Functional View 706
Fuzzy DEMATEL 359, 530-531, 535-536, 548, 555, 558, 1328, 1338, 1344, 1348
fuzzy MOORA 1328, 1341, 1344-1345, 1348
Fuzzy Sets 1552

G

Global Warming 11, 18, 50, 52, 72, 79, 185, 232, 235, 237, 247, 365-367, 374, 379, 381, 417-418, 428, 431, 471, 629, 668, 683, 694, 706, 708, 781-782, 788, 791-793, 795, 853, 871, 1244, 1306, 1361, 1439, 1489, 1510, 1523, 1526, 1544, 1546, 1580, 1591-1592, 1605, 1633, 1636, 1639
Globalization 132, 222, 277, 381, 525, 810, 863, 875, 950, 1072, 1174, 1245, 1275, 1329, 1359, 1420, 1650, 1663, 1666
globalized economy 274-275, 286
Governance 88, 101-102, 104-107, 258, 277, 355, 357-358, 732, 889, 926, 928, 931-932, 943, 949, 1006, 1009-1010, 1015, 1017, 1091, 1093-1094, 1097-1100, 1102, 1112, 1123-1124, 1167, 1198, 1215, 1233, 1235-1237, 1239, 1241, 1593, 1635, 1641
Green Agriculture 477, 1649, 1651-1655
Green Attributes 521-523, 843, 870, 1017, 1024, 1042, 1216, 1218-1221, 1224, 1226-1227
Green Banking 49-59, 63, 66, 781-788, 791-794, 796, 1071-1079, 1081-1086, 1661
Green Banking Unit 52, 784, 796
Green Behavior 17, 20, 173, 180, 222, 465, 486, 823, 848-849, 852, 993, 1006, 1185, 1194, 1198-1199, 1206, 1211, 1215, 1371, 1373, 1376-1381
Green Benefits 1004
Green Buildings 74-75, 78-79, 106, 338-339, 341-342, 976, 979, 1091, 1308, 1583, 1661
Green Business 238, 243-244, 250, 379-380, 385, 390-391, 413, 464, 467, 566, 582, 584, 732, 814, 964, 966, 969, 989-991, 997, 1000-1001, 1042, 1091, 1421, 1447, 1493, 1544
Green Cloud Computing 396-398, 404-405, 708, 1360-1363, 1365-1367
Green composites 643-657
Green Computing 395-397, 401, 403-406, 409, 412, 625, 664-669, 675-677, 679-681, 707-709, 718, 1360, 1364, 1367, 1594
Green Consumer 17-20, 24-25, 34, 153, 158, 193, 195, 209, 211-212, 214-215, 220, 222, 472-473, 475, 492, 799, 842, 845, 1034, 1161, 1166, 1199, 1447, 1513, 1525, 1536, 1544, 1613, 1618, 1622
Green Consumer Behavior 17, 34, 209, 212, 220, 842, 1525
Green Consumerism 182, 990, 1033, 1522, 1527, 1537, 1544, 1620
Green Consumers 18-19, 34, 157, 464-465, 467, 472, 475-476, 484, 486, 512, 514-515, 517-518, 520, 524, 529, 732, 810, 843, 853, 951, 1006, 1034, 1165, 1199-1200, 1456, 1530, 1544, 1613, 1616, 1618
Green Creativity 415, 419, 421-423, 426-433, 439
Green Customer Satisfaction 153, 180, 1179, 1194
Green Customers 165, 463, 493, 1177
Green Design 79, 86, 93, 146, 258, 276-277, 279, 284, 544, 549, 555, 557-558, 625, 867, 869, 871, 873, 875, 1020-1023, 1217, 1219, 1248, 1312-1314, 1332, 1423, 1466, 1584
Green Dimension 153-154, 164-165, 167, 171, 173, 180, 1161-1162, 1176-1179, 1183, 1185, 1194
Green Economy 18, 36, 125, 153-154, 464-465, 489, 533, 1161-1162, 1196, 1198, 1244, 1544, 1630-1633, 1649-1652, 1654-1655, 1660-1665, 1681, 1685
Green Employees 467, 469, 486, 489, 1319
Green Energy 157, 237, 331, 733, 1021, 1025-1026, 1028-1029, 1165, 1498
Green Enterprise Computing 395
Green Entrepreneurial Orientation 1137-1138

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

green entrepreneurship 1136-1138, 1142-1143, 1153-1154
Green Environment 708, 718, 1421, 1449
Green Finance 258, 783, 796
Green Gap 17-18, 20, 22-28, 34
Green Growth 328-331, 335-337, 339-342, 386, 1286, 1298-1299, 1631, 1638-1641, 1649, 1660, 1662-1663, 1682, 1685
Green Hotels 513, 521-523, 529, 838, 840, 843-844, 846, 849-850, 852-853, 1049, 1581
Green Index 708, 721, 723-724, 1449
Green Industry 385, 390, 394, 1580
Green Innovation 276, 284, 292, 388, 496, 503, 673, 733-736, 743, 871, 1010, 1012-1014, 1032-1033, 1035-1037, 1039-1042, 1137, 1139, 1286
Green Investments 781-788, 791-794, 796, 1246, 1630-1631, 1633, 1635, 1653, 1655
Green IS 75, 147, 192, 244, 246, 258, 464, 467, 524, 566, 572-573, 579, 625-630, 634-635, 637, 642, 708, 732, 752, 754-757, 764, 770-773, 873, 1234, 1330, 1386-1390, 1392-1400, 1403, 1405-1408, 1420, 1423, 1529, 1630
Green IT 88-89, 91-93, 96, 101, 103, 105, 123, 232-240, 242-250, 256-259, 262-263, 266-269, 273, 365-369, 373-375, 395, 410, 413, 428, 565-569, 571-572, 579, 625-628, 630, 666, 672-673, 681, 752, 754-757, 760, 764, 768, 770-773, 1037, 1091-1095, 1097-1100, 1102, 1233-1237, 1239-1241, 1285-1290, 1294, 1296, 1298-1300, 1387-1388, 1397-1398, 1403, 1407, 1430-1431, 1591-1594, 1596-1598, 1603-1605, 1609
Green IT Adoption 88-89, 92, 101, 123, 262, 367, 760, 1285-1286, 1288-1290, 1300
Green IT Alignment 232-234, 236-240, 242-250
Green IT Enablers 365, 374-375
Green Jobs 330, 341-342, 1660, 1665, 1681, 1685
Green Lifestyle 25-27, 269, 1197, 1449
Green Logistics 471-472, 1245, 1420-1421, 1425-1428, 1433-1436, 1467, 1530, 1613
Green Logistics Solutions 1420, 1425-1426, 1436
Green Maintenance 720, 722
Green Market 208, 463, 465, 467, 475, 477, 479, 482, 484, 492-493, 501-502, 518, 831-832, 1035, 1138, 1195-1196, 1201-1202, 1215, 1513
Green Marketing 181-182, 185-190, 192-200, 202, 204, 207, 222-224, 388, 463-466, 468, 472-473, 475-477, 479-480, 484-487, 489-496, 498-503, 511-513, 515, 517-520, 523-525, 529, 797-806, 809-815, 821-824, 831-832, 846, 950-952, 955-956, 958-959, 1032, 1034-1035, 1043, 1048-1051, 1064, 1066, 1175, 1179, 1217, 1423-1424, 1444-1451, 1453, 1456-1457, 1463, 1511, 1523-1532, 1535-1537, 1611-1613, 1615-1623, 1661
Green Marketing Mix 502, 518, 1463, 1526, 1530, 1611-1613, 1616, 1619, 1621, 1623
Green Marketing Orientation 1616-1617, 1620-1621, 1623
Green Marketing Strategy 195, 492-495, 500, 502, 803-804, 1445, 1453, 1463
Green Mindfulness 415, 421, 423, 426, 432-433
Green Network 389-391, 394
Green Organizations 146, 467, 473, 484, 486
Green Packaging 534, 743, 869, 1219, 1247, 1258, 1314-1315, 1333, 1424, 1498, 1507
Green People 1511, 1522
Green Performance 277, 348, 486, 581, 587-588, 593, 595, 743, 870, 992-993, 1001, 1004, 1007, 1136-1143, 1145, 1148-1154, 1223, 1288, 1306, 1316, 1420, 1426, 1435-1436, 1468, 1548, 1660, 1663, 1675
green performance indicators 1420, 1435
Green Practices 75, 91, 127, 132-133, 145-147, 238, 240, 258, 283-285, 347-348, 350, 357, 385-386, 512, 518, 520-523, 534, 565, 629, 731, 736, 743, 754-755, 759, 761, 763, 766-767, 772-773, 798, 814, 822-824, 839-840, 842-843, 847-850, 853, 859, 865-866, 869-871, 887, 967, 990-994, 1003-1006, 1023, 1050-1051, 1065, 1217, 1220, 1250, 1252-1255, 1261, 1263-1264, 1310, 1319, 1422, 1425, 1465-1470, 1491, 1494, 1500-1501, 1545, 1550, 1559, 1592
Green Price 471, 832
green proactiveness orientation 1139
Green Procurement 97, 169, 276, 284, 346-350, 357-358, 530-536, 544, 548, 550, 555, 557-559, 884-894, 899, 1007, 1181, 1248, 1258, 1264, 1464-1470, 1476, 1479, 1487, 1491-1492, 1496, 1499, 1507, 1544, 1613
Green Procurement Practices 346-350, 357-358, 531, 533-536, 544, 550, 555, 557-558, 888, 890-891, 1464-1465, 1468-1470, 1476
Green product design (gpd) 859-860, 869
Green Project 246, 719, 721-722, 1308
Green Promotion 153, 258, 472, 1161, 1507, 1530, 1535
Green Purchase Intention 206, 208-212, 215, 217, 219-223, 230, 1032-1034, 1036-1037, 1039, 1042, 1198-1199, 1537
Green Purchasing 25, 97, 133, 207-208, 213, 217, 220-222, 230, 276, 284, 347, 365, 368, 531, 533-534, 582-584, 759, 845, 848, 865, 875, 888, 1007,

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

1034, 1042, 1198-1199, 1203, 1206, 1211, 1215, 1312, 1314, 1330, 1332, 1372, 1423-1424, 1446, 1465-1467, 1491, 1497, 1522, 1524-1525, 1529
Green Purchasing Behavior 208, 222, 1199, 1206, 1211, 1522, 1524
Green Purchasing Intention 207-208, 213, 217, 221-222, 230, 368
Green Resource 714
Green Retailing 1489, 1491-1493, 1497, 1501, 1507, 1621
Green School Cost 86
Green Schools 71-74, 76-77, 79, 87
Green Self-Efficacy 415, 421, 423, 426, 432-433, 1522
Green Services 517-518, 520, 522-524, 529, 726
Green Specifications 683-685, 688, 692-694, 700-701, 703-706
Green Strategies 283, 468-469, 477, 484, 486, 809, 812, 814, 840, 991, 997-998, 1003, 1154, 1559, 1615
Green Strategy 153, 169-171, 180, 347, 465, 467, 489, 764, 870, 990, 998, 1161, 1181-1183, 1194, 1447, 1465, 1558
Green Strategy Mix 153, 169-171, 180, 1161, 1181-1183, 1194
Green Supplier Selection 861, 1216-1218, 1221, 1548, 1555
Green Supply Chain 92, 97, 125-127, 130-132, 135, 145, 274-279, 281-284, 286, 291-294, 296-297, 300, 302-303, 390, 394, 471, 493, 534, 572, 579, 581-582, 584-590, 592, 595-597, 602-605, 607-611, 614-615, 621, 752, 755, 762, 770, 822, 859-860, 864-865, 867, 870, 967, 1021-1022, 1028, 1034, 1092, 1217, 1223, 1244-1245, 1248, 1251, 1255, 1264, 1306, 1308-1309, 1312-1313, 1317, 1319, 1328-1332, 1335, 1344-1345, 1348, 1350, 1359, 1421-1425, 1446, 1479, 1487, 1489-1491, 1494, 1507, 1545, 1547, 1555, 1571, 1613
Green Supply Chain Management (GSCM) 92, 125-127, 130-135, 143, 145-146, 152, 274-279, 281-286, 291-294, 296-297, 300, 302, 493, 572, 579, 582, 607, 609, 752, 755, 759, 762, 770, 772, 822, 859-861, 864-871, 876, 967, 1021-1022, 1028, 1092, 1217-1218, 1223, 1244-1256, 1258, 1260-1261, 1263-1265, 1306-1312, 1314-1323, 1328-1330, 1332-1333, 1335-1338, 1344-1345, 1348, 1350, 1359, 1421-1423, 1425, 1446, 1490-1491, 1507, 1545, 1547-1548, 1550, 1552, 1554-1561, 1571
Green supply chain management (gsm) 1425
Green Supply Chain Risk Management 1479, 1487
Green Technology 53, 58, 140, 143, 184, 194, 246-247, 276, 279, 367, 381, 412, 642, 664-665, 735, 781-782, 1091, 1332, 1361, 1498, 1584
Green Tourism 838-839, 1572-1574, 1580-1583, 1585-1586
Green Transportation 1308, 1314-1315, 1423, 1498, 1508
Green Trust 167, 1179, 1510, 1512-1513, 1516-1519, 1522
Green-Based Product Innovation 731, 734, 737, 740, 742-743
Greenhouse Gas 126, 130, 232, 256, 491, 530, 567, 593, 597, 664, 668-669, 673, 678, 753, 760, 783, 912, 975, 979, 1247, 1307, 1335-1337, 1360, 1398, 1421, 1430, 1436-1437, 1439, 1499-1500, 1508, 1593, 1616, 1636-1637, 1639, 1650, 1659, 1669-1670, 1679-1680
Greenhouse Gasses Emissions 1660, 1685

H

Hotel Industry 512, 520-525, 838-840, 1512
Huawei 1020-1022, 1026
Hypothesis 56-58, 63, 183, 210-211, 221, 261-262, 294, 301-302, 340, 484, 588, 734, 737, 743, 755, 757-758, 830, 889, 991, 1078-1079, 1081, 1098, 1100, 1197, 1219, 1222-1223, 1232, 1239-1240, 1378-1379, 1435

I

Identified Regulations 260-261, 268-269, 273
Inclusive 77, 87, 282, 329, 331, 340, 417, 442, 449-450, 454, 1035, 1105, 1107-1110, 1114, 1123-1124, 1126, 1514, 1573, 1631, 1650, 1666
India 20, 28, 126, 132, 181-182, 186-187, 199-200, 202, 285, 328-331, 333-339, 341-342, 367, 518, 531, 533, 628, 671-673, 783, 821-824, 826, 830-831, 833, 838, 846, 852, 971-976, 979-980, 989-993, 1002-1004, 1034, 1037, 1039, 1048-1053, 1064-1066, 1093, 1106, 1119, 1124-1125, 1250, 1341, 1344, 1370-1371, 1373-1374, 1376, 1378, 1380, 1490, 1524, 1536, 1591-1593, 1596-1600, 1603-1605
Industrial Symbiosis 42, 1004
Information And Communications Technology 90, 257, 1233

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Information Systems 53, 89, 103, 239, 269, 277, 565-566, 568-573, 579, 593, 603, 606, 608, 624, 733, 756-757, 773, 864, 1100, 1286, 1319, 1386-1387, 1390, 1403, 1446, 1593
Innovative Green Procurement (IGP) 346-349, 357-358, 884-886, 888-894, 899, 1464-1465, 1467-1468, 1476, 1479, 1487
Innovative Green Procurement Performance 884-886, 888-889, 891-893, 899
installation time 1025, 1027-1028
institutional pressure 1010, 1142-1143
institutional uncertainty 1136, 1138, 1141-1145, 1147-1148, 1151-1154
Integrated Regulations 260, 268, 273
Intergenerational Justice 1-2, 4, 16
Internet Of Things 440-441, 450, 454, 602-604, 606, 609
Interpretive Structural Model 134, 369, 1473
Interpretive Structural Modelling (ISM) 125-126, 346, 535, 1464, 1470, 1488
interquartile range 1223-1224, 1232
Introjected Regulations 260-261, 268, 273
Investments 11, 73, 92-94, 98-99, 164, 244, 334-336, 340, 390, 429, 431, 433, 566, 627, 629, 685, 766, 781-788, 791-794, 796, 814, 912, 974, 976, 990-991, 998-999, 1014-1016, 1033, 1105, 1107, 1111-1112, 1114, 1117, 1126-1127, 1169, 1174, 1246, 1253, 1289, 1430, 1630-1631, 1633, 1635, 1649-1650, 1652-1653, 1655, 1661, 1664, 1675-1676
IoT Business Models 441, 450-451, 454
IT Professionals 89, 255, 257, 260-261, 267-269, 588, 1397-1398

K

KobrA 684, 686-693, 695, 697, 706
Kuwait 35-36, 39-40, 42-45, 1093

L

Legislative Authorities 797, 807, 809-810
Legitimacy 624, 1010-1013, 1016, 1112, 1136-1144, 1147, 1149, 1151-1154, 1273, 1275, 1277-1278, 1280
Life Cycle Assessment 277, 279, 465, 643-644, 646, 653, 663, 1022, 1321, 1467-1468
Linear Economy 5-9, 11, 16
Long Term Marketing Performance 731, 734, 736-737, 740, 742-743
Long-Term Orientation 207-208, 210-211, 215, 217, 219, 221-223, 231, 465, 929, 942-943, 955, 1015, 1017
lower electricity consumption 1061, 1064-1066
Lower Ninth Ward 1572-1585

M

maintenance cost 1025, 1028
Malaysia 206, 208-209, 213-215, 222, 285, 385, 390, 628, 657, 752-756, 758-759, 761, 765, 773, 843, 845, 1093, 1510-1512, 1514, 1519
Man-Nature Orientation 207-210, 215, 217, 219, 221-223, 231
Market Penetration 908, 923
Marketing Benefits 1216, 1221, 1224, 1227, 1450
Marketing Environment 192, 196, 204
Marketing Mix 26, 158, 185, 204, 494, 502, 511, 518, 1166, 1444, 1447, 1463, 1526, 1530, 1611-1613, 1616, 1619-1623
Marketing Performance 731, 734, 736-737, 740, 742-743, 1444, 1446-1447, 1449-1451, 1453, 1456-1457, 1463, 1615, 1621
Mars Logistics 1426, 1433
Mathematical Model 907-908, 913, 919
Monetary Value 914-915, 917, 923
Morphological Chart 649, 655-656, 663
Motivating Factors 797, 1497
Multi-Criteria Decision Making 530, 594, 650-651, 1545-1546, 1571
Multiple Regression Analysis 1444, 1451, 1453
Multi-Sided Markets 907-910, 913, 923

N

Natural Fiber 643-644, 648-649, 654, 663
Natural Fibers 651
New Ecological Paradigm (NEP) 22, 841
New Orleans 1572-1581, 1583-1585
Niche Tourism 1572-1575, 1583-1584

O

Objective of the Organization 930
Omsan Logistics 1426, 1432
Online Ordering System 394
Operating Cost 396, 1025, 1028

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

P

Participatory Value Model 443, 454
Perceived Consumer Effectiveness (PCE) 22, 24-25, 34, 1537
Performance Outcomes 72, 285, 292, 733, 755, 759, 766-767, 876
Personal Care Products 1370-1374, 1378, 1380-1381
Power Management 93, 242, 412, 571, 628, 668, 1026, 1287, 1298, 1592
Power Saving 412, 709-710, 724
Premium Price 20, 25, 211, 222, 224, 318, 523, 821, 824, 826, 828-832, 1209
Pre-Test 754, 762, 768
Primary Interest of the Azienda 926-927, 931-933, 935, 937, 943, 949
Product Development 96, 127, 146, 237-238, 243, 245, 248, 284, 295, 421, 431, 493, 533, 583, 606, 609, 643-646, 649, 651, 653, 657, 735, 800, 869, 893, 1021, 1028, 1037, 1319, 1447, 1613, 1619-1620, 1622
Pro-Environmental Consumer Behavior 34
pro-environmental product consumption 1059-1060
Pro-environmentalist 1511
PROMETHEE 652, 1547-1548, 1557, 1559-1561, 1571
Psychological Factors 224, 942, 1386, 1388-1389, 1399, 1406
Purchase Behavior 208, 212, 736, 821-826, 828-830, 832-833, 1035-1036, 1042, 1199, 1370-1374, 1378-1379, 1523, 1531, 1536, 1544

Q

Qualitative Study 90, 1264
Quantitative Analysis 580, 1094
Quiet Computing 679

R

Raw Materials 1, 4, 6-7, 9, 11, 16, 146, 161, 275, 279, 349, 380, 388, 479, 491, 514, 582-583, 593, 653, 671, 763, 813, 864, 875, 1114, 1120, 1167, 1170, 1218-1219, 1247, 1249, 1308, 1330, 1446, 1457, 1469, 1530, 1661, 1664
Rebound Effect 633, 642, 910
Recyclable Products 664, 1055, 1448
Regression Analysis 147, 821, 828-829, 884, 892, 1147, 1149, 1206, 1444, 1451, 1453
Reliability 22, 26, 59-62, 95, 100, 103-104, 154, 184, 202, 217, 239, 265-266, 299-300, 319-320, 581, 587, 676, 699, 707-708, 738-739, 753-754, 761, 768-770, 773, 786, 788, 827, 872, 876, 884, 887, 892, 1039, 1071, 1073-1076, 1080-1082, 1084, 1095, 1146-1148, 1162, 1222-1223, 1232, 1236, 1370, 1372, 1375, 1378, 1449, 1456, 1494, 1512
Resilience 1-2, 10-11, 16, 1652
Resource Allocation 404, 407, 709, 1364
Resource Dependence Theory 127, 346, 348, 1464-1465, 1468, 1479
Resource Efficiency 35-36, 38, 43, 45, 50, 385, 394, 410, 760, 782, 796, 909, 1006, 1195, 1287, 1632, 1635
Resource-Based View 259, 293, 1277
Return on Asset (ROA) 1359
Reverse Logistics 275-279, 283-284, 533, 609, 759, 866-867, 870, 1245, 1249, 1308, 1330, 1332, 1335, 1359, 1423-1424, 1457, 1491-1492, 1495-1496, 1500-1501, 1508, 1547
Risk-based strategy 282
Risks 52, 96-97, 99-101, 103-104, 106-107, 145, 147, 162, 258, 292, 348-349, 358, 477, 582, 585, 630-631, 766, 784, 873, 875-876, 912, 990, 992-993, 1002-1003, 1005, 1011-1012, 1014-1015, 1049, 1109, 1114, 1123, 1172, 1209, 1235, 1391, 1396, 1405, 1421, 1423, 1425, 1429, 1439, 1465, 1468-1469, 1479, 1487, 1547, 1584-1585, 1597, 1604, 1609, 1661, 1664-1665

S

School Environment 72, 74, 87
Self-Determination Theory 255-256, 260, 268-269, 273
Selling 44, 72, 193, 243, 282, 425, 472, 479, 492, 519, 671-672, 768, 773, 806, 863, 887, 923, 971-972, 1007, 1065, 1278, 1496, 1513, 1526
Service Marketing Mix 204
Service Quality 276, 284, 521, 724, 1071-1075, 1082-1084, 1086, 1425
Shared Value 98, 101, 310-312, 314-323, 441, 454, 1105-1109, 1112-1117, 1119-1120, 1122-1127, 1135, 1272-1276, 1279-1280, 1436
Sharing Economy 38, 907-913, 917-919, 923
Simulation 465, 479, 481-484, 486, 605, 611, 614-615, 646, 760, 1366
social economy 1198, 1200, 1215
Social Responsibility 2, 7, 11, 50, 54-55, 57, 145, 158, 164, 168, 193, 196-198, 204, 233, 237, 280, 285, 303, 312, 315-323, 365, 382, 390, 428, 469, 489, 492-493, 501, 511, 518, 521, 533-534, 568, 588-589, 665, 732, 736, 758, 765, 781, 796, 798, 810-811, 824, 952, 964-965, 976, 1014, 1020,

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

1023, 1035, 1072, 1105-1106, 1109, 1111, 1122, 1135-1137, 1143, 1153, 1166, 1176, 1180, 1197, 1215, 1219, 1235, 1272-1275, 1310, 1321, 1421, 1428, 1445, 1525, 1535-1537, 1544, 1546, 1613, 1655, 1663
Social Sustainability 105, 328, 341, 521, 1273, 1329, 1390
social values 1108
social-normalisation theory 1048, 1050, 1060, 1066
Societal Value 909, 924, 1110, 1116
Socio-Efficiency 1544
Solar Computing 678
Strategic Alignment 232-237, 239-240, 244, 246, 248, 1109
Strategic Orientation 278, 293, 296, 301-303
Structural Equation Model 156, 375, 870, 1037, 1164, 1216, 1223-1224
Structural Equation Modeling (SEM) 49, 51, 59, 63, 206, 213, 215-216, 231, 264, 568, 731, 738, 740, 785-787, 790, 1039, 1081, 1083, 1223-1224, 1232, 1476, 1479
Structural View 689-690, 693-697, 701, 703-704, 706
Supplier Relationship 97, 105, 143, 146, 347-348, 1332, 1465
Supply chain (sc) 859-860
Supply Chain Management (Scm) 245, 274, 292, 493, 603, 754-755, 860, 864, 1245, 1308, 1329-1330
Sustainable Consumption (SC) 38, 153, 158, 160-161, 180, 207, 220, 491, 503, 533, 625, 1161, 1166, 1169-1170, 1172, 1174, 1194-1199, 1215, 1523-1525, 1527-1530, 1544, 1618, 1635
Sustainable Development 1-4, 7, 10-11, 16-17, 37-38, 41-42, 44, 153, 158-159, 164, 168, 180, 184, 193-194, 209, 258, 328, 366, 414, 469-470, 489, 491, 520, 531, 534, 610, 624-625, 631, 732-733, 782, 796, 807, 811, 822-824, 839, 875, 924, 965, 967, 976, 1007, 1105, 1108, 1123-1127, 1135, 1137, 1161, 1166-1167, 1169, 1173, 1176, 1180, 1194, 1244-1245, 1272-1273, 1278, 1315, 1334, 1387, 1390, 1399, 1448-1449, 1489, 1497, 1524-1528, 1535, 1537, 1544, 1574, 1579, 1582-1584, 1593, 1615, 1630-1632, 1634-1635, 1641, 1649, 1653-1654, 1660-1661, 1663, 1665, 1685
Sustainable IT 1593, 1598
Sustainable Marketing 192, 194-195, 199, 202, 204, 520, 802, 809, 1445, 1463, 1536, 1617
Sustainable Strategies 573, 579, 803
Sustainable Supply Chain 291, 295, 347, 860, 1245, 1251, 1308, 1465
Sustained Competitive Advantages 737, 740, 742-743, 991

T

Taiwan 39, 211, 237, 250, 285, 297, 299, 580, 588-589, 597, 736, 1332, 1341, 1519
Taxi Ridesharing 907-909, 911-914, 916, 918, 924
Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) 1387
Techniques for Sustainability 579
Technology Adoption 90, 92, 94, 140, 143, 237, 1319, 1332, 1386, 1392, 1405
Telecommunication 571, 1020-1023, 1029, 1361
Theory Building 535, 548
Timeliness 49, 51, 53-55, 58-59, 62-63, 66, 103
TOPSIS 650, 652, 1387, 1400, 1403, 1405-1407, 1547-1548, 1550, 1552, 1555, 1559-1561, 1571
Total Interpretive Structural Modeling (TISM) 535
Tourism 94, 520-523, 732, 838-839, 841-842, 853, 1203, 1337, 1572-1575, 1579-1586
Transformational Leadership 415, 421-422, 426, 431-433
transitional economy 1138, 1141-1143, 1153-1154
Turkey 20, 211, 1336-1337, 1341, 1344, 1420-1421, 1424-1426, 1431-1435, 1439-1440, 1444, 1446, 1451, 1453, 1463
Turkish companies 1256-1258, 1260-1261
Two-sided Market 913, 919
Typology 379-381, 386, 388-389, 394, 473

U

Undernourishment 1650, 1659
United Arab Emirates 1306-1312, 1316-1317, 1322
UTAUT 49, 51, 53-55, 59, 1072, 1074-1075, 1079, 1086

V

Valorization Model 310-312, 314, 318-319, 321-322
Value Allocation 917, 919, 924
Value Appropriation 910, 917, 924, 1115-1116
Value Chain 5, 248, 297, 311-314, 316-322, 614, 642, 965, 969-971, 978-981, 984, 1105-1108, 1113-1114, 1119, 1124, 1135, 1276, 1390, 1429, 1499, 1507, 1526, 1612, 1616-1617
Value Co-Creation 321, 441, 447, 452, 454, 1109, 1272-1274, 1276-1281

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use

Value Creation 97, 101, 146, 250, 297, 310-313, 315-317, 319-321, 358, 423, 425, 440-443, 447, 449-451, 454, 811, 907-911, 913, 915-916, 918-919, 923, 925-926, 928-929, 933-934, 936-943, 949, 967, 989, 1105, 1108-1109, 1112-1113, 1115-1117, 1120, 1124, 1126, 1245, 1273-1278, 1280, 1618, 1621
Video on Demand 683-684, 706
VIKOR 652, 1547-1548, 1555, 1559-1561, 1571
Virtualization 89, 91, 93, 100, 106, 234, 396, 401-404, 411, 571, 628, 666-667, 679, 685, 707, 768, 1091, 1234, 1287, 1299, 1361-1362, 1364, 1594

W

Waste Management 7-8, 37, 52, 91, 275-276, 279-280, 284, 520, 782, 812, 844, 852, 867-868, 873, 975, 978, 1003, 1006, 1247, 1253, 1307-1308, 1312-1313, 1315, 1335, 1337, 1431, 1433, 1439, 1491-1492, 1494-1495, 1501, 1508, 1536, 1676, 1681
Watermarking 690, 698, 702-703, 706
Willingness To Pay 169, 172, 183, 522, 798, 824, 840-841, 843, 845, 848-850, 852-853, 1181, 1184, 1205, 1208, 1211, 1252, 1370, 1372, 1374, 1378, 1380, 1496

EBSCOhost - printed on 2/8/2023 8:31 PM via . All use subject to https://www.ebsco.com/terms-of-use