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Managerial Issues in Digital Transformation of Global Modern Corporations

Thangasamy Esakki

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A volume in the Advances in Logistics, Operations, and Management Science (ALOMS) Book Series

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

Library of Congress Cataloging-in-Publication Data

Names: Esakki, Thangasamy, 1970- editor.
Title: Managerial issues in digital transformation of global modern corporations / Thangasamy Esakki, editor.
Description: Hershey, PA : Business Science Reference, [2020] | Includes bibliographical references and index. | Summary: “”This book explores the prospects and challenges of the digital transformation of modern business corporations during the process of transition from the outdated business endeavors to the updated ones”--Provided by publisher”--Provided by publisher.
Identifiers: LCCN 2019039214 (print) | LCCN 2019039215 (ebook) | ISBN 9781799824022 (hardcover) | ISBN 9781799824039 (paperback) | ISBN 9781799824046 (ebook)
Subjects: LCSH: Information technology--Economic aspects. | Information technology--Management.
Classification: LCC HC79.I55 M3585 2020 (print) | LCC HC79.I55 (ebook) | DDC 658/.05--dc23
LC record available at https://lccn.loc.gov/2019039214
LC ebook record available at https://lccn.loc.gov/2019039215

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

All work contributed to this book is new, previously-unpublished material. 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.

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John Wang
Montclair State University, USA

ISSN:2327-350X
EISSN:2327-3518

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Business Science Reference • © 2021 • 374pp • H/C (ISBN: 9781799869481) • US $215.00

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701 East Chocolate Avenue, Hershey, PA 17033, USA
Tel: 717-533-8845 x100 • Fax: 717-533-8661
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The Czech Republic has experienced tremendous growth over the last three decades. However, as the previously exploited competitive advantages (e.g., low labour cost) lose growth potential, the country has to address the digital economy sector. The digital economy readiness study analyses and merges findings from the European and OECD databases, outlining the current situation in the country. Also, the study compares the skill set supplied by the Czech workforce with the global market situation. Research areas cover analysis of diverse factors such as age, education, gender, and nationality. Study results show that the Czech Republic has a substantial competitive advantage both within the EU and across OECD thanks to its highly skilled workforce. Hence, ongoing digital transformation gives a positive outlook for further development of the Czech digital economy.

The banking environment has become highly competitive today. The banking sector is undergoing the process of radical transformation due to excessive competition of foreign and private players and changes in tastes, preference, and habits as well as expectations of customers for newer products. India has a diversified financial sector undergoing rapid expansion, both in terms of strong growth of existing financial services firms and new entities entering the market. The Government of India has introduced several reforms to liberalise, regulate, and enhance this industry. The Government and Reserve Bank of India (RBI) have taken various measures to facilitate easy access to finance for micro, small, and medium enterprises (MSMEs). Also, the advancements in technology have brought the mobile and internet banking services to the fore. Thus, many banks launched contact-less credit and debit cards in the market. These types of cards, which used to near field communication (NFC) mechanism, allowed customers to transact without having to insert or swipe.

Modern world digitalization is inevitable. The role of digitalization in the banking sector has altered customers' preferences and demands. The latest innovation and developments in the digital era have affected the banking industry and the effects on the relationship between customers and banks. The banks' new digital focus has to be aligned with other factors in the banks for them to function effectively. The purpose of this study is to investigate how the banks' relationship with customers is affected by this digital focus. It indicates that the relationship with customers has become less personalized and more automated. It also shows that an alignment in the bank has contributed to increased satisfaction among digitally oriented customers.

This study aims to advance studies on open innovation, digital technologies, and institutional infrastructures by building on extant research in the field. Most research to date focused on digital technologies and digital affordances, while institutional infrastructures and affordances are less explored. To provide a background for such an approach, this study identifies and integrates two major issues—technological affordances and institutional affordances—that enable or constrain open innovation practices within firms. The framework developed indicates that the degree of openness of the innovation practices is related to the availability of digital technologies and institutional infrastructures in a specific context and the practices of incumbent firms in mobilizing these structures.

Globally, the developmental process primarily originates from creative and innovative thinking of an individual. Undoubtedly, higher education promotes the academic quality and research in a country. In order to disseminate knowledge to the aspirants in educational and research institutions, the information and technology has been put to use widely across the world. The digital transformation gained importance in the field of education to accelerate the wheels of world economy. During its period of transition, there are multifarious managerial issues. They ought to be tackled prudently by the government or policymakers. Otherwise, digital transformation in higher education can never be considered as a boom but bane. Hence, it necessitates an efficient management for yielding better fruits. The current study has been undertaken to examine the Indian digital initiatives in the higher education system, identify the crucial managerial issues, and suggest remedies for improvement of the Indian higher education system via digital transformation.

Digital transformation is one of the critical drivers of change in aviation as in many areas. Aviation operations are always aimed to be carried out with a high degree of safety and security standards. Efficient aircraft maintenance management makes a significant contribution to meeting these standards. The digital revolution offers excellent opportunities for safety, reliability, and efficiency advancement for aviation continuing airworthiness. This chapter provides a basic overview of aircraft maintenance processes and highlights some of the maintenance management issues. This chapter addresses some of the industry 4.0 technologies that have been tested for use or currently used in aircraft maintenance operations and discusses the impact of these technologies on current management problems. Consequently, this chapter is expected to present useful information and comments for the aircraft maintenance community, including managers and professionals, and encourage them to think about other possible innovations beneficial to their processes.

Like many other industries, the maritime industry has started to work on digital transformation due to its many benefits. Port management, which is one of the building blocks of the maritime industry, has also accelerated digital transformation efforts under the leadership of developed ports in the world. Today, conventional port managements are faced with many problems. The complex and dynamic nature of the port environment does not allow these problems to be solved by conventional methods. This chapter introduces how the smart port environment that can be achieved through digitalization efforts of ports can find solutions to existing and potential problems.

The digital economy is growing at unprecedented speed and scale. Digital technologies generate the digital transformation of everything – organizations, industries, society. Digital technologies and digital business models disrupt industries in a digital vortex to a different degree by industry. In the new business context, value creation changes from the classical net present value of discounted cash flow or economic value added. Changes are given mostly by uncertainty. Reconciling classical value with digitalization becomes a research topic – the topic of this chapter. The chapter is a case study on Siemens, a Harvard Business Review case in digitalization, and one of the most important value-based management practitioners in the world, in the view of the economic value added model and in the view of journals indexed in Web of Science. The Siemens case is used to explore how economic value added and digitalization can work together and finds that they do in different stages that follow the logic of the innovation lifecycle.

Machines have emerged as intelligent players and are set to replace skilled practitioners in various fields. So, what would be a leader's contribution be if machines do the decision making? The chapter addresses this question by proposing that artificial intelligence will act as a catalyst enabling managers and leaders in the process of knowledge management. Further, the chapter aims to bring together the three constructs of leadership, artificial intelligence, and knowledge management and try to theoretically establish a relationship among them. The work is immensely relevant to the Indian context given the fact that at its current stage of development, artificial intelligence has the potential to add $957 billion to the country's economy by 2035. Thus, the chapter will emphasize the relationship between leadership and artificial intelligence and how it supports knowledge management in organizations and influences its everyday decision making.

The COVID-19 pandemic has amplified the influence of digital transformation on business entities. Although it is becoming more feasible to invest in digital technologies due to their swift progression in terms of reaching higher technical capabilities and better pricing levels, some companies could not achieve expected improvements in their business results. On the contrary, a remarkable number of companies had the opportunity to develop their businesses by leaps and bounds. Academic research on the subject revealed that a company's digital maturity level is directly related to the company's success and progress in sustainability issues. In this chapter, the concepts of cross-functional collaboration and corporate digital cultures, which are the basic components of achieving digital maturity, which must be coordinated together, are elaborated, and an applicable roadmap proposal is created.

Many tasks that require human intelligence to perform changed to being executed by artificial intelligence such as voice recognition, image recognition, and various predictions. This study investigates how adopting AI-based technologies could redefine leadership roles and identify the gap of critical leadership competencies of AI-based technologies in Oman's public sector. The study used secondary data sources of four Omani ministries. The results confirm that the work of the leaders in Oman's public sector focuses more on administrative coordination, control, developing strategies, and problem solving. On the other hand, there is little attention given to innovation and focusing on developing people. AI-based technologies enhance leader performance and productivity in many areas such as mindful tech-savvy humanist, fostering systemic intelligence, building trust and innovation, developing creative capabilities, fostering leadership skills, enhancing strategic thinking skills, managing uncertainty, and having creative foresight.

In this chapter, the authors proposed background modeling and subtraction-based methods for moving vehicle detection in traffic video using a novel texture descriptor called Modified Spatially eXtended Center Symmetric Local Binary Pattern (Modified SXCS-LBP) descriptor. The XCS-LBP texture descriptor is sensitive to noise because in order to generate binary code, the value of center pixel value is used as the threshold directly, and it does not consider temporal motion information. In order to solve this problem, this chapter proposed a novel texture descriptor called Modified SXCS-LBP descriptor for moving vehicle detection based on background modeling and subtraction. The proposed descriptor is robust against noise, illumination variation, and able to detect slow moving vehicles because it considers both spatial and temporal moving information. The evaluation is carried out using precision and recall metric, which is obtained using experiments conducted on popular dataset such as BMC dataset. The experimental result shows that the method outperforms existing methods.

Preface

In this digital era, the corporates of diverse sectors have constantly been undergoing a transition from their traditional mode of business operations and management to the modern and technology-oriented ways. It is, therefore, imperative for all the business enterprises to deliver a good digital business experience to their customers and employees as well. This inevitable shift of business operations to the modern processes compels the use of innovative digital business applications by those business concerns. As an outcome, lowering the cost of its operations and enhancement of the customers' experience or satisfaction become the core objective of digital transformation.

In order to grow and remain competitive in today's global business market of the organization, efficient management of managerial tasks by capable managers is very essential. As a whole, for the organizational success, playing multifarious managerial roles, encompassing the most common managerial issues viz; time management, delegating tasks, taking time for team, proper goal planning and personality in a workplace, is crucial. An effective management may, therefore, either make or break the entire organizational set up gradually that largely depends upon the managerial competence for adaptability to the dynamic business environment. In other words, it may be said that there is a challenging task of adaptation to meet the dynamic changes of market forces to avoid extinction or failure of the organization. Under this circumstance, keeping in view the internal and external business environment, the business corporates ought to make a business analysis taking into consideration their strengths, weaknesses, opportunities and threats. Hence, innovative ways of business operations will be felt necessary in order to capitalize the business opportunities by ensuring optimal profitability to the business enterprises through maximising the consumers' satisfaction. Even, the institutions rendering the educational and financial services are an exception on this front.

In this context, digital transformation enables such organizations or institutions to better compete with their global counterparts in commensurate with the changing in technological advancements. It supports the digitalization of the organization for shaping the modern customers' expectations worldwide. However, there is no single application or technology that leads to digital transition. The technical-knowhow involves a multiple key processes like cloud computing, commoditized information technology, block chain, augmented reality, social media, robust data programs, artificial intelligence, Internet of Things (IoT) and so on. While extending the benefits to the organization, it is also being witnessed that the updated digital revolutionary approach poses in numerous challenges which are very simple, rather simply complex, owing to its herculean task of replacement of the outdated traditional ones. In the process of such transitions, many firms and institutions find it very difficult to acquire efficient manpower such as qualified leadership, IT personnel with adequate knowledge and competence to lubricate their wheels of success. Without integrating the dual edges of managerial competence and digital evolution, it is next to impossible to any firm for its survival and growth subsequently. For the purpose, it emphasizes the need for a good supply chain management, appropriate organizational culture and structure for serving their stakeholders in the organization perpetually for a longer time. There have been many research studies being undertaken from every nook and corner of the world. However, the concept of digitalization is not static but rather it is dynamic in nature. It, therefore, needs constant updations and innovations in digitalisation process becomes inevitable to ensure conducive environment for survival and growth, be it an individual or business. Last but not the least, this nascent trend of digitalization in trade and commerce, including the educational system, necessitates a need for an edited collection of original researches on *Managerial Issues in Digital Transformation of Global Modern Corporations.*

OBJECTIVE OF THE BOOK

This book is intended to provide relevant theoretical frameworks and the latest empirical research findings on this front. Undoubtedly, because of its scope, relevance and practical applicability, it is expected to stimulate the interest among the academicians, researchers, professionals and entrepreneurs globally to gain deeper insight into the *Managerial issues in Digital Transformation of Global Modern Corporations.* While highlighting the prospects of digital revolution in business, it is also anticipated to apparently throw a light on the challenges involved in digital transformation of the modern business corporations during the process of transition from the outdated business endeavours to the updated ones. The outcome of the current research collections will not only contribute to the existing field of literature in the field of commerce and management but will also possess a practical utility for business entities and financial institutions in reality and thus, the topic of the research fits in the world today.

TARGET AUDIENCE

The target audience of this book consist of academicians, researchers, policymakers, and corporates engaged in the field of commerce and management. The onlookers are also anticipated from various relevant disciplines such as Economics, Information and Technology, Business Administration, Education and Research, and so on. Over and above, this book provides a deeper insight into field of commerce and management in general and extends a positive support to the corporal executives and managers in particular. This will also enable all the profit and non-profit organizations globally to gain additional knowledge on the pertinent managerial issues in digital evolutions.

ORGANISATION OF CHAPTERS

The book is organized into 17 chapters. A brief description of the chapters is as follows:

Chapter 1: Digital Transformation in Business Era

This chapter discusses the role and significance of digital transformation for augmenting the growth of trade and commerce. Over and above, it also improves the comprehension of a common folk by portraying well how well the gap between the potential online buyers and actual buyers is bridged in order to attain the business goals.

Chapter 2: Digital Transformation – Influence on Business Performance in Competitive Milieu

This chapter addresses the influence of digital transformation on the performance of business in the face of acute competition. It further articulates the barriers and obstacles for effective use of the digital technologies and initiatives. Besides, it also explains how such digitalization process entails the birth of a new business venture.

Chapter 3: The Digital Economy Readiness Study – The Czech Republic in European Context

This chapter describes the close nexus between the digital transformation and socio-economic development in the context of Czech Republic in Europe. It focuses on the competitive cost advantages owing to digitalization initiatives undertaken by the respective nations and its impact on European economy.

Chapter 4: Digitalisation and Financial Service Innovation in Banking – A Global Perspective

This chapter presents the digitalization initiatives launched in banking sector and evaluates the effectiveness of their financial services for attaining the broader goals of financial inclusion. It discusses the several reforms introduced and implemented by the Government of India by integrating the digitalization process suitably and beneficially.

Chapter 5: Impact of the Digital Transformation Process on Banks' Relationships With Customers

This chapter reviews the impact of digital transformation process on the performance of banks in terms of customer relations. In addition, it also measures the satisfaction of their customers in respect of pre and post digitalization services provided by such banks, emphasising their degree of relationship with those service rendering banks.

Chapter 6: Prospects, Challenges and Opportunities of Digital Financial Services in Developing Countries

This chapter pinpoints the prospects, challenges and opportunities associated with the digital financial services available worldwide. It identifies the strengths and weaknesses of digitalization and suggests the policy makers with remedial measures to overcome the challenges and formulate appropriate digital business strategies for accomplishing the broader goals of global economy.

Chapter 7: Digital Marketing in the Context of Consumer Privacy – An Insight

This Chapter examines the digital marketing in the context of consumers' privacy. It highlights the digital marketing endeavours and significant influences on the consumers' privacy in terms of exposure of personal information, money, and energy.

Chapter 8: The Transformation of Traditional TVs Into Digital Platforms – Strategic Marketing Analysis on Turkish Market

This chapter examines the digital broadcasting sector in Turkey in the context of strategic marketing management. Notably, it stresses a fact that growing market has increased its growth momentum with the effect of the pandemic has made the digital transformation of traditional TV media platforms in Turkey.

Chapter 9: The Role of Technological and Institutional Affordances in Open Innovation – An Integrative Framework

This chapter, in general, portrays the role of technological and institutional affordability. It indicates that the degree of openness of the innovation practices is concerned with the availability of digital technologies and institutional infrastructures and the practices of all the firms in an industry.

Chapter 10: Indian Digital Transformational Initiatives in Higher Education System – An Analytical Study

This chapter presents the Indian digital transformational initiatives launched by the Government of India in Higher Education System. It, subsequently, identifies the Strengths, Weaknesses, Opportunities and Threats and suggests the remedial measures to enhance the quality of education and research not only to maintain the status quo of developmental process but also to lubricate the wheels of Higher Education vehicle towards a right path of human resources development in India.

Chapter 11: Digital Transformation Approaches for Aircraft Maintenance Operations

This chapter describes the digital transformation approaches for aircraft maintenance operations. It provides a basic overview of aircraft maintenance processes and highlights some of the maintenance management issues. Besides, this chapter also addresses some of the industry 4.0 technologies that have been tested for use or currently used in aircraft maintenance operations.

Chapter 12: Digital Transformation in Port Management – Smart Ports

This Chapter explains the digital transformation in port management. It describes how the complex and dynamic port environment do not allow the problem usually being solved by the conventional methods. It examines how the smart port environment can be conducive for solutions to the existing and potential problems in port management via digital transformation.

Chapter 13: Siemens' Digitalization Strategy in a Value-Based Management Framework

This chapter highlights the Siemens' digitalization in a value-based management framework, having investigated and analysed various variables in depth as a case study. It justifies that the Siemens case can be used to add economic value through digitalization strategy and innovation, in a value-based management framework.

Chapter 14: Artificial Intelligence – The Missing Link Between Leadership and Knowledge Management

This chapter describes the importance of artificial intelligence and analyses the missing link between twin variables, leadership and knowledge management. It discusses the relationship amongst three constructs of leadership, artificial intelligence and knowledge management and its relevance in sound decision making.

Chapter 15: Mind the Gap – It's About Digital Maturity, Not Technology

This chapter focuses on minding the gap stating that it is about digital maturity but not technology. It throws light on the concepts of cross-functional collaboration and corporate digital cultures which are the basic components of achieving digital maturity. It emphasizes a need for coordination and an integrated approach for resolving business-related issues through digital maturity.

Chapter 16: Towards an Artificial Intelligence (AI)-Driven Government in Sultanate of Oman – Transforming and Augmenting Leadership Competencies

This chapter portrays an AI-driven Government in Sultanate of Oman through transformation and augmentation of leadership competencies. It expounds that an AI-based technology enhances a leader's performance and productivity for fostering systemic intelligence, building trust, innovation, developing creative capabilities, imparting leadership skills, enhancing strategic thinking skills, managing uncertainty, and gaining creativity.

Chapter 17: Moving Vehicles Detection in Traffic Video Using Modified SXCS-LBP Texture Descriptor

This chapter presents the background modelling and subtraction-based method for moving vehicles' detection in traffic video using a novel texture descriptor called as Modified Spatially eXtended Center Symmetric Local Binary Pattern (Modified SXCS-LBP) descriptor. It asserts that this innovative method outperforms the existing and prevalent methods.

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Acknowledgment

At the outset, I would like to express my sincere gratitude to all the contributors and reviewers of this book entitled, *Managerial Issues in Digital Transformation of Global Modern Corporations*. Remarkably, I am highly indebted to those contributors who have played dual role of both the contributors and reviewers. Besides, my special thanks also goes to all those who have guided and extended their timely assistance in the review process of this project.

Further, I would like to thank all my colleagues, friends and family members for their constant motivation and moral support. Last but not the least, it is my immense pleasure to convey my thankfulness to the Publishers, IGI Global, and their team for its publication and dissemination of knowledge globally.

Chapter 1
Digital Transformation in Business Era

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ABSTRACT

The chapter offers the roadmap for digital transformation. The aim of the research is to give insight into the fundamental comprehension of digital transformation. This era of increased technological proliferation combined with internet and mobile penetration presents a favorable ecosystem for the development of e-commerce in India. The country is currently at the cusp of a digital revolution. Launch of 4G services and decline in the tariffs of data plans and prices of data cards/USB dongles have reduced the cost of ownership of an effective internet connection and also availability of low-cost smartphones, and the extension of internet and broadband to the remotest corners will boost the augmentation of the internet user base, effectively bridging the gap between potential online buyers and actual buyers. The demographic dividend of the country also seems to encourage and favor the growth of e-commerce. E-commerce is a business online.

INTRODUCTION

Digital transformation has affected all sectors of society, in particular economies. This mostly involves changes in the core business operations and modification of products and processes, as well as organizational structures, as companies ought to set up management practices to conduct these complex transformations. Various new digital technologies like social networks, mobile, big data, the Internet of things, other innovations in form of a chain have developed which has given companies now an opportunity to radically change their business models. Consequently, society overall is facing a radical change due to the development of digital technologies and their extensive implementations of all markets. The Digital India project aims to offer a one-stop-shop for government services that will have the mobile

DOI: 10.4018/978-1-7998-2402-2.ch001

phone as the backbone of its delivery mechanism. With the entry of e-commerce international players such as Amazon and Alibaba, the competition is expected to further intensify as both of these come with deep pockets and the patience to drive the Indian market. E-commerce includes electronic trading of goods, services, and electronic material which has included the handling of purchase transitions and funds transactions and transfer over computer networks. The e-commerce sector has seen unprecedented growth in 2014 where the business has focused to attract investor interest. The growth was driven by rapid technology adoption led by the increasing use of devices such as smartphones and tablets, and access to the internet through broadband, 3G, etc. which led to an increased online consumer base. With mobile apps being developed by most e-Commerce websites, the smartphone is increasingly replacing PCs for online shopping. In 2013, only 10% of the mobile users used smartphones, and only 5% of the e-commerce transactions were made through a mobile device. Most mobile transactions so far are for entertainment, such as booking movie tickets and music downloads. India's overall retail opportunity is substantial and coupled with a demographic dividend i.e. young population, rising standards of living and upwardly mobile middle class, and rising internet penetration, strong growth in e-commerce is expected. E-Travel is the most popular form of e-commerce. Digital marketing", is used synonymously through terms like "internet or web marketing", "e-marketing", "e-commerce", and "e-business". Even though all of these terms are interconnected, a dis-similarity lies there amid all the terms. Moreover, Internet or web marketing mentions the advertising of services and goods using the internet demanding a real-time live internet connection (Yasmin, et al., 2015). On the other hand, the term E-business is used in a wide range of extent and pacts with the utilization of updated technology concerning the internal procedure of business as well as business dealings with the third party. Digital marketing is also known as online marketing, internet marketing, or web marketing. In digital marketing, digital technologies are used to marketing products and services. (P.Satya 2015) explains its popularity in certain countries like the USA where online marketing is common, web marketing in Italy, and after 2013 digital marketing is come to know in the UK and worldwide. (Khosla and Kumar 2017) in their analytical report mentioned that some expected trends to come in near future in e-commerce. E-commerce can be grown in a niche business, merge, capture more rural markets, grow in internet marketing, digital payment mode, and supply chain management. E-commerce is a part of E-business and depicts its side of commerce also e-marketing which comprises its side of marketing. Furthermore, the term E-marketing too recognized as "electronic marketing" creates a practice of both digital and internet technologies as well as includes the advertising of goods or services over automated ways and means or mass media. With the help of the internet, companies can market their products and services by using smart devices like tablets, smartphones, T.V. social media, e-mail. (Mc Kinsey 2020) defines digital transformation as an effort to enable the existing business model by integrating advanced technologies. In addition, E-marketing is also interpreted as an exercise of applying digital technology together with information technology in an attempt to complete the procedures of marketing which comprise formation, communication, and distribution of worth to consumers as well as manage consumer relationships. Internet marketing is a subset of e-commerce with new technology. Marketers not only advertise the product but also create new business opportunities. Digital marketing is more cost-efficient for marketing businesses. Digital marketing is changing the brand position, pricing, and attract customers. The commercial side of Selling and buying through the internet is reflected by the term "E-Commerce" and also the term includes the monetary businesses applying electronic media.

OBJECTIVES OF THE RESEARCH

- This paper has aimed to demonstrate the current state of academic research in digital business transformation and to give a broad understanding of the definition of digital transformation.
- The main purpose of this paper is to recognize the usefulness of digital marketing in the competitive market.
- To identify and study the various Digital Marketing tools used by top companies/Digital marketing and also the role that Digital Marketing plays in growth and development in the economy of India.

REVIEW OF LITERATURE

Andrienko(2020)e-Commerce has increased significantly in coronavirus predicament because of virus people prefer buying from home search s e-Commerce last Walmart is one of the biggest e-commerce players.

Andrew Annacone (2019) digital technology is enabling radically new ways to deliver values to customers, altering the competitive landscape, and changing the underlying economies of the market.

Paul, et al. (2018), Nowadays' society is driven through digital technology. There are many places in the world where people may not get pure water to drink but they have their smartphones. This is why most people are very comfortable with online marketing. One more implausible stimulus on the lives of people, at the moment, is digital marketing. Furthermore, digital marketing affects the interactions of people, habits, work, and purchases.

Todor, (2016), Digital marketing which is also known as Internet marketing has been defined merely as "achieving marketing objectives through applying digital technologies". Moreover, Digital marketing is the usage of expertise and methods for assisting the activities of marketing in an attempt to develop the knowledge of customers by way of matching their requirements. In India, the significance of digital marketing and the way digital marketing affect the consumer has been realized by serval business organization. This is why numerous business organizations to be successful go for the combination of online approaches with traditional approaches to meet the requirements of consumers more exactly.

Alavi, (2016), To increase the traffic approach of the business organization, Digital Marketing is the most influential method. On the other hand, in terms of the corporate world, Digital Marketing is observed as the utmost extensively used marketing and advertising aid that has a habit of leaving the outmoded styles of marketing. Traditional styles of marketing allow an organization to reach some limited audiences, whereas digital marketing permits the organization to reach wide-reaching marketing as several cities are there, where the inhabitants do not partake in up-to-date facilities, but they have their smartphones. This is why several companies are getting conscious about utilizing the digital platform to enlarge their approach to the brand.

Fernandes and Vidyasagar, (2015), various types of Social media such as Facebook, WhatsApp have unlocked the gateway of businesses to interconnect with masses of individuals about goods and services as well as has unlocked the opportunities of new marketing in context to the extensive area of the market. Only when the managers of the various organization are fully aware of practicing the new strategies for interaction to attract the consumers toward their organization, the successful implementation of the digital marketing strategy will be possible. Furthermore, the Marketing expert must understand the campaigns of online social marketing also programs as well as comprehend the way to do it successfully with the indicators of measuring the performance.

Dasgupta, and Ghatge, (2015), Digital marketing is a large parasol below which both the technical and the non-technical services to make an upsurge of popularity by way of the internet, are sheltered. Nowadays, the IT industry has generated a wide range of job roles for persons to pursue occupations and exhibit their capacities. Moreover, it yields specialists from the various field such as web development, web designing, artists, brand consultants, social media consultants, graphic designer, content writers, etc. to derive together and co-operatively work in the direction of making a graphic illustration of notions, which are not very tough to plant into the attentions of the audience. Unlike the rapid growth of the industry, the demand for inventive specialists in the arena is increasing, as well as making more occupation in India then creating India a center for IT activities.

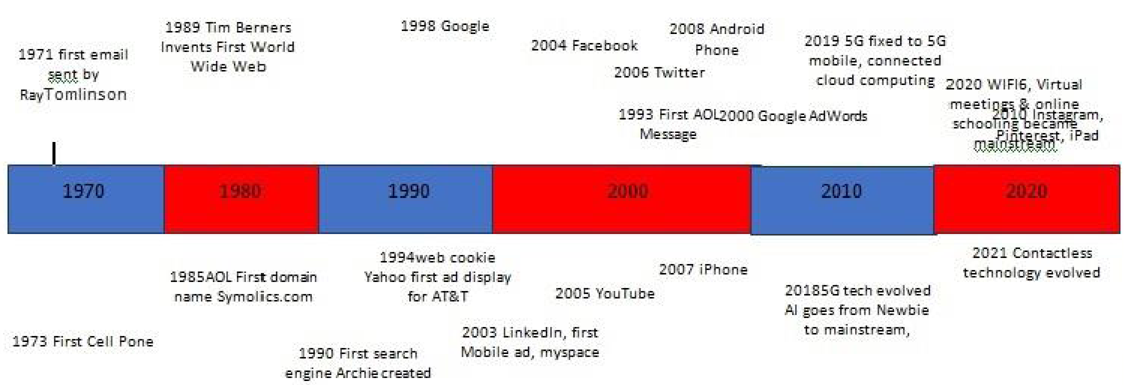
Don Schultz (2008), IMC is a strategic business process used to plan, develop, execute and evaluate coordinated, measurable, persuasive brand communication programs over time with consumers, customers, prospects, and other targeted, relevant external and internal audiences. **Duncan & Caywood, (1996),** who believe that although the concept of IMC is not new, the fact that previously marketing communication was not coordinated strategically and strategy is now believed critical, give this concept a new look.

Zhang and Mao (2008) mentioned two findings of the consequence of trust in mobile massages that send to customers:*Recognizing ease of use and psychological disposition have significant influence in trust for advertisement which declared by mobile device.*Trust increases behavioral intention in accepting SMS ads directly and indirectly to increase the usefulness of massages that contains advertisement

Kliatchko (2005) reflects the same concept. As per the author, IMC is the concept and process of strategically managing audience-focused, channel-centered, and results-driven brand communication programs over time. This definition is a bit more specific and along with strategy and accountability, it emphasizes specifically on communication being channel-centered and audience-focused. Managing and coordinating the integration of the company`s communication across different media and channels is an important aspect of IMC.

- 1969: The first digital message transmitted over the network, on 29 October 1969, travelled from a Sigma 7 computer at the University of California, Los Angeles (UCLA) to an SDS 940 Host

Figure 1. A picture or phases of digital transformation



computer at the Stanford Research Institute (SRI), in Menlo Park, California. The system crashed mid-message, but the internet was born that day.

- 1970: It was just the beginning of a revolution as the first-ever email was sent by Ray Tomlinson (a programmer).
- 1975: Birth of Microsoft corporation
- 1990: The term Digital Marketing was first used after the launch of the world's first search engine known as – Archie that allowed people to find specific files.
- 1994: Yahoo was launched and then Yahoo Web search Google was launched, followed by the introduction of search engine marketing.
- 2000: Pay per click (PPC) advertising was launched. Google launched Google AdWords (which is based on a PPC model)
- 2003: Anybody can create any type of website with the release of WordPress – personal website, a government website, blogs, etc. LinkedIn was launched which changed the professional networking landscape. Myspace was launched – which went on to become the largest social networking site in the world (from 2005 to 2008) before Facebook started dominating the scene.
- 2004: Facebook – Facebook was a revolution in itself. The biggest social media platform – was launched. Also, Yelp was founded in 2004, and the Yelp website and mobile application enables people to publish reviews about businesses online and helps to access and read reviews posted by other people. In the current scenario, posting reviews and getting paid for it has become a form of affiliate marketing (a subtype of digital marketing).
- 2005: Currently the biggest video streaming platform YouTube had been launched in the world that has made advertising very easy where both the advertiser and the video producer earn money through it. SEO – Search Engine optimization came into the picture which is the use of certain keywords strategically to improve "organic" results (unpaid results). Google Analytics is a service offered by Google which helps business owners to track and analyze website traffic, measure Advertising ROI and track social networking sites and different apps. 2006: Twitter was launched as a microblogging and social networking service. Twitter advertising includes the promotion of posts, accounts, and also promoting trends using hashtags which can make a trend go viral
- 2007: Microblogging and social networking site – Tumblr was launched that had allowed users to create blogs (which can also act as advertising platforms). The first iPhone was launched which took the mobile industry by storm and Apple had sold over a million iPhones in less than 3 months. Facebook Ads was introduced which was a system that helped business owners connect with their users and they could choose a very specific audience to advertise their products. In India, Flipkart was launched which took the E-commerce sector of India by storm and changed the face of the E-commerce industry in India.
- 2008: Spotify was launched where the internet overtakes newspapers as an outlet of news.
- 2009: WhatsApp was launched, which is currently used worldwide by most people to connect with their friends and family. It also has an option to create a business account. It has become the platform where businesses can advertise their services and more importantly can be used to communicate with their clients and prospects.
- 2010: Instagram was launched which is usually the go-to for new businesses to create brand awareness by creating a business account and posting content related to their niche and also advertise their products and services online in the current scenario. Internet ads surpassed newspaper ads.

- 2011: An online networking site Google+ was launched by Google which is now not in use and has been shut down. Snapchat was launched where businessmen don't often use Snapchat as an advertising option unless they tie-up with influencers to do so, but still Instagram is preferred as a better platform to connect with influencers for advertising.
- 2012: The use of Visual content marketing and infographics increased.
- 2013: Facebook acquires WhatsApp
- 2014: Mobile users surpass Desktop users.
- 2015: Rise of wearable technology (like fitness bands)
- 2017: Facebook reaches a milestone with 2 billion users.
- 2018: 5G Technology evolved blockchain; Artificial Intelligence goes from newbie to mainstream.
- 2019: 5G fixed to 5G mobile, connected cloud computing.
- 2020: WIFI 6 virtual meetings and online schooling became mainstream.
- 2021: Contactless technologies evolved.

RESEARCH METHODOLOGY

The nature of this study is descriptive and qualitative data has been obtained. Exploratory research is that type of research that includes a detailed study of the subject matter. Enough research papers were used which had relevant information and had conducted an in-depth study of the same. Blogs of expert Digital Marketers were referred to get an understanding of the current status of the field. Secondary data has also been collected from articles published in different journals and from business news websites that list the top companies in the digital marketing field. Data has been collected on a pan–India basis.

Different Social Media Platforms

Instagram: It is a social media platform that allows users to post content in the form of photos and videos and Instagram stories. The story is a function that allows you to post photos or short videos which remain in your feed for 24 hrs. Instagram stories provide brands a creative outlet to interact with their followers, with many possibilities for customization. Instagram showed that 60% of users say that they learn about different products and services through Instagram. 75%, also said that they took action such as visiting a site after seeing the post. Businesses and influencers can make tutorials and guides on how to use a particular product and show its versatility. For example, @Etsy shares DIY projects that are simple enough for followers to replicate.

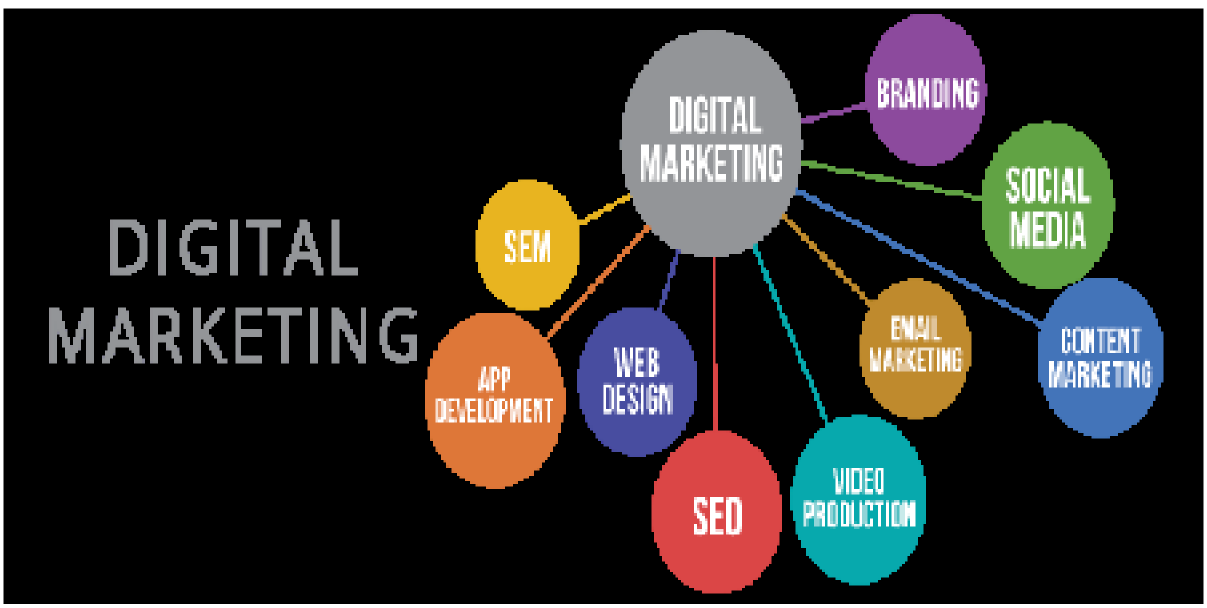
Facebook: Facebook allows you to create a Facebook page for your business which you can optimize. A Facebook business manager is a tool that is helpful to create ads and post them on Facebook and also helps to organize and manage your business. It allows you to manage ad accounts, business pages, and employees who work on those accounts and pages; all in one place.

Twitter: It is a microblogging or news social network that helps in discovering the latest news (on the topics that you care about or are interested in) very easily and also where one can post 280 -character messages called Tweets. Twitter has 145 million daily users. 85% of B2B marketers use Twitter to distribute content.

LinkedIn: It is a social networking platform for businesses and people searching for employment and also helps in finding professional connections and building professional relations.

YouTube: It is a video-sharing platform that can be used by anybody with any type of content can be posted in any niche as long as it does not violate the YouTube guidelines. On average, around 80000 YouTube videos are viewed every second across the globe where this platform also shows the analytics of the videos that have been posted and also the likes and comments that it gets. This is a great tool for businesses to advertise their products and also show demonstrations of how their products can be used as the videos can be seen by anybody and everybody. Also, it helps in creating a community of loyal patrons of the brand. **Snapchat:** Snapchat has become almost as popular as the other social media platforms mentioned above. Snapchat is booming. Snapchat has over 300 million active monthly users and there are over a million snaps created every day. Snapchat is a fun-loving platform that people use for authentic content and used as a household name. It provides an opportunity for brands and influencers to show "behind the scenes" content to engage their followers.

Figure 2.



To make your business accounts popular and easily searchable is to use the same social media handle/account username that are unique are hard to find, so using sites such as namecheckr.com (explained under the next heading – Social media marketing tools) makes it easier to find unique usernames available across all the social media platforms that a person want to use. Optimally, one can lock up a domain name as they want to handle, or next best – a keyword in your niche. Social media means a lot to most millennials where 69 percent of millennials experience FOMO – Fear of missing out. Because of this, 60% of millennials make reactive purchases online. Facebook is a common contributor to FOMO. Social media marketing tools

1. **IFTTT** (If this then that): This is a marketing tool that creates a simple connection between services that can be used regularly. It allows us to create "APPLETS" that can trigger a chain reaction when

we link our accounts on IFTTT. Eg: an APPLET can be used which automatically posts on your Twitter handle when one can post something on the Instagram handle.

2. **Buffer:** This is an application that lets the user schedule their social media posts.
3. **Namechekr.com:** This site helps to check the availability of social media handles/account usernames over different social networks.

Digital Transformation in the Business Era

In digital transformation, digital technologies are used to create a new business or modify the existing business process to meet the changing requirement of business and marketing. Digitization and Digitalization are frequently using for digital transformation. These are the phases of digital transformation. Digitalization means changing the business model with the help of digital technologies and provides new opportunities for new revenue. In a digital economy, business processes are integrated with digital technology. The digital transformation didn't occur overnight or instantly. There are three, phases and digital transformation is the last part of the chain. The starting process in automation was digitization followed by digitalization and finally, digital transformation is the current stage. Digitization means the conversation of content from analog to digital form. During the digitization phase, several new digital formats such as scanners, CD ROM (1982), TIFF (1986), PDF (1993) DjVu (1996) were invented. The word digitalization was used Ist in 1971 by Robert Wachar in his essay. Digitalization refers to improving business processing activities by leveraging digital technology. It is hard to stop technological development, which leads to the next phase. Digitalization has three phases. The initial phase is where single processes were automated and the mid-phase is where related processes are also automated and joint together. The Most complex phase is 3rd phase where multiple systems of the business process are automated. Digital transformation is the current phase of overall automation and reorganization. Digital transformation affects products and processes, as well as organizational structure, and makes organizations competitive in globalization. It creates the need for an organization to rethink and possibly reinvent its business model so that organization develops different capabilities to remain competitive. Digital transformation does not mean use technology for technology sake, but rather to use it for business transformation. It means to change business strategy and taking technology benefits. Digital Transformation is playing its umbrella roles as digitization and digitalization as its components. Mostly these three terms were used interchangeably but digital transformation is a newer and frequently used term. Digital transformation has a great impact on all activities because it provides valuable opportunities for business growth, Government Organization, and Public Organization. In the past Retail Industry and media, advertising was considered important digital channels which value reach the customer most of the shopping was done by using cash previously people transact in the stores previously while mobile technology and smart device evolution the shopping trends were shifted to online shopping using plastic money the business methods completely changed when the digital era began. The evolution of social media smart device and online shopping portals brought the digital transformation in the market trends. In the last decades, digital technology transformed innovation and entrepreneurship in a significant way. Digital device mobiles trends increasing significantly in the business era. Nowadays people are so using their mobile phones for Digital transactions. Now touch power in these devices replaced by voice run technology. The voice run technology carries out functions like automatic bill payment, adding items to the shopping cart, and answering the queries of the customer. As per the studies(Fitzgerald et al,2014, (Svahn et al 2017) established large companies like GE, Volvo, Johnson, Control Boeing, and Caterpillar define themselves with the help of their innovation studies and corporate functionally with the help of digitalization. Even the government agencies and public institutions have changed their regulations policies and the law relating to consumer rights, intellectual property rights, and entrepreneur financing security and data privacy and security. About 80% of large corporate giants and 30%of new generations of smaller businesses start-up have adopted machine learning and artificial intelligence. Bringing artificial intelligence in organization for service providing is an example of digital transformation. Artificial Intelligence refers to make machines with the ability to think, reach and surpass human-level intelligence. John Mc Carthy has first introduced the term artificial intelligence which was closely associated with the field of symbolic Artificial Intelligence. It was popular until the end of 'Intelligent Agent' emerged in 1990. To overcome some of the limitations of symbolic Artificial Intelligence, "Computational Intelligence" emerging as a subfield of Artificial Intelligence. Artificial Intelligence is not only limited to computer science but has included other areas like Health, Education, Music, Art, and Business. It is expected artificial intelligence will touch nearly all industries in a few years. Artificial Intelligence can be used to create other Artificial Intelligence is currently an active field of Artificial Intelligence research. The future Scenario is called the Artificial Intelligence SINGULARITY' which means the ability of machines to build better machines by themselves. Artificial Intelligence is about transforming the future business process and economy. COVID-19 spread in 212 countries and territories and the infected cases death rate increase in numbers. It is an unprecedented difficult situation that claiming thousands of lives. Artificial Intelligence gives the advantage to accelerate the process of diagnosis and treatment of COVID-19 disease and provide efforts towards solving complex issues in different fields. Digital transformation has become a movement, that attracts companies in reviewing processes, gaining competitiveness, optimizing operational activities, and innovating. Currently, it is being considered as the fourth industrial revolution.

In digital transformation, the use of data is the central point. As the famous saying is, "Data is the new oil." Data can be collected from different sources and formats such as structured and unstructured data. If the business treated correctly the collected data, it will be helpful in timely decision making. Artificial intelligence is dependent on data.

This data extracted from a spreadsheet, mark-up files, and database. Artificial intelligence and machine learning allow using data for further improving current products and services or for innovation strategies. Digital transformation is applied with artificial intelligence to create the value of a product. It involves three stages of the production process such as design, execution, and delivery. (Jair Ribeiro 2020) Artificial intelligence improves research and develop product and make an accurate forecast of the execution phase, in the design phase.

In the execution phase, Artificial Intelligence and machine learning help him continues maintenance. In the delivery phase, Artificial Intelligence and Machine Learning are used to monitor, recommend and forecast actions. Artificial Intelligence can strengthen the operational capacities of businesses and increased profitability and creating predictive capability of the business.

Digitalization not only improves businesses but also changed the consumer. Most of the consumers use their mobile phones for purchasing everything from electronics goods and clothes to groceries and services 64% only the people on Instagram have interacted with an influencer that matters to them and 40% out of them learning about products and services as the survey by Face book Commission. In 2020, retail ecommerce sales worldwide amounted to 4.28 trillion US dollars and e retail revenues are projected to grow to 5.4 Trillion US dollars in 2022. All over the world, the most famous online activity is online shopping as per (Statista 2021) retail sales are increasing from 2014 to 2024. In 2021 e-commerce revenue is projected to reach US dollar 2723991m by 2025 and no. of users is expected to 4913.9m.

In developed countries, the market is in its maturity phase as internet users grew to 93% in the US and 97% in the UK, and 92% in China for online shopping. Now there is extremely high competition in e-commerce players. Consumers can communicate effortlessly and actively with firms and other consumers with the help of different media channels.

Digital Transformation altered consumer expectations buying behavior. Online shopping and online retailers such as Alibaba and Amazon have strongly affected traditional retailers. The ING bank considers Amazon as a probable competitor in online shopping, the music industry is substantially changing with Spotify, TIVO and Netflix change the structure of the TV broadcasting and film industry, and Booking.com disrupting the hotel industry. Before crystallization ping was done by using cash. Now it is people have started using digital modes of payment such as Pay tm, Google Tej, Phonepe, debit card, credit card. With the introduction of digital modes of payment the circulation paper currency has minimized. The government also initiated the society towards a digital payment system. Some corporate houses have started giving a discount on digital payment to encourage consumers towards the digital mode of payment. Previously in Nigeria, all G2P payments are made through bank account electronically. India has also started such a trend in most of the cases and progressing towards this. By using digitalization, payment reaches beneficiaries in time and also avoids corruption. It also helps to reduce the chance of accumulation of black money. And proper utilization of funds is assured. Different payment apps are also in smartphones, which facilitates the consumer's lives in urban areas and rural areas. Ecommerce provides goods with a density of city whether a digital mode of payment is available or not. Ecommerce also tapping rural customer's rise in internet marketing, rise in digital payments, and supply chain management. In India, goods move from different points to the ultimate consumer, which not only makes goods costly but also becomes outdated or expired in some situations. In e-commerce, standardized, properly packed, and branded goods are sold with a minimum route. Digital platforms help firms attain growth-related goals like the expansion of business globally. Digital devices like smartphones with digital payments apps are helping in business growth. Nowadays smartphones are used as digital wallets. Without Govt. support digital payment is not possible. Govt. has to make policies and programs to support digital payment Reserve Bank of India has given sanctions to different companies like Reliance, Paytm, Vodafone, Airtel, and Aditya Birla for beginning payment bank services in India. In the corona period, people mostly prefer digital wallets. It is also considered cheaper and convenient than the previous type of payment. Nowadays customer prefers to buy electronic goods and apparel, etc in digital mode because the customer feels it is authenticated branded sites and get assurance of services after the sale by the company.

For the new structure of an organization, technology is the major determinant. Digital transformation is an overall transformation of business process and grabs the potentials of advance technology and change business models with keeping an eye on the future revolution. Digital transformation opens new doors for business models. It creates valuable products, discovering clients, and increases revenues. Business relies and the majority of the ecosystem is blooming as they gather other association or even competitors. Digital transformation is playing an important role to fill the gap created by lockdowns. It was not possible to work, learn, shop, and many more without digital transformation and advance technology in the lockdown period. The business had invested in advanced technology and more focused on customers as well as employees using digital abilities. Digital transformation completely transforms the business function by changing old school processes to advanced ones. Businesses can better engage themselves with the ethical use of technology. Businesses need to pop up with a constantly changing world. In the digital era, the focus is on attracting customers by meeting the online customers' demand in a much better way. According to master thesis UK, people are often looking for information and reviews related to the company's services.

Digital business transactions are flourishing during corona period as due to precautions people did not want to visit any store and this digital business will grow more as it will become the habit of a customer even in the normal period in future as companies provide best services at the reasonable rate. In e-commerce companies are also expected to maintain high business ethics. Before corona time, the use of the internet was limited that's why e-commerce was growing pretty slow. But at the time of lockdown which is still going on e-commerce become popular.

WEB-BASED BUSINESS MODELS

Making a web-based business arrangement, for the most part, includes making and conveying an online business site. Depending on the gatherings associated with the exchange, the initial phase in the advancement of a web-based business website is to distinguish the web-based business model that can be characterized into principle 4 models. These are discussing as pursues:

1. **Business-to-Business (B2B) Demonstrate:** This is said to be the quickest developing area of online business that includes electronic exchanges for requesting, obtaining, and in addition, other administrative assignments between houses. The B2B display is anticipated to end up the biggest esteem segment of the business inside a couple of years where it incorporates exchanging products, for example, business subscriptions, professional administrations, assembling, and discount dealings. Some of the time in the B2B model, a business may not have any physical existence but exist between virtual organizations as a business is led just through the Internet. The principle two advantages of the B2B model are such as it can productively keep up the development of the inventory network and the assembling and procuring procedures, and it can mechanize corporate procedures to convey the correct items and administrations rapidly and cost-viably.
2. **Business-to-Customer (B2C)** The B2C display includes exchanges between business associations and buyers. It applies to any business association that pitches its items or administrations to shoppers over the Internet and also displays product data in online list and store it in a database. In addition to this, it incorporates administration internet managing an account, travel administrations, and wellbeing information. The principal motivation behind why the B2C model of web-based business is more inclined to the security dangers since individual consumers give their charge card and individual data on the website of a business organization. Furthermore, the shopper may question that his data is anchored and used effectively by the business association. Subsequently, it turns out to be exceptionally basic for the business associations to provide security instruments that can ensure a customer for anchoring business data.
3. **Consumer-to-Customer (C2C)** The C2C demonstrate includes an exchange between purchasers where the shopper offers straightforwardly to another purchaser. However, it is basic that both the dealer and the purchaser must enlist with the sale website. While the vendor needs to pay a settled charge to the online sales management firm to offer their items, the purchaser can find items without paying any expense. Online sale Web sites that give a shopper to promote and offer their items

online to another consumer. The site brings the purchaser and dealer together to lead deals. eBay currently buys the item from the seller and afterward, pitches it to the purchaser. Any purchaser would now be able to peruse the site of www.ebay.com to scan for the item he inspired by. On the off chance that the purchaser goes over such an item, he places a request for the equivalent on the Site of eBay along these lines, however, the exchange is between two customers, an association goes about as an interface between the two associations. One of the Indonesia largest online market place is Tokopedia (C2C Retailer) which provide a platform for small and mid size C2C enterprises (SME) for free. Tokopedia was top ecommerce website bringing in 140.4 million web visits between second quarter of 2019.

4. **Consumer–to-Business (C2B) Display:** The C2B display includes an exchange that is directed between a buyer and a business organization where the consumer is the dealer and the business association is the purchaser. This classification includes individuals who pitch items and administrations to associations and in this sort of an exchange, the consumers choose the cost of a specific item instead of the provider. Notwithstanding the models talked about up until now, five new models are being dealt with that involves transactions between the legislature and different substances, for example, purchaser, business organizations, and different governments. Every one of these exchanges that include government as one entity is called administration. The two different models in the E-Administration situation are:
    a. **Government–to-Government (G2G) Demonstrate:** This model includes exchanges between two governments. The main objectives of G2G is to favour e-government initiatives by improving communication assessing data and date sharing. For instance, if the Pakistani government needs to buy oil from the Arabian government, the exchange included is arranged in the G2G demonstration.
    b. **Government-to-Buyer (G2B) Show**: In this model, the administration executes within the singular customer. For instance, an administration can authorize laws relating to tax payments on individual shoppers over the Web by utilizing the G2C demonstrate.

FUTURE RESEARCH DIRECTIONS

After getting to know about the evolution of digital marketing, e-commerce and online retailing one can easily explore the difference between the traditional system of marketing and business vs the digital marketing and business and then, the various types of digital marketing schemes, strategies, and the different tools required to carry out the strategic digital marketing plans. There are several theories and contextual concepts that were taken into consideration while conducting this research program. In addition to the research, the special implications toward the formation of the marketing strategy and associated tactics in the form of a completely different geographical setting would make this study a bit more interesting. There is also an important scope for futuristic research for the conducting of comparative research that has to be carried out in other forms of service-based industries. It is to be done to serve the sole purpose to get a broader picture of how the quality of the service as catered to the customers is instrumental in playing an important role in the development of the market of India.

LIMITATIONS OF THE STUDY

The limitations as connected with the investigator while directing the research is that a delinquent was come across though gathering the material and information like the consumers, as well as the organizations, are unwilling to release the necessary information. Although the objective of the research is told by the researcher marketers and various organizations do not want to reveal their information. On the other hand, even though there is a various journal about the impact of digital marketing, the researcher can't be able to access all of the journals due to a limited period.

CONCLUSION

This study concludes the era of business is about innovation and technology-based products and services, here technology and systems consist of one way and reverse journey, which is visible when a bank launches a mobile app and at the same time other company is involved in inventing new apps for banks and other simplified ways of living life. The business world has witnessed the popularity of the online shopping industry and has also seen the emergence of e-commerce in other areas which has ultimately given rise to Digital Marketing. Digital is touching urban India in many aspects and still holds tremendous potential which can multiply the opportunities for business enterprises. This paper is an attempt to examine the aspect of Digital Marketing and tries to quantify the value and space of need identification habit of a company, to examine the future shape of Digital Marketing in the business world. This paper also talks about the role that digital marketing plays in India and the tremendous growth and the changes that took place in the digital landscape of India after the launch of 'Digital India' – A campaign that was launched by Prime Minister Mr.Narendra Modi in 2015 to improve India's digital infrastructure. This study conclusively proves how effective digital marketing can be if the campaigns are properly designed.

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Chapter 2
Digital Transformation:
Influence on Business Performance in Competitive Milieu

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ABSTRACT

Digital transformation and innovative business models are enabling a high level of competition among business enterprises. The worldwide adoption of the internet and an increasing number of associated technologies have strengthened the digital transformation. Digital technologies allow the customers to co-create value by designing and customizing products, perform last-mile distribution activities, and help other customers by sharing product reviews. Digital transformation is an enterprise-wide phenomenon that leads to the development of new business. This is intrinsically linked to strategic changes in the business model as a result of the implementation of digital technologies models, which may be new to the focal business units or industry. The chapter articulates the influence of digital transformation on the performance of business enterprises in the competitive environment. It analyzes the barriers to the effective use of digital technologies and also the digital transference initiatives of modern business enterprises.

INTRODUCTION

The use of digital technologies can increase the performance and competitiveness of a business enterprise. Digital technologies can enhance the innovation process by enabling transposition and collaboration since they can offer new functionalities and deliver value through a digital solution. The worldwide

DOI: 10.4018/978-1-7998-2402-2.ch002

adoption of the internet and an increasing number of associated technologies such as broadband internet, smartphones, Web 2.0, SEO, cloud computing, speech recognition, online payment systems, and so on have strengthened the digital transformation. Therefore, successful digital transformation requires an enterprise to develop a wide range of capabilities, which will diverge its significance depending on the business context and the speciðc entrepreneurial needs. Digital technology needs to become central to how the business operates, and enterprises effectively need to re-think and possibly re-invent their business models to endure the competition in the market.

The emergence of novel and powerful digital technologies, digital platforms and digital infrastructures has transformed innovation and entrepreneurship in significant ways. The customer's expectations and behaviours are also changing as a response to the digital revolution. Beyond simply opening new opportunities for innovators and entrepreneurs, digital technologies have broader implications for value creation and value capture. The dynamics of market changes and the high level of turbulence in the business environment make modern economic enterprises face the challenge of continuous improvement in their operational methods and development. In practice, it implies the necessity to use modern information and communication technology (ICT) solutions in knowledge management, which enable to support business processes within the acquisition and reinforcement of an enterprise's competitive advantage. Digital business blurs the physical and virtual environment in a way that transforms business designs, industries, markets and enterprises. The enduring digital business evolution exploits emerging and strategic technologies to integrate the physical and digital worlds and create entirely new business models in the market (Patro, 2021).

Digital transformation provides productive solutions for individuals to solve their complications because of its quick reach. It enhances the skills and knowledge of individuals as well as business enterprises. Such skills include artificial intelligence, augmented reality, cloud computing machine learning, data exploration, and growth hacking and so on. Many enterprises invest huge amounts in digital transformation instead of a smart investment. The enterprises are trying to improve the abilities of their employees for future growth. Despite the rapid spread and uptake of digital technologies, adoption and usage differ among the enterprises through demographic categories, industries and business size, rising apprehensions about the inclusiveness of the digital transformation (OECD, 2017). The digital transformation is having a wide-ranging impact on the business environment, creating both opportunities and challenges for the entrepreneurs.

BACKGROUND

In recent years, enterprises in almost all sectors have taken several initiatives to explore new digital technologies and exploit their advantages. This frequently involves transformations of key business operations and affects products and processes, as well as organizational structures and management thoughts. The enterprises should begin management practices to administer these complex digital transformations. An important approach is to formulate a digital transformation strategy that serves as a central concept to integrate the entire coordination, prioritization, and implementation of digital transformations within an enterprise.

The exploitation and integration of digital technologies often influence major segments of an enterprise and even go beyond their borders, by impacting products, business processes, sales channels, and supply chain systems. Potential beneðts of digitization are diverse and embrace rises in productivity, innovations in value creation, and novel forms of interaction with customers. As a result, entire business models can be reshaped or replaced (Downes & Nunes, 2013). Owing to this wide scope and extensive values, digital transformation strategies seek to coordinate and prioritize many independent threads of digital transformation.

While there are various concepts of IT strategies (Teubner, 2013), these mostly define the current and the future operational activities, the necessary application systems and infrastructures, and the adequate organizational and financial framework for providing IT to perform business operations within an enterprise. Thus, IT strategies usually focus on the management of the IT infrastructure within an enterprise, with a slightly partial effect on driving innovations in business development. To some extent, this restricts the product-centric and customer-centric opportunities that arise from new digital technologies, which often cross the enterprise borders. Further, IT strategies present system-centric road maps to the future use of technologies in an enterprise, but they do not necessarily account for the transformation of products, processes, and structural aspects that go along with the integration of technologies.

According to Henderson and Venkatraman (1993), to align between business strategies and IT strategies, it is critical to obtain a close fit between digital transformation strategies, IT strategies, and all other organizational and functional strategies (Bharadwaj et al., 2013). Digital business strategies state the possibilities and the effects of digital technologies for business enterprises. For instance, Oestreicher-Singer and Zalmanson (2013) shed light on the connection of content and community, and prove that community-based digital business models can create profitable revenue streams in times of ‘freemium’ business models. Drnevich and Croson (2013) stated how information technology (IT) can impact an enterprises business-level strategy and its capabilities. Therefore, while digital business strategies often describe desired future business opportunities and strategies for enterprises that are partly or fully based on digital technologies, they do typically not include transformational insights on how to reach these future states. In contrast, a digital transformation strategy is a blueprint that supports enterprises in governing the transformations that arise owing to the integration of digital technologies, as well as in their operations after a transformation (Matt et al., 2015).

Digital transformation strategies take on a different perspective and pursue different goals. Approaching from a business-centric perspective, these strategies focus on the transformation of products, processes, and organizational aspects owing to new technologies. Their scope is more broadly designed and explicitly includes digital activities at the interface with or fully on the side of customers, such as digital technologies as part of end-user products. This constitutes a clear difference between process automation and optimization, since digital transformation strategies go beyond the process paradigm, and include changes to and implications for products, services, and business models as a whole.

OBJECTIVES OF THE CHAPTER

The objective of the chapter is to analyze the influence of digital transformation on the performance of business enterprises in the competitive environment. The chapter articulates the barriers to the effective use of digital technologies by the business in enhancing the performance and also the digital transference initiatives of modern business enterprises. Further, assesses the implication of the digital transformation for the business sector.

TYPES OF DIGITAL TRANSFORMATION

Given the several priorities of any enterprise, digital transformation of business is the everyday aspect that enterprises puff around. A digital transformation is an essential tool that empowers discovering fundamental means in adhering value to the customers, achieve competitive advantage and acclimate with economies of the global markets.

The digital transformational change that the enterprises are undergoing nowadays is pro-active action towards a sudden technology disruption. New and innovative technologies not only generate threats to the enterprises but also create abundant opportunities for the business enterprises to succeed. Speaking of the context, digital transformation can be visualized into four different types that provide strategic advantage to any enterprises. The four types of transformations are (Annacone, 2019):

1. **Process Transformation**: Different processes within an enterprise are the one which has to transform initially to walk the pathway of digital transformation. Process transformation creates a way to enhance strategic synergy and the adoption of technology in all these areas is necessary. Process transformation is witnessed at all levels of the enterprise ranging from regional small enterprises to multinational corporations. For instance, ordering cab through Uber, ordering groceries via Amazon, ordering pizza through the company app, booking tickets through the app have been in process transformation. Every enterprise that wants to sustain in the market and succeed need to automate their processes.
2. **Business Model Transformation**: In the current business environment, enterprises are following digital technologies to transform traditional business models. Business model transformations are aimed at the fundamental building blocks of delivering value in the industry. Digital transformation can be seen in many ways and business model transformation is no different as it can be related to innovations used by the business enterprises like Apple for the reinvention of music via iTunes, Netflix for video distribution and Uber for taxi services. By a shift in the fundamental building blocks of value, enterprises that achieve business model transformation open substantial new and innovative opportunities for growth.
3. **Domain Transformation**: Domain transformation is yet another digital component where a change is hardly foreseen but holds limitless growth opportunities. Domain transformation occurs when a business enterprise can transfer into another area successfully. Amazons launch of Amazon web services (AWS) was one such domain transformation that completely changed the face of what Amazon usually does, as AWS now represent 60 per cent of Amazon's profit. So, do has companies like Apple and Google.
4. **Cultural/Organizational Transformation**: As change is inevitable, even digital transformations have to be backed up by other changes within organizational mindsets, processes, and talent & capabilities for the digital world. If the digital transformation is positively backed by cultural and organizational structures, it will lead to efficient digital transformation. Though cultural/organizational changes are a long-term phenomenon, companies that are future-ready and know its untapped synergy will realize its importance.

AREAS OF DIGITAL TRANSFORMATION

Digital transformation is about the contribution of rule-based IT system in economic services. In which way economic activities are operated and the value is formed (Zysman, 2011). Society takes the benefits of fast and radical digital technologies. Due to globalization, enterprises are facing heavy competition according to the customer's demand. Digital transformation is applicable in public governance and private agencies that why various enterprises are introducing the concept of digital transformation (Reis, 2018). Digital transformation consists of many services and applications such as internet information searches, electronic commerce, digital economy etc. It improves productivity and several other benefits like social welfare, particularly on several sustainable development goals, associated with the delivery of public services.

Digital transformation involves multiple technologies like telecommunication network, software engineering, electronics delivery of government services, electronic commerce, social networks and availability of online information. Digital transformation applies to indifferent areas like steam engines, electricity and railways sweeping, sweeping across economist, our societies (local, regional and global communities). The significant areas of implementing digital transformation include (Kaur & Bath, 2019):

1. **Education Sector:** Digital transformation makes communication between students and teachers. It converts the offline lectures into video, creating digital text and quiz. Digitalization is required in students' admission, registrations for programs and courses, examination, program development, etc. Smart class is a medium to make the lectures more informative through digital transformation. Moreover, remote monitoring and biometric-based authentication are implemented in organization for employees and students. Digital transformation is playing an avital role in institute security. Students can access their syllabus notes from the big data as well as online lectures are provided on YouTube, google and amazon. There various websites from where student can ask any question related to study and subject experts assist the students by giving an appropriate answer.
2. **Industries:** Digitization is the main approach to establish business models. It includes a variety of channels like retail stores, online stores, mobile stores, mobile app stores, telephone sales etc. in a customer's shopping experience by means research a product before purchase it. Digitization improves the performance of service operations via remote connectivity and enables predictive maintenance, continuous uptime, rapid service response etc. It makes possible further and faster progress for almost everyone. Digitization increases investment and safety. It also connects the industrial area to smart governance.
3. **Social Media:** Digital transformation provides the facilities of search on Google, watched videos on YouTube, messages sent on WhatsApp, recording on Facebook, sent an email, etc., for the people. It is much faster than other media like postal. Nowadays these all applications are available in one's pocket through a personal mobile phone. Online shopping makes it easier for customers to buy anything by ordering from home. Multimedia replaces the television because all the shows are available on mobile apps. Digital transformation creates new jobs for the network traffic manager, head of social media, community manager etc. It establishes the communication between enterprises, job boards and communication agencies. It provides a new and exciting way to emerging technologies through existing technologies. It connects the enterprise and individuals at the international level. All reliable and trustworthy information can be accessed online by anyone. It supports by assisting the customer and suggest the appropriate suggestion.

4. **Healthcare:** Digital transformation enables medical devices to an electronic record the health of the patient. It reduces human errors and implements the recent digital strategies. It gives the patient better treatment with medical devices. Sometimes the patient needs an on-demand checkup due to the busy schedule, then prior appointment through digital transformation makes it possible. Moreover, the digital transaction is used to save the patient record on big data and the cloud identifies the patient whenever the doctor needs the history of the patient. It is also beneficial for pharmaceutical representative to sell their medicines by advertising through digital transformation. There are various health sensors such as heart rate sensors, exercise trackers, sweat meters, oximeters etc. are helpful to check out illnesses and diseases that can affect the future of the patient. Artificial Intelligence-powered tools are performed routine tasks that can be done by any nurse in a hospital. Digital marketing strategies are used at high volume in healthcare. It engages the patient to the medical facilities with valuable benefits.
5. **Banking:** Digital Transformation offers products and services directly to the customers, companies and financial institutes. The automated financial device also helps individuals with low income. Change in new technologies only implemented by the bank when the financial market or individuals do not disrupt. Banking reduces the gap between customer's satisfaction and expectations. It is featured by simplicity, transparency, ease to customer acquisition, ease to distribution and commercial attractiveness and specialization. Several mobiles and web technologies are available in this digital era for banking transactions like an end to end digital banking, digital investment services, electronic trading, online cash management etc. (Sharma, & Piplani, 2017). Banking activities are performed using plastic money like credit cards, debit cards, smart cards etc. Furthermore, electronic channels like automated teller machine, telephone, the internet, social media etc. provide banking services to the customers (Omarini, 2017).

INFLUENCE OF DIGITAL TRANSFORMATION ON THE BUSINESS PERFORMANCE

Digital transformation is been experienced by many industries with business activities being affected in all parts of the globe. While the degree of disruption may be different across business segments and countries, Hirt and Willmott (2014) identified seven main drivers which impact traditional forms of business. In contradiction of this, they play a vital role in considering strategic planning and implementation processes (Grab et al., 2019).

1. **Extensive Pressure on Price Setting and Profits:** The abundance and structure of information provided to customers across the internet help closing the previously existing information asymmetry between the enterprises and clients. This improvement in market transparency puts customers in a better position with the effect of higher bargaining power and lower prices. However, the latter might be subject to regional differences given substantial fluctuations in digital sophistication across the globe (Grab et al., 2018b).
2. **Competition is Not Restricted to Own Industry:** Barriers for market entry have proven to be useful for many decades, allowing market participants to defend themselves against competition from other players. The rise of digital enterprises has largely distorted this old perception of shielding industries. These enterprises rely on superior management skills, flat organizations, technical-savvy

staff and entrepreneurial spirit to challenge the current heavyweights in any given industry. In the process, they do not only question the status quo of doing business, old paradigms are further put into question. As a result, ramp-up costs are no longer the deciding factors for success, which forces the old guard to seek new strategies beyond pure rent-seeking.

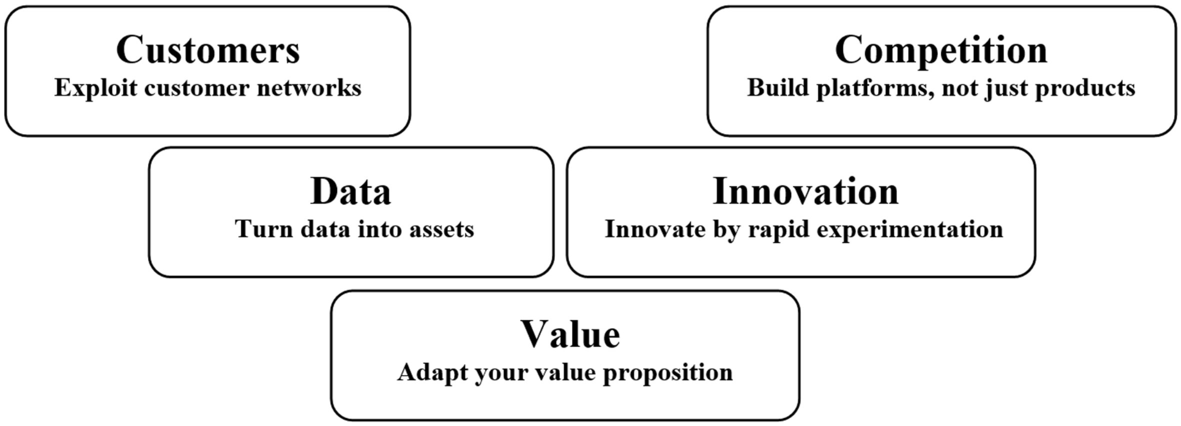
3. **Dynamic Satisfied Customers:** Large enterprises have taken the element of perfect customer lock-in to new levels by pooling internal resources and capabilities in the form of superior business enterprises, talented staff and technological advancements for the benefit of an attractive organizational culture. This stimulates a positive perception cycle which in addition to high-quality services and products turns enterprises into go-to places for customers. This return effect reinforces the customer relationship and manifests the winner takes it all dynamic of the digital era.
4. **Integrated Business Models:** Against the background of the winner takes it all dynamic stimulated by large enterprises, smaller enterprises may find it particularly difficult to compete on an equal footing. Therefore, innovative market participants aim to piggyback on the success of larger market players by adding their businesses to the existing platform structure provided by bigger enterprises. This translates into a win-win situation since customers can find a broader selection of products and services within a known environment.
5. **Identification of Smart Brains:** According to Frey and Osborne (2017), enterprises need to take a strong stance towards the impact of ongoing business automation as well as the further introduction of robotics and artificial intelligence in the workplace by stating that almost half of all professions worldwide have the potential to be replaced by machines over the decades to come. In this context, the business enterprises need to find new strategies to address the issue of talent gaps within their organization, while at the same time thinking of new ways to train people who are stuck in professions that will no longer be needed (Manyika, et al., 2017; Nedelkoska & Quintini, 2018).
6. **Convergence of Global Supply and Demand:** Online service providers are not limited in their regional focus. In this light, the enterprises have almost unlimited access to customers when it comes to expanding their growth strategies. From a customers' perspective, standardized products are made available across country frontiers. Along the entire value chain, clients expect a harmonized process from the moment delivery is made to the after-sales service (Grab et al., 2018a).
7. **Continually Growing Business Models:** Digital transformation represents a major change for most enterprises who have so far lived under the impression that small incremental changes are sufficient to stay in business. However, in a world where the competitors are formulating and implementing radical solutions within the industry, this kind of slow-moving approach will no longer be successful (Grab et al., 2018c).

KEY PARAMETERS OF DIGITAL TRANSFORMATION

The digitalizing process is never complete unless its key parameters are aligned with the main process. Hence, updating technology needs rethinking of its key parameter. According to Rogers (2016), there are five domains of digital transformation.

1. **Customers**: Earlier it was business to market strategy but now it is business to consumer and this becomes more imperative with digitalization in place. In the present digital age, customers do more than purchasing the product, they promote, influence and also help in shaping business reputations

Figure 1. Domains of digital transformation
Source: Rogers (2016)



and indirect brands endorsements. Further, they use their digital tools like mobile, tablets and personal computers to discover, evaluate, purchase and stay connected with brands.

2. **Competition**: Digitalization changed the face of competition. The earlier perception of 'let's disintegrate our competitors' has now become 'let's integrate, cooperate with mutually benefitting interdependence'. The globally established enterprises are thriving in the belief of cooperation with sustainable growth.
3. **Data**: The business enterprises generally process the data and use the information for evaluation, forecasting and decision making. But with digitalization, data flows from different channels involving every conversation and interaction retrieved from unstructured pathways of social media, mobile devices and various other hubs of technology. This new big data gives way for advanced predictions, newer patterns of trends and of course exploring new sources of value-driven data. Hence, digitalization has also changed the ways data is collected and used.
4. **Innovation**: Innovation was singular in focus till now with its main output being the finished product but now with as digitalization has taken rapid momentum, the new approach of innovation is mostly concerned with careful experimentation, maximum learning while minimizing costs. Innovation now is the constant development of product given the customer feedback loop.
5. **Value**: Traditionally every enterprise brand proposition was considered to be fairly constant, but in modern days digitization had led to a change in the path of enterprises from being constant to an evolving value proposition phenomenon. Modern business enterprises consider adaption as the best response when opportunities are escalating with a curve of transformation.

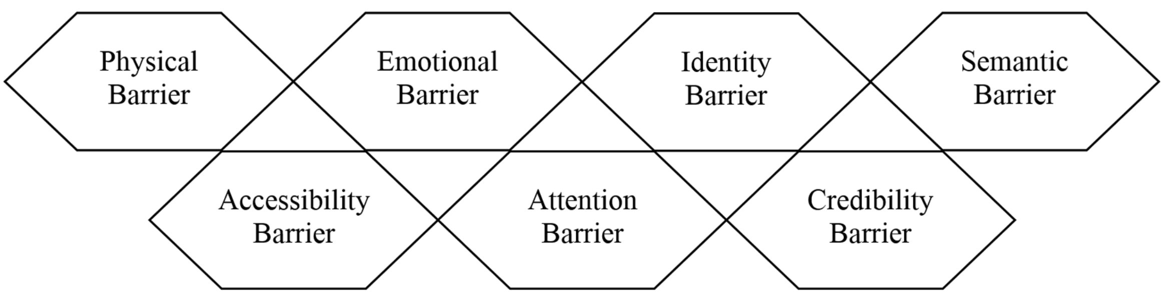
BARRIERS TO THE EFFECTIVE USE OF DIGITAL TECHNOLOGIES

The digital shifts underway are reshaping economies and societies today and will continue to do so in the future. The ongoing digitalization of the economy and society holds many promises to spur innovation, generate efficiencies, and improve services throughout the economy. Moreover, the successful transition to a digital economy is a necessary condition for boosting more inclusive and sustainable growth and enhancing overall well-being (OECD, 2017). Digitalization raises important policy challenges including privacy, security, consumer policy, competition, innovation, jobs and skills, among others. Failure to adequately address these issues could lead to economic inefficiencies, reactionary policies, a worsening of inequalities and a further erosion of the social fabric, as well as slower growth. The challenge for policymakers is to identify the policy mix that will enable their economies to best maximize the benefits of an increasingly digitalized global economy and adequately address the resulting challenges.

As the cost of data collection, storage and processing continue to decline dramatically and computing power increases, social and economic activities are increasingly migrating to the Internet. Technologies, smart applications and other innovations in the digital economy can improve services and help address policy challenges in a wide range of areas, including health, agriculture, public governance, tax, transport, education, and the environment, among others. Information and communication technologies (ICTs) contribute not just to innovation in products, but also innovation in processes and organizational arrangements.

Digital technologies have made the lives of people easier, faster and better with effective communication. However, still, some of its brightness is scarred by few significant barriers which are both internal within your colleagues and externally with people in the outside world. These barriers interfere with a medium that an individual chooses to communicate that may be via texts, emails, chats, messaging, discussion boards, apps, social media, websites and any other platform (Girardin, 2020).

Figure 2. The 7 barriers to digital technologies



1. **Physical Barrier**: Digital technology within itself has broken the physical barrier between people even with greater distance but speaking of physical barriers, digital technology is marred by other environmental conditions like time, place and medium. Well, time is a barrier if an individual does not have enough hours in the day to respond to emails, update their website or create content for other platforms. The place would be a barrier if one tries to communicate with people on a channel that they don't use and lastly medium is a barrier if the digital communication tools fail to work as expected.
2. **Emotional Barrier**: Emotional barriers or what one can specifically call psychological barriers can perhaps be the most common communication barriers. As an individual's beliefs, attitudes and values are different from person to person, it often has a lot of influence on how they interpret digital communication. Because people are social and emotional being, one cannot eliminate emotions from communication. Eventually, to make digital communication efficient there is a need for

evaluation of emotional motivations of what one wants to communicate and empathy should also be a tool for an individual to ensure better communication.

3. **Identity Barrier**: Identity barriers can lead to miscommunications, misinterpretations, and ultimately misrepresentation of innovative ideas and views. Identity barriers may cause through gender, race, ethnicity, sexual orientation, class, age, disability, veteran status or other personal, social or cultural identities.
4. **Semantic Barrier**: Semantic barriers are about the different interpretations of words and symbols used in communication. It can through individuals who speak a different language, with restricted language proficiency, limited knowledge or different use of words and symbols than another does. Digital technologies are vulnerable to semantic ambiguities where and sender and receiver will not end up on the same page as they don't have the same understanding of an intended message. The same language often gives rise to different contextual interpretations. The same would be the situation for jargon, slang, acronyms, the use of which is likely to create a barrier between those who understand and those who don't.
5. **Accessibility Barrier**: Digital communication is effective when people of all kinds can access and understand information. While communicating in an enterprise, managers should be responsible to communicate effectively with people who have communication disabilities also. Information should be accessible to people with visual, auditory and cognitive disabilities.
6. **Attention Barrier**: Attention barriers bubble up when individuals miss out on information because of distraction in focus. Transfer of information to people when they are on their computer, tablet, a smartphone is a challenge nowadays. It is complex to break through the noise and garner attention barrier with digital communication.
7. **Credibility Barrier**: Trust issues with the sources of information acts as a catalyst to credibility barriers. Even in normal communication, the validity of the message is entitled to the reputation of the sender. If the receiver doesn't trust the sender, he will view the message itself with scepticism and vice-versa. Hence, perceived credibility can be a significant barrier to digital communication.

DIGITAL TRANSFERENCE INITIATIVES OF MODERN BUSINESS ORGANIZATIONS

Most startups in the present world have digitization imbibed within their organizational structure streamlined from the moment they took their first step and these enterprises do have a considerable advantage over some of the old and more matured enterprises who still haven't sorted out their way into digitization. Therefore, it is of great interest to see and explore how modern business enterprises are taking advantage of their digital transference initiatives. Keeping in mind the parameters, barriers and areas of digitization, thriving in this digital age requires radical thinking and innovation. While some are struggling to get their foothold into digitization, few other enterprises are giving standout performances. Let's see few enterprises that have proved to be standing out in competition (Zigurat, 2019).

1. **Volkswagen**: The automobile industry is a busy corner where we have plenty of competition, and Volkswagen is a German automaker, which has taken massive decision to invest USD 4 billion by 2025 to reinvigorate its digital ecosystem. The initiative will anyhow enable the company to reach customer better than ever (Volkswagen expects to make around USD 1.1 billion in sales by

2025 from new digital services), but also this initiative will help the German automaker to go a few miles ahead of competitors who are still planning to come up with such strategies. The new digital ecosystem will also help Volkswagen vehicles to be connected to the Internet of Things (IoT), which will enhance the customer experience is not just driving but also with other walks of their daily lives.

2. **Domino's Pizza**: Embracing digital transformation via client feedback and changing times have enhanced Domino's pizza outlook. It has been so revolutionary that four-fifth of dominos sales come from digital platforms. This was possible only after it took the transformation mode from a fast food business chain into a company imbibed with a digital marketing loop backed up by programming hires and tech personnel. Lately, dominos has also entered into the self-driving cars platform and delivery robots to develop an automatic delivery system.
3. **Starbucks**: Since origin, Starbucks has taken a keen interest in placing their stores with an analytical approach and they have always been a strategic unit. Now they are even using data like population density, population income and traffic pattern to identify target areas for a new store to be located. Starbuck is known for using its menu and product lines with consumer preferences to increase sales in a strategic way. The most competitive advantage Starbucks gain is from its Starbuck reward loyalty program from which it gets exclusive customer data.
4. **IKEA**: This Swedish furniture giant is another company which have taken huge steps towards digitization and has made its presence relevant and competitive in future to come. In 2017, the enterprise created an augmented reality tool called the IKEA Place app the lets customer visualize how the furniture will look at a certain space of the house, which was an instant hit in the market. Other technology-driven campaigns and sustainability-focused content have made it a digitally innovative brand.
5. **LEGO**: An enterprise that was almost bankrupt once had its new synergy when an updated digital strategy helped the company to thrive. LEGO has achieved many content marketing triumphs that gave it a much-needed impetus in this digital world. The enterprise gets most of its new ideas from its online community. This strategy has led to a great source of new ideas and innovation that keeps its relationship with customers intact digitally.

THE IMPLICATION OF DIGITAL TRANSFORMATION ON THE BUSINESS SECTOR

Digital transformation has taken the form of continuous development of the existing and fast absorption of innovative technologies, that can be put into operation to affect all business activities of an enterprise. The emergence of innovative digital technologies enables the continuity of the digital transformation process in the business sector. Digital technologies such as social, mobile, analytics, cloud and so on are vital, but their influence is not in their individual use, but in whether an enterprise knows to transform itself and its business through the integrated application of digital technologies (Popovic-Pantic, et al., 2019).

A well-organized digital transformation strategy is something that initiates and is the basis for success in an enterprise digital transformation process. The strength of the digital transformation strategy deceits the objectives of an enterprise and aspects that will be the focus of the process. From a business perspective, the digital transformation strategy aims to transform products, processes and organizational aspects by using digital technologies. In addition to this, it is essential to emphasize that this strategy is trans-functional, as it affects all activities and functions in the enterprise.

The success of the management and employees in designing a high-quality digital business strategy, as well as its implementation, significantly influences the existing level of digital maturity of an enterprise. Digital maturity imitates an enterprise's current level of digital transformation, as well as the existing digital gaps that will pave the way for the enterprise to endure this process. In digitally mature enterprises, the business process automation will be at the highest level. In these enterprises there is no repetition of work, operational costs are minimized and can be easily planned and predicted, there is a logical sequence and correlation between business functions so that the output of one function is used as input in another function, contacts with all stakeholders are automated, the risk of human error is minimized, work is done in are liable enterprise information system etc. Digitally mature enterprises are focused on the integrated application of modern digital technologies in changing the way they perform business, as opposed to less digitally established enterprises, which seek to solve individual problems encountered in business through individual digital technologies (Popovic-Pantic, et al., 2019).

According to Chalons and Dufft (2017), digital transformation consists of three phases:

1. In the first phase, it is necessary to equip workplaces with smartphones, tablets and other mobile devices, as well as collaboration tools such as videoconferencing and chat. This phase is best described by the term consumerization, which implies a change in technology in a business under the influence of technologies originally intended for the customer market but which, because of their different opportunities and options, find their place in the business world also.
2. In the second phase, the focus shifts from employees to consumers. The goal is for the customer to experience the optimal digital experience, as the emphasis must be on comprehensive digital transformation. This means that digital transformation must be equally carried out on the processes directly confronted by the customer, such as marketing, sales, customer support, but also on back-end processes that are not visible to consumers and which have an equal impact on their experience in enterprise relations such as finance, storage, logistics, and so on.
3. The third phase embraces new sales models, products and a whole new business model, all of which results in a new digital ecosystem. The digital ecosystem is essential in the conditions of globalization which results in increased competition and the inability of many enterprises to survive and survive in such situations. By combining the strengths of actors from different sectors, while sharing the necessary information, there is a chance to offer customers better options compared to their competitors whereas, in return, the overall value that enterprises are appropriating is increased.

The dynamics of the digital transformation process and, thus, the level of digital maturity varies from enterprise to enterprise. There are several challenges faced by the enterprises while trying to be effective in this process. The system of values, assumptions and beliefs shared by the employees of an enterprise highly influences not only the success but also the decision to initiate the digital transformation process (Hartl & Hess, 2017). Lack of knowledge about digital technologies and their application capabilities can make it difficult to manage the digital transformation process. That is why an enterprise needs to recruit an expert or appoint one of its existing employees to the position of chief information officer. Employees are often inclined to have a deep version even to minor changes, and especially when it comes to the radical, big changes that digital transformation brings. For this reason, a new chief digital officer function is emerging in enterprises, and their key task is to direct and actively engage employees whose jobs and workplaces are affected by the digital transformation process, which should alleviate resistance to change and thus ensure full digital transformation capacity (Ghobadian & Gallear, 1997).

The intensive use of fast-growing digital technologies is a major mean of reducing costs, increasing the efficiency and effectiveness of business processes, increasing customer satisfaction through overall collaboration with the enterprise, thereby enhancing the market position and competitive power of the enterprise (Fitzgerald, et al., 2013; Aboelmaged, 2014). The enterprises that have undergone intense digital transformation are rapidly reaching a high level of digital maturity, thus, becoming more able to use their digital technologies more efficiently and productively to improve their performance and to occupy a leading position in the market. By applying an integrated digital strategy, such enterprises can improve business processes and perform modularization more easily, which further strengthens their capacity to adapt and implement new business practices and initiate innovation (Nwankpa & Roumani, 2016).

The enterprises that use digital technologies to initiate changes, enhance business processes and operations are much more innovative compared to those which do not behave according to the postulates of the digital era. Kagermann (2015) states that digital transformation drives innovation and change, regardless of the type of industry, due to the increasing approximation of the real and virtual worlds. Originally conceived of the business philosophy and logic underlying the business of the enterprise from its inception will experience some form of modification or complete restructuring through the digital transformation process, creating the conditions for the development and commercialization of new products and services (Stief, et al., 2016). The implementation of new digital technology incites growth of enterprise productivity through appropriate improvements and changes in the production process (Fuentelsaz, 2009). Urbach and Ahlemann (2016) stated that digital transformation is the use of technological innovations in business to increase productivity, sales and establish new forms of cooperation with customers. Thus, digital transformation will significantly improve the business by increasing innovation, productivity, streamlining business operations, stimulating consumer satisfaction, etc.

CONCLUSION AND FUTURE IMPLICATIONS

Digital transformation has the power to transform the stability among the business enterprises competing in the homogeneous market environment. It influences the identified tectonic business models by setting a new playing field and changing the way enterprises compete on different levels. The existing strategic management theories and models partially serve the purpose to assess an enterprise's internal resources and capabilities. In combination with tools and systems for analyzing the existing and future market environment, the enterprises can further adopt strategic choices. However, the challenges posed by digital transformation are disruptive and a systematic understanding, monitoring and acting on the important factors will be crucial for the growing enterprises.

The ongoing digitalization of the economies and societies will expand and deepen over a period of time. Digitalization not only contribute to productivity and efficacy of the business enterprises but also enable to a broader socio-economic development. It is an accelerator of growth and the business enterprises must be ready to make the most of it. A pro-active, approach to the digital economy will enable the enterprises in maximizing the enormous potential the digital economy holds for the economies and well-being. However, there are certain areas where necessary focus can be initiated. Encouraging investments in digital infrastructures and their key enablers is one such focus area. Enhance framework policies to foster the financing of digital infrastructures and innovative business models. Encourage the development of standards to support IoT and industries. Craft more effective strategies that enable all people to adapt and excel in the digital economy. Coordinating and cooperating to better measure digitalization across industries and adapting legal frameworks to the realities of an increasingly digital economy.

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KEY TERMS AND DEFINITIONS

Collaboration: It refers to the act of working together with another person, a group, or enterprises to achieve the goals or do something.

Digital Infrastructure: It refers to the digital technologies that provide the foundation for an enterprise's information technology and operations.

Digital Marketing: It refers to the act of promoting and selling products/services by leveraging online promotional strategies such as social media marketing, search marketing, and email marketing.

Digital Technologies: It refers to the electronic tools, systems, devices and resources that generate, store or process data.

Digital Transformation: It refers to the process of integrating digital technologies to create new or modify existing business processes, culture, and customer experiences to meet changing business and market requirements.

Digitalization: It refers to the use of digital technologies to change a business model and provide new revenue and value-producing opportunities. It is the process of moving to a digital business.

Globalization: It refers to the integration of the economy of the nation with the world economy. It describes an interdependence of nations around the globe fostered through free trade.

Innovation: It refers to an idea that has been transformed into practical reality. It is something new or a change made to an existing product, idea, or field.

Transposition: It refers to the act or process of changing something from one position to another, or of exchanging the positions of two things.

Chapter 3
The Digital Economy Readiness Study:
The Czech Republic in the European Context

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ABSTRACT

The Czech Republic has experienced tremendous growth over the last three decades. However, as the previously exploited competitive advantages (e.g., low labour cost) lose growth potential, the country has to address the digital economy sector. The digital economy readiness study analyses and merges findings from the European and OECD databases, outlining the current situation in the country. Also, the study compares the skill set supplied by the Czech workforce with the global market situation. Research areas cover analysis of diverse factors such as age, education, gender, and nationality. Study results show that the Czech Republic has a substantial competitive advantage both within the EU and across OECD thanks to its highly skilled workforce. Hence, ongoing digital transformation gives a positive outlook for further development of the Czech digital economy.

INTRODUCTION AND BACKGROUND

The digital economy sector is starting to dominate innovation across the industry, below presented ICT statistics can help better understand how digital technologies transform the current world economy (Eurostat, 2019). The statistics track and monitor:

- The production of and access to digital technologies
- The uptake and usage of digital technologies
- The impact of digital technologies, notably in the economy and on the labour market.

DOI: 10.4018/978-1-7998-2402-2.ch003

RESEARCH PROBLEM DEFINITION

The Czech Republic has a low share of the digital economy while compared to the market structure of its western partners in the EU (EUSH, 2019). The low share of digital on total economy grants a vital growth opportunity, especially considering that the country has all the means to shift part of its resources towards digitalisation. The fact that the country has high growth potential and resources to deliver makes Czechia a point of interest for numerous stakeholders. Some consulting companies ever label these traits as "Digital Challenger" country (McKinsey & Company, 2018).

In order to utilise the full digital potential of the Czech economy, it is paramount for strategic stakeholders such as universities, government, and leading business companies to take action and execute vital steps towards the emergence of the digital sector (Brunet-Thornton & Martinez, 2018). The most vital part of a successful digital transformation is taking advantage of an available skillset and developing a capable workforce, as recognised by many (Kaplan, 2017; Gates, 2017; Bughin, 2017).

During structural change towards the high value-added digital sector, it is paramount to have a highly qualified workforce to sustain such growth (Frey & Osborne, 2017). Key transferable skill sets that enable rapid growth are mainly problem-solving ones and ICT knowledge in general (OECD, 2017; Henke & Bughin, 2016).

At the moment, multiple trends are contributing to the growth of the digital economy sector. In 2016 the Czech Republic surpassed Germany as a country with the lowest unemployment rate in the EU. The country remained in that position throughout 2017 and 2018 (Eurostat, 2018). With an average of 3,2% in 2018 (Czech Statistical Office, 2019), the low unemployment rate had two dominant impacts on the country's economy.

First of them is a rapid growth of average salary across all the country's industry segments and geographical regions. Figure no. 1 below clearly shows the relation between average gross wages growth and decreasing unemployment rate. While wages growth enables closure of the salary gap between the Czech Republic and its western neighbours, it has other impacts as well. The companies are being forced to transform their operations model – human labour is no longer such a strong competitive advantage on the European market. The shift from labour-intensive jobs to high value-added ones is a long-term process and requires extensive investments (Brynjolfsson, 2014).

This wage growth in Czechia does not correlate to an overall growth pace of wages across the EU. While the upward and downward trends due to economic and seasonal cycles are reflected in both lines. The Czech wage growth is up to 750% higher than the EU average (e.g. Q4 2016).

A synergy of both the low unemployment rate and salary growth makes the country attractive to a foreign workforce - as evident from statistics of non-Czech nationals registered by the Czech statistical office in graph no. 2 (CSU, 2019).

While the wage growth helps close the salary gap between the Czech Republic and Eurozone, there is no correlation between wages and productivity growth. This productivity factor also contributes to digital transformation in a long-term range (Ford, 2015).

THE CZECH DIGITAL ECONOMY READINESS IN THE EU CONTEXT

The Czech Republic scores above average in most ICT-related metrics measured by the Eurostat. The position of the country as a digital challenger is evident in an overall comparison of the following metrics:

Figure 1. Average gross wages growth and decreasing unemployment rates in Czechia
*Source: Czech Statistical Office (2014-2018); Czech Unemployment office (2018); Eurostat (2018a), Labour productivity and unit labour costs *2018 unemployment data include only Q1 to Q3.*

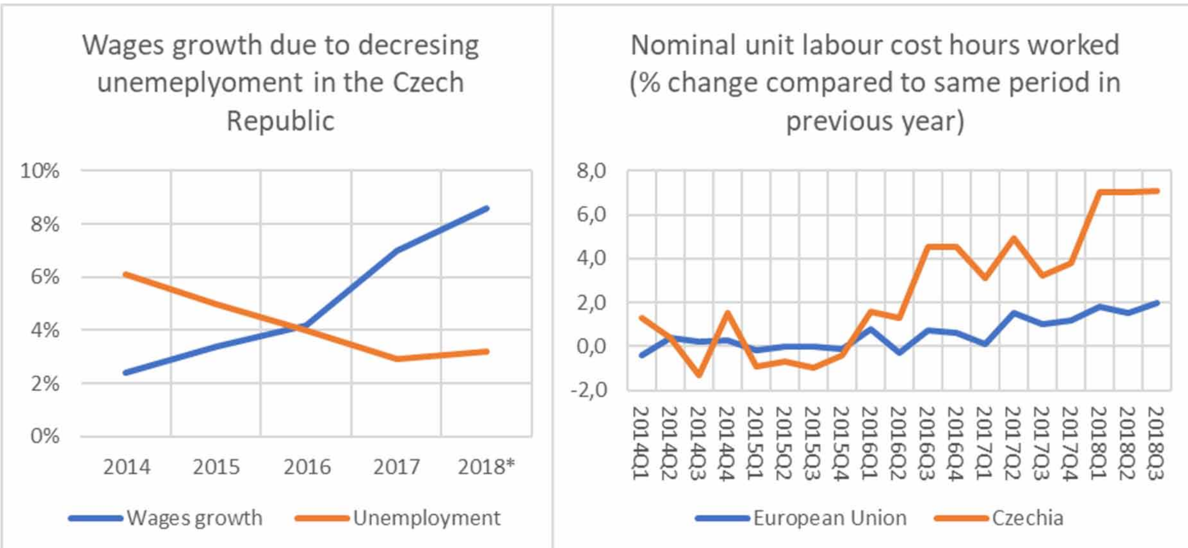


Figure 2. The total and average number of non-Czech nationals in the country and comparison of employment rate among foreign-born residents
Source: Czech Statistical Office, Directorate of the Alien Police Service (2018); OECD International Migration Statistics: Employment and unemployment rates by gender and place of birth (2018)
** EU28 (2015-2017) & OECD (2014-2017) data unavailable - The foreign-born employment rate is calculated as the share of employed foreign-born persons aged 15-64 in the total foreign-born population (active and inactive persons) of that same age.*

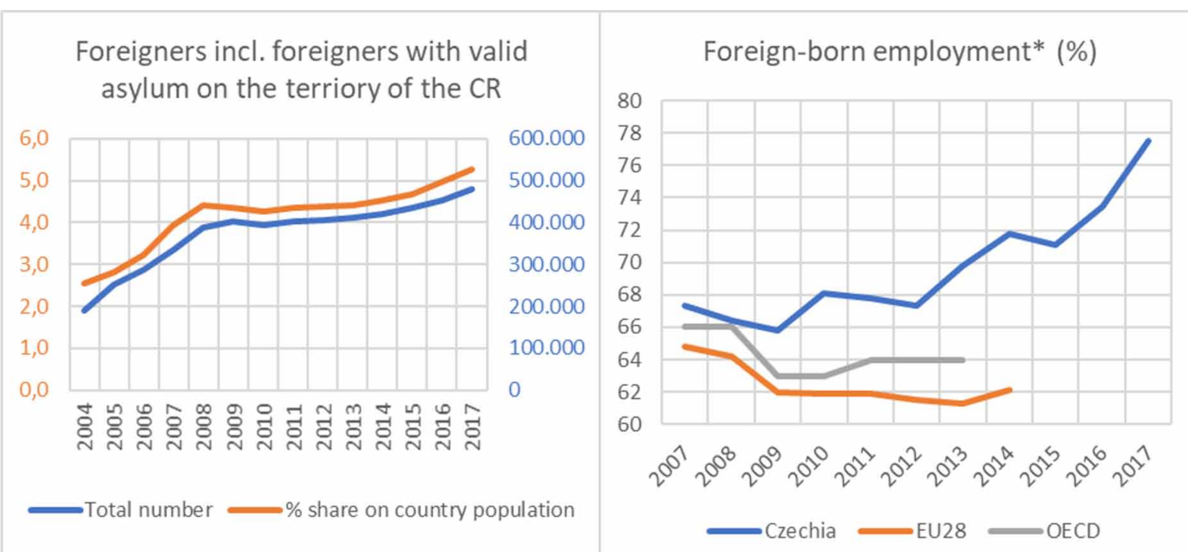
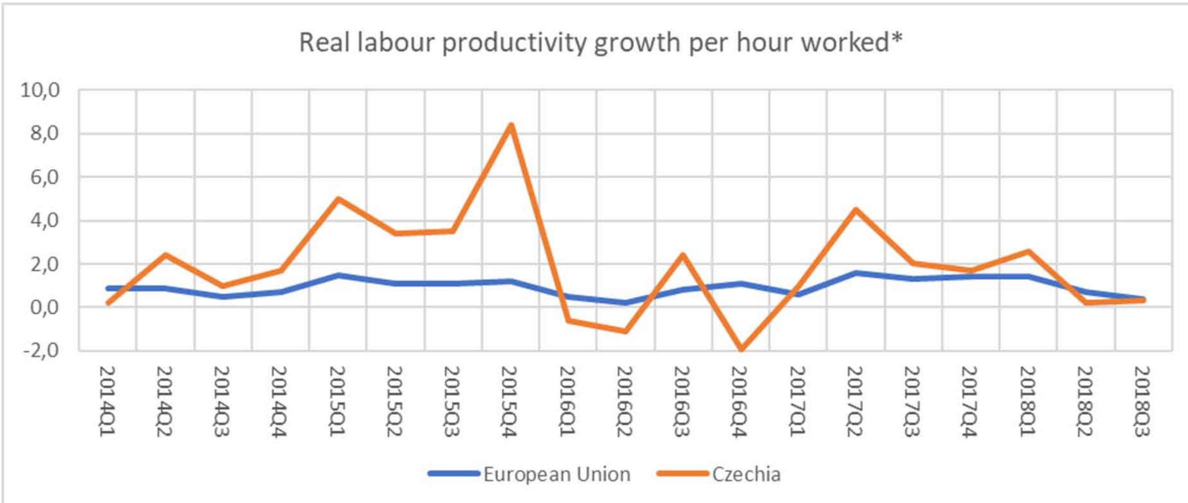


Figure 3. Average quarterly productivity growth across the EU and Czechia
Source: Eurostat (2018b), Real labour productivity per person employed
**Percentage change compared to the same period in the previous year*



Percentage of ICT Sector on GDP

Value-added at factor cost in the ICT sector as % of total value added at factor cost. While metrics do not include all the European countries, Czechia outranks most of Europe and its neighbours.

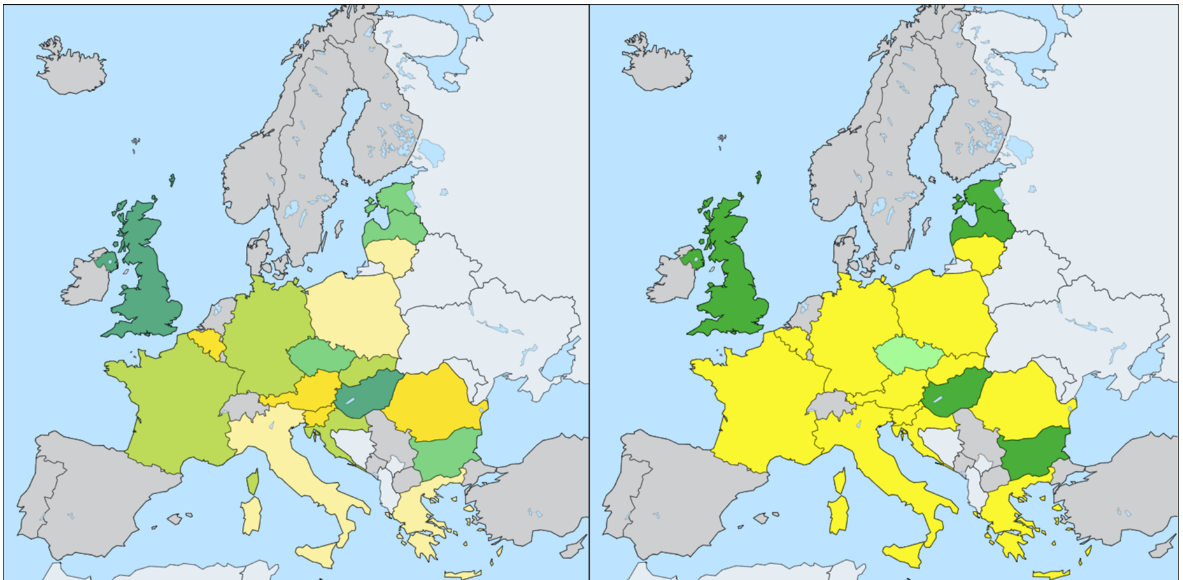
As a share of the digital economy is expected to grow globally (OECD, 2017). A relatively high share of ICT on GDP provides a solid fundament for further growth. In global comparison, all European states have a growth potentiation, especially considering the latest estimates done by the China Academy of Information and Communications Technology (CAICT) under the Ministry of Industry and Information Technology. China's digital economy share on GDP is estimated at 38.2% (CAICT, 2018). While there is a slight difference in the methodology of Eurostat and CIACT, the EU still has a significant growth protentional. Also, the share of the digital economy in China keeps growing. While the 2017 share was just 32.9%, more than 5% points were added just within a year (CAICT, 2018). They prove that ITC enables the kickstart of economic growth and makes it possible in the long term.

Percentage of ICT Personnel on a Total Employment

Czechia ranks in the upper half of the statistic in the number of persons employed in the ICT sector as % of the total employment.

This statistic comes as especially crucial in the context of the previously mentioned low unemployment rate. Even though there might be a limited supply of personnel, its qualifications are overall on an above-average level. The experience acquired within ICT jobs is crucial in further enabling digital growth (Manyika, 2017). Notably, ICT experience does not necessarily reflect all the skills and qualifications utilised in the digital economy. On the other hand, this metric reliably distinguishes probable future skill set supply on the market.

Table 1. Percentage of ICT on GDP



Legend	Count
2.13 to 3.28	4
3.28 to 3.83	4
3.83 to 4.22	4
4.22 to 5.43	4
5.43 to 6.88	3
Data not available	19

Legend	Count
0.497 to 1	12
1.0000	1
1 to 1.604	6
Data not available	19
Lowest ranking country - Greece	
Highest ranking country – United Kingdom	

Source: Eurostat (2019). Left Overall statistics. Right Czechia = 4.29% (1.000)

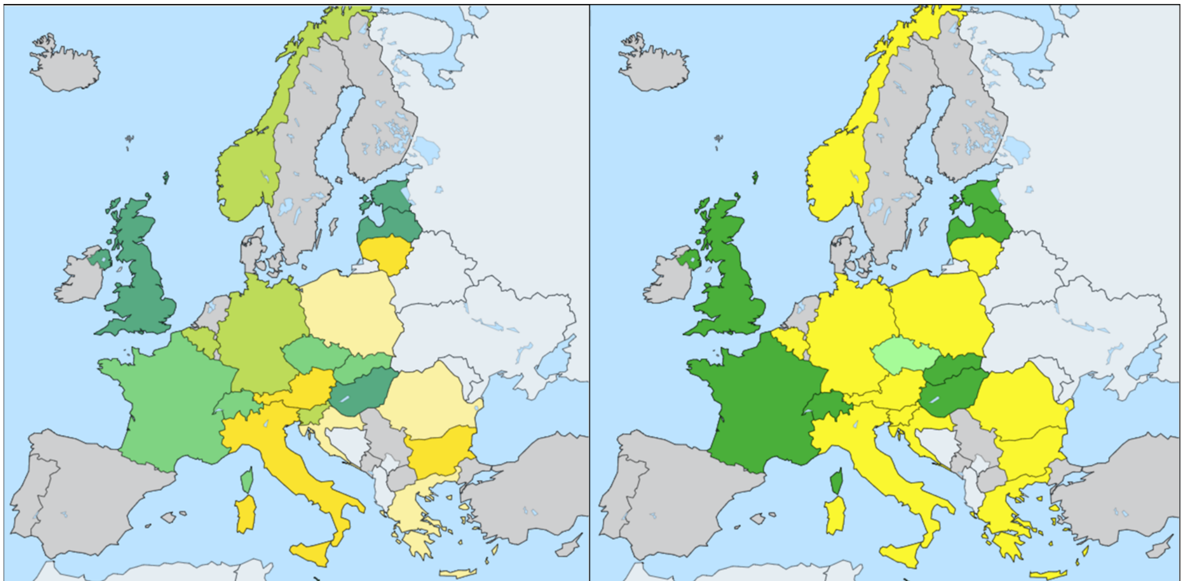
Individuals Who Have Basic or Above Basic Overall Digital Skills

Measured as a % of individuals aged 16-74 with the desired skill set. In this area especially, Czechia can exploit the available workforce skillset and kickstart its digital growth.

This Eurostat comparison comes as the most important in general business relevance and application. Regardless of industry, age, gender, education, or any other feature, 60% of the Czech population can master basic or above basic digitals tasks. The Czech Republic can count itself to the leading group of states in central Europe and Scandinavia in the digital competencies of its citizens.

Remarkably, Czechia ties with Estonia. Estonia is considered as a role model state in matters of bureau agenda digitalisation. As of 2019, Estonians can manage all government-related agendas virtually with no need for physical presence or communication with civil servants (Pesti & Randma-Liiv, 2018), except for marriage and divorce (EESTI.EE, 2019).

Table 2. Percentage of the ICT personnel on total employment



Legend		Count
	1.55 to 2.34	4
	2.34 to 2.59	4
	2.59 to 2.92	4
	2.92 to 3.11	4
	3.11 to 4.74	5
	Data not available	17

Legend		Count
	0.524 to 1	12
	1.0000	1
	1 to 1.601	8
	Data not available	17
Lowest ranking country – Greece		
Highest ranking country - Malta		

Source: Eurostat (2019). Left Overall statistics. Right Czechia = 2.96% (1.000)

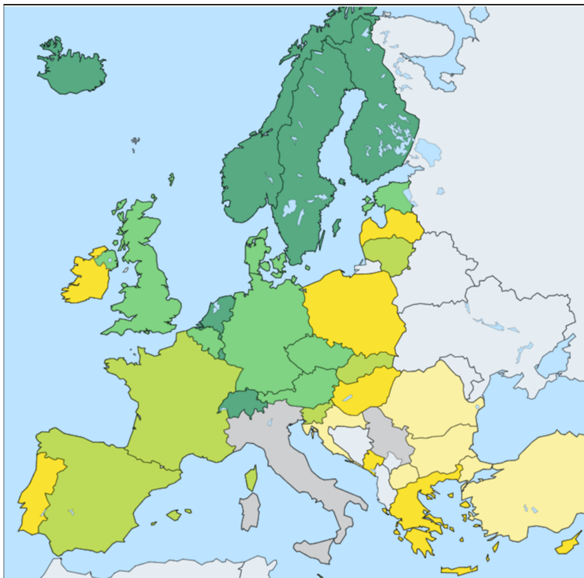
THE CZECH DIGITAL ECONOMY READINESS IN OECD CONTEXT

Similarly, the Programme for the International Assessment of Adult Competencies (PIAAC) reports Czechia among the top qualified nations in ICT competencies. There is a specific generational gap in digital mastery across the OECD countries. Along with Scandinavian countries and Korea, the Czech Republic managed to transfer to a tech-savvy education model with considerable success. Unfortunately, some OECD countries yielded little success over the years (e.g., the US, the UK, or Russia).

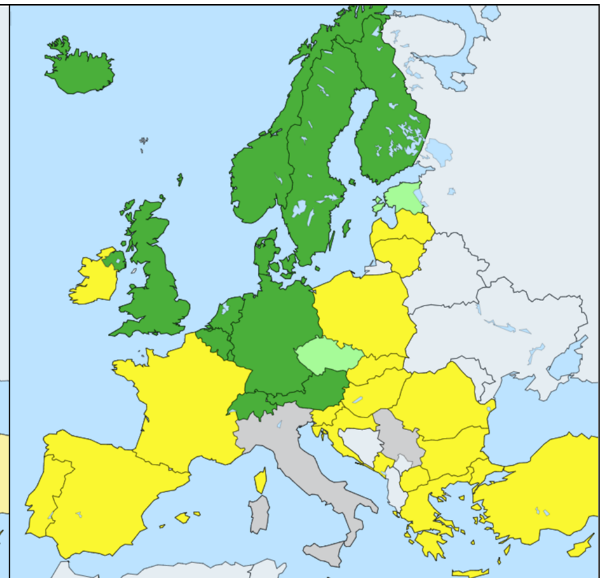
Problem-solving skills are recently becoming critical in a majority of blue-collar professions. Due to rising automation, many repetitive work tasks are carried out by machines or algorithms (Brynjolfsson, 2014). Consequently, the qualification requirements for current blue-collar jobs will be rising. With problem-solving skills ranking as the top required ones (Smet, 2014).

This dataset presents the most representative one in terms of reliably. It genuinely reflects the guaranteed supply of skilled employees in the future decades. Figure no. 4 also shows that countries with solid fundamentals of such skills, such as the UK or USA, have made little progress in problem-solving education with only circa 25% and 18% improvement. In contrast, Korea managed to improve problem-solving skills in circa 60% of the young population in a similar timeframe. Nevertheless, as the

Table 3. Percentage of Individuals who have basic or above basic overall digital skills



Legend	Count
21 to 41	7
41 to 50	8
50 to 59	6
59 to 71	7
71 to 85	7
Data not available	3



Legend	Count
0.524 to 1	12
1.0000	1
1 to 1.601	8
Data not available	17
Lowest ranking country – Bulgaria	
Highest ranking country - Iceland	

Source: Eurostat (2019). Left Overall statistics. Right Czechia = 60% (1.000)

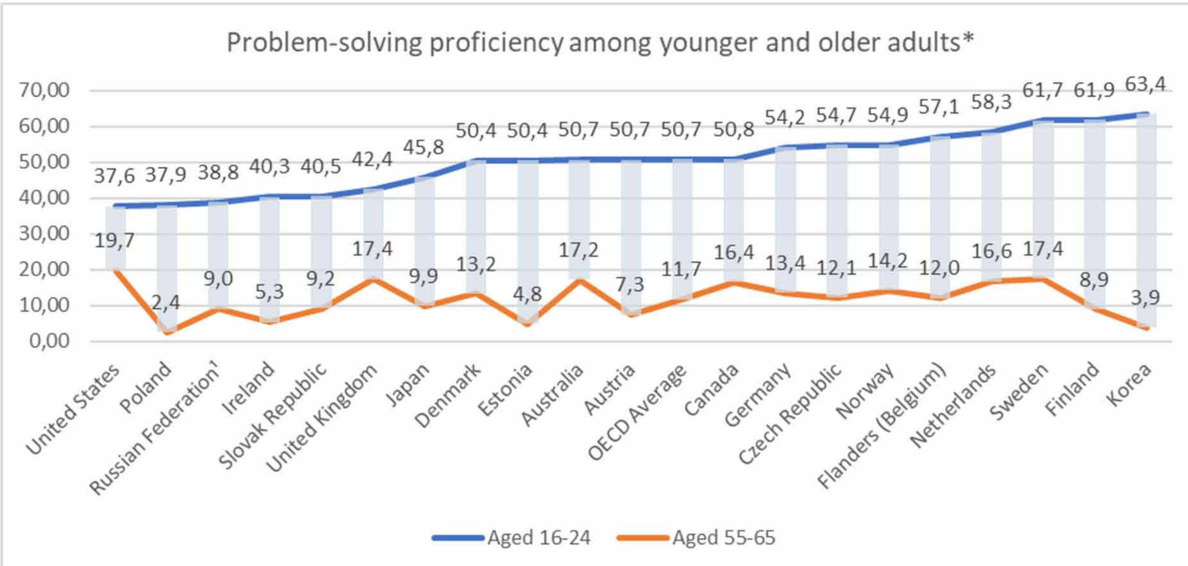
education timeframe pro-longs and requalifications are becoming standard practise in many industries, it is still possible to increase problem-solving competencies of the general population regardless of age (Manyika, 2017).

The Czech Republic ranks among top European states with 42,7% improvement, closely surpassing, e.g., the Netherlands (41,6), Germany (40,7), Norway (40,6), or Denmark (37,2). However, there is still a considerable growth gap while compared to the best performing European country Finland with its 52,9% improvement rate.

Research data on problem-solving skills distribution across the population also allows assessing whether parents' education is one of the cornerstones for problem-solving proficiency among offspring. Graph no. 5 describes the likeliness of acquiring problem-solving skills on level 1 or 2 based on the subject's parents' education.

As apparent from the graph, this does not seem to be the case across OECD. There is a slight correlation between the parent's education and the level of acquired problem-solving skills. This being remarkably evident in the case of the Czech Republic, where the majority of parents allocate to a category where at least one parent has an upper secondary degree, but neither has a tertiary degree (75,5% of the population not visible in Figure 5 below).

Figure 4. Problem-solving skills in technology-rich environments across OECD population
Source: OECD (2013), Survey of Adult Skills (PIAAC) (2012), Table A3.3 (P).
** Percentage of adults aged 16-24 and 55-65 scoring at Level 2 or 3 in problem-solving in technology-rich environments*



Eurostat data show that the Czech population follows the European trend of attending colleague and university education. While the below sample includes only respondents aged 30-35, it permits us to draw a long-term trend. Also, the trend shows that since the Czech Republic stabilised after the transfer to a market economy, the popularity of tertiary education keeps growing steadily.

Tertiary education is presumed as one of the cornerstones of digital enablement and plays a significant role alongside ICT infrastructure and problem-solving skills in the digital sector growth (Eurostat, 2019). As the popularity of different majors varies across regions and in time, it is impossible to estimate the future supply of STEM qualified graduates (MSMT, 2019a). However, in general, STEAM majors have a rising number of new students since 2017 (MSMT, 2019b).

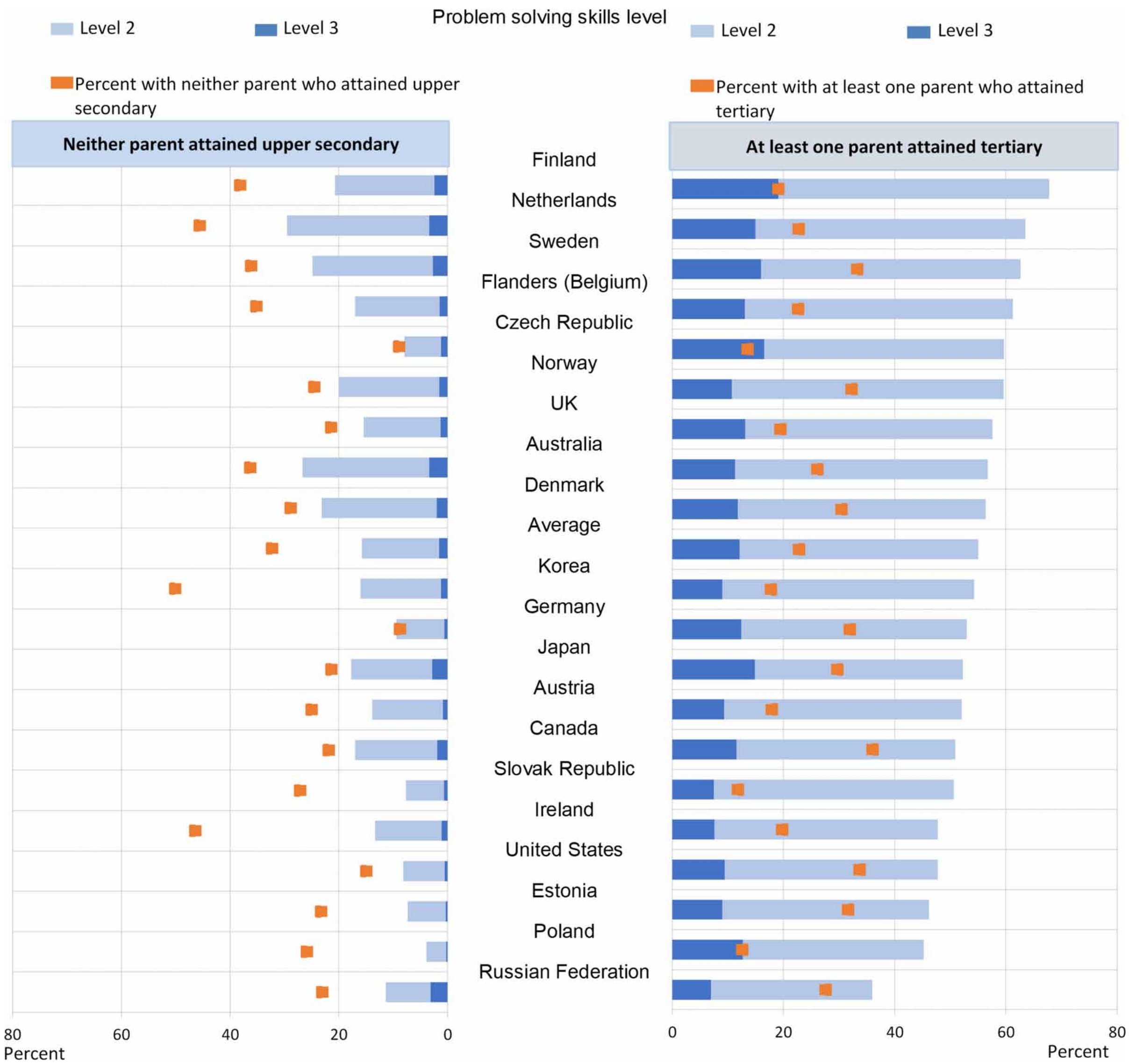
WORKFORCE, EDUCATION, AND DIVERSITY FACTORS

Diversity and better inclusion of a diverse workforce could present a partial solution to the low current supply of workers in the Czech Republic. Primary areas of consideration being gender and nationality distribution.

None of the Czech public institutions gathers or publishes information on a foreign-born and foreign-language workforce. Therefore, it is not possible to check the sector distribution of inclusion opportunities that would enable the growth of qualified work supply.

A steady growth trend is visible across non-Czech nationals residing in the country, the figure no. 7 shows both the rising popularity of university education and a rising number of foreigners in primary schools due to a higher influx of adult foreign workforce (CSO, 2018).

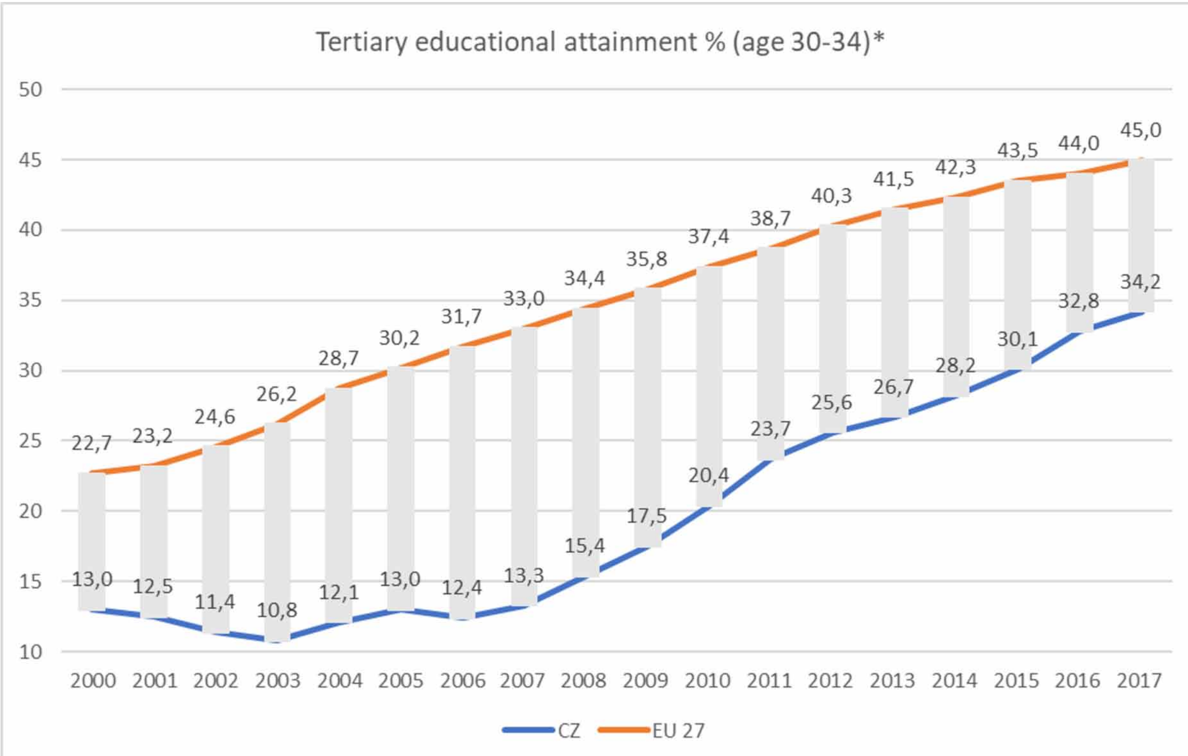
Figure 5. Problem-solving proficiency among adults with low- and high-educated parents
Source: Survey of Adult Skills (PIAAC) (2012), Table A3.7 (P) and Table B3.5 in Annex B.



The Czech government acknowledged the necessity of foreign workforce inclusion. It deployed multiple immigration regimes allowing an easier influx of foreign workforce such as “fast-track visa” (CzechInvest, 2019) or for workers from selected regions such as Ukraine (Confederation of Industry of the Czech Republic, 2019).

As per gender equality, the last decade exhibits a trend of women rapidly surpassing men in a ratio of acquired tertiary education. While graduation statistics in the Czech Republic for 2007 were almost equal at men 13% and women 13,7%. In 2017 a staggering difference came to place, with men at 27,7% and women at 41%. However, the same trend is visible across the EU, with a gender gap of 5,6% in 2007 and 10% in 2017.

Figure 6. Comparison of Czechia with the EU – tertiary education participation
Source: Eurostat (EU – LFS, 2018)
** The indicator measures the share of the population aged 30-34 who have completed tertiary studies (e.g., university, higher technical institution).*



There is no reliable dataset available on gender ratio among STEM students across the OECD or EU states. Hence the following results of PIAAC give an alternative dataset, showing which countries have a strong potential to improve education possibilities in STEM programs for women.

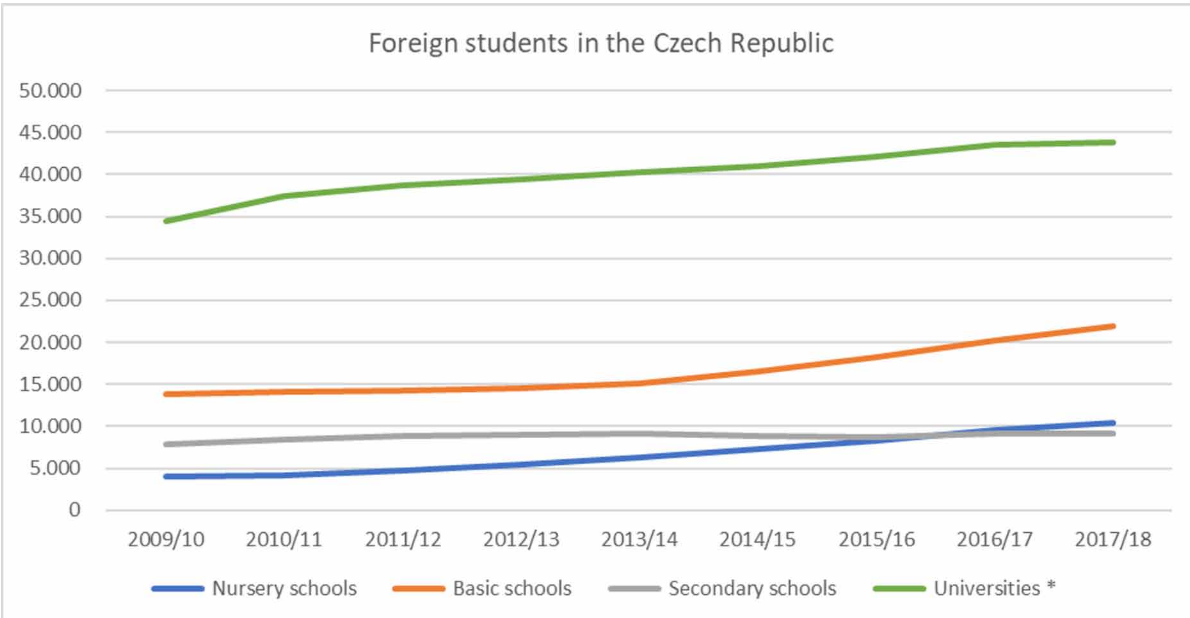
The Czech Republic has a gender gap of 5,1%, almost tying up with an OECD average of 4,7%, whereas Japan (10,8), Austria (8,4), and the UK (8,2) score with the most significant gender gap in problem-solving skills in technology-rich environments. Russia, on the contrary, comes as an example among all other OCED states, with women scoring higher on average in problem-solving than men.

REQUIRED SKILLSETS AND THEIR UTILIZATION

The comparison in figure 10 gives an overview of currently utilised skills at a workplace across OECD and within Czechia. The goal is to examine whether there are significant differences between the industries and company sizes. Examined skill sets include the three most relevant ones for the digital economy: numeracy, ICT, and problem-solving skills.

Comparing the Czech Republic and the OECD average shows no significant difference in utilising the three examined skills. Remarkably problem solving (1,81) is the least mastered skill set in the PIAAC

Figure 7. International students in the Czech Republic – last decade trend
Source: Czech Ministry of Education, Youth, and Sports (2018)
** Institutions of tertiary education type*



dataset, with a considerable gap towards other skills. Total average scores of other surpassing skills set rank at reading (2,04), ICT (2,04), and numeracy & writing (2,03).

As demonstrated so far, the Czech Republic outranks the OECD average in all the selected skill sets relevant to digital sector growth, however not by more than 5%. Hence it is not possible to draw any conclusions on further desired development of the Czech skillset supply.

Figure 8. Comparison of Czechia with the EU – tertiary education participation – gender distribution
Source: Eurostat (EU – LFS, 2018)

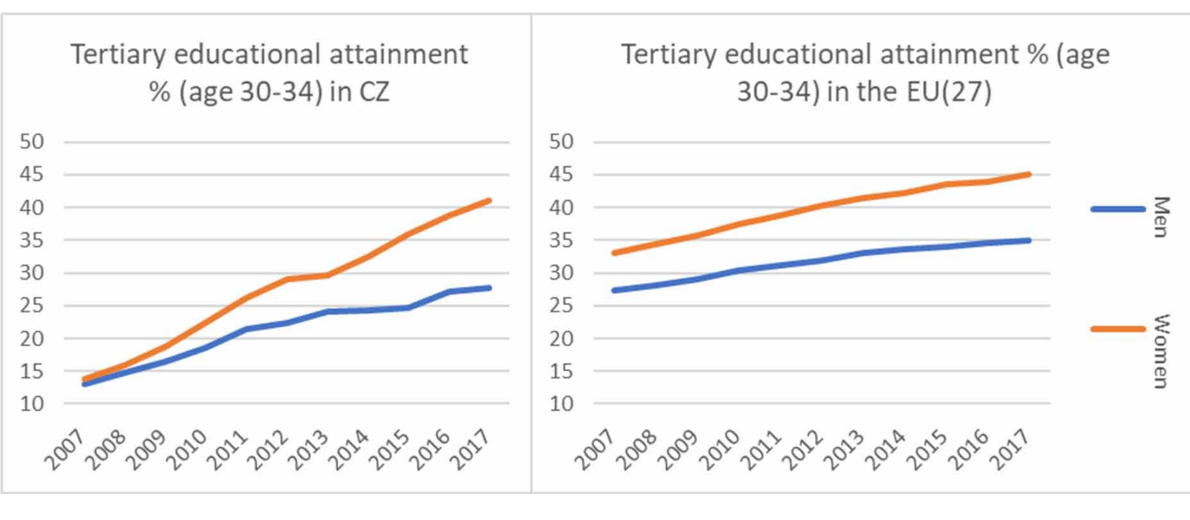


Figure 9. Problem-solving proficiency in technology-rich environments – gender distribution
Source: Survey of Adult Skills (PIAAC) (2012), Table A3.5 (P).
**Scoring at Level 2 or 3 in problem-solving in technology-rich environments*

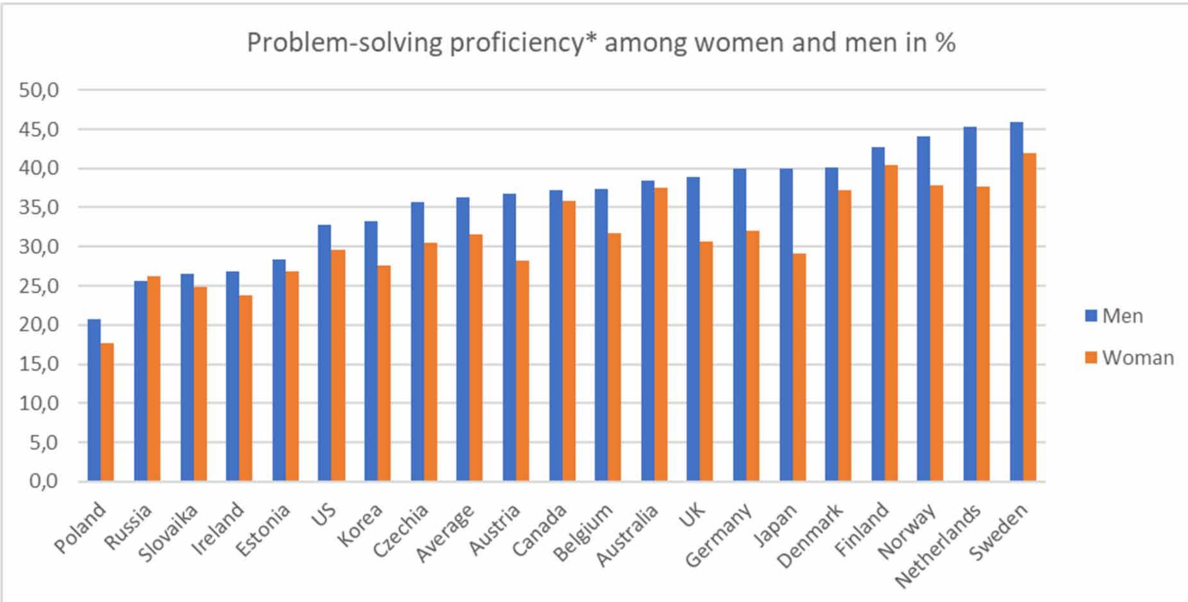


Figure11 shows the gender-based distribution (men minus women in percent) of information processing skills utilisation at work. This difference tends to be lower for Czechia in numeracy skills and almost evened out in ICT skills. Men than women significantly more utilise problem-solving skills in OECD countries.

Figure 10. Skillset utilization at work – CZ and OECD direct comparison
Source: Survey of Adults Skills (PIAAC) (2012), Table A4.1.
Notes: Skills use indicators are standardised to have a mean of 2 and a standard deviation of 1 across the entire survey sample.

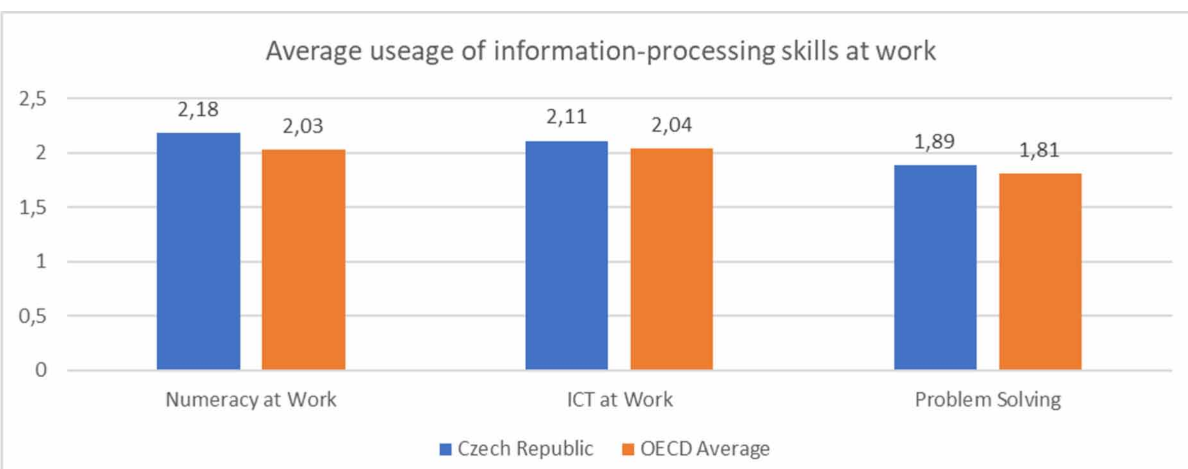


Figure 11. Skillset utilization at work – gender distribution
Source: Survey of Adults Skills (PIAAC) (2012), Tables A4.5a and A4.5b. In percent
**Adjusted estimates are based on OLS regressions, including controls for literacy and numeracy proficiency scores, hours worked, and occupation dummies (ISCO 1 digit).*

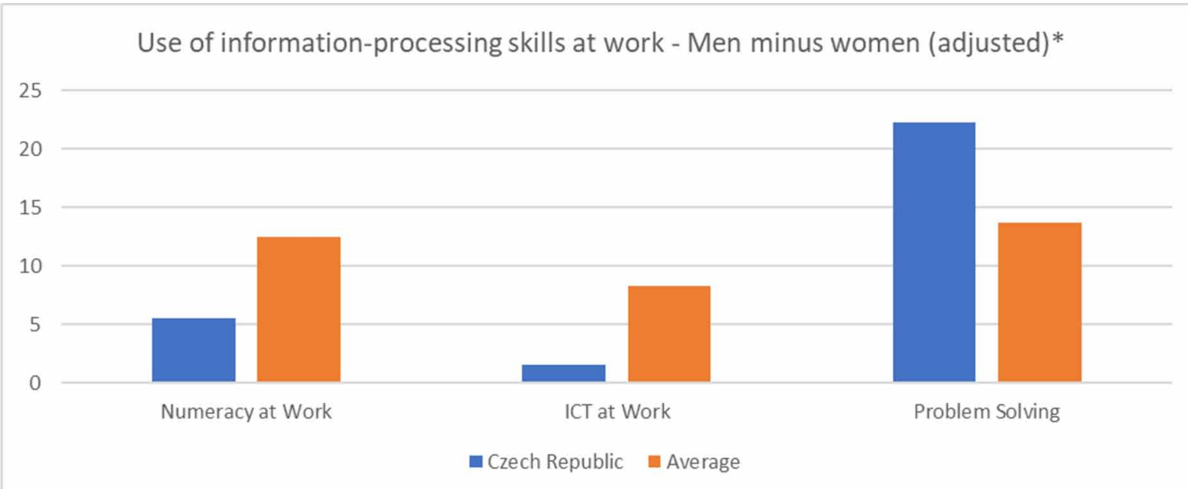


Figure 12. Skillset utilization at work –enterprise size distribution
Source: Survey of Adults Skills (PIAAC) (2012), Table A4.21. Mean values
Notes: Skills use indicators are standardised to have a mean of 2 and a standard deviation of 1 across the entire survey sample.

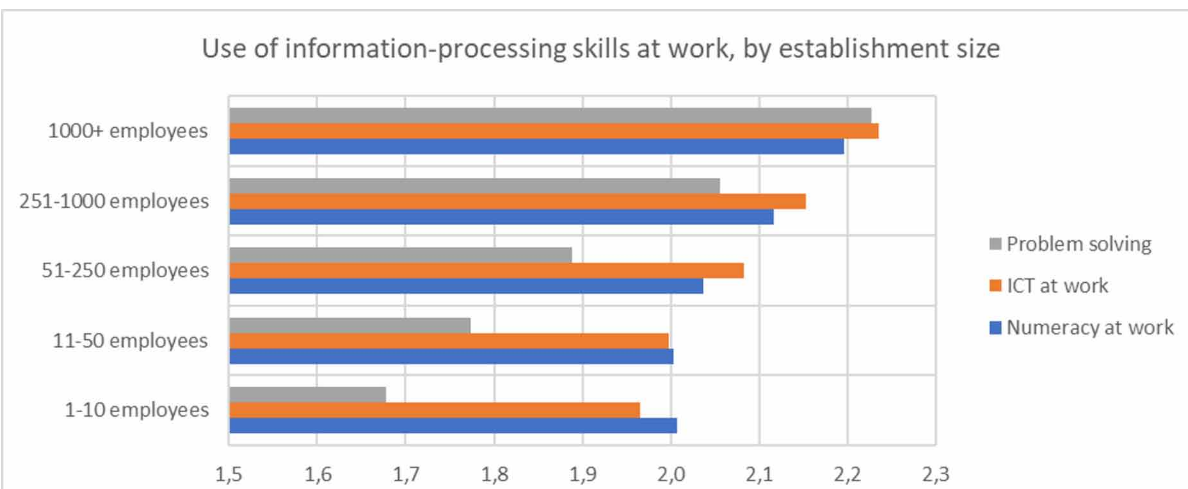
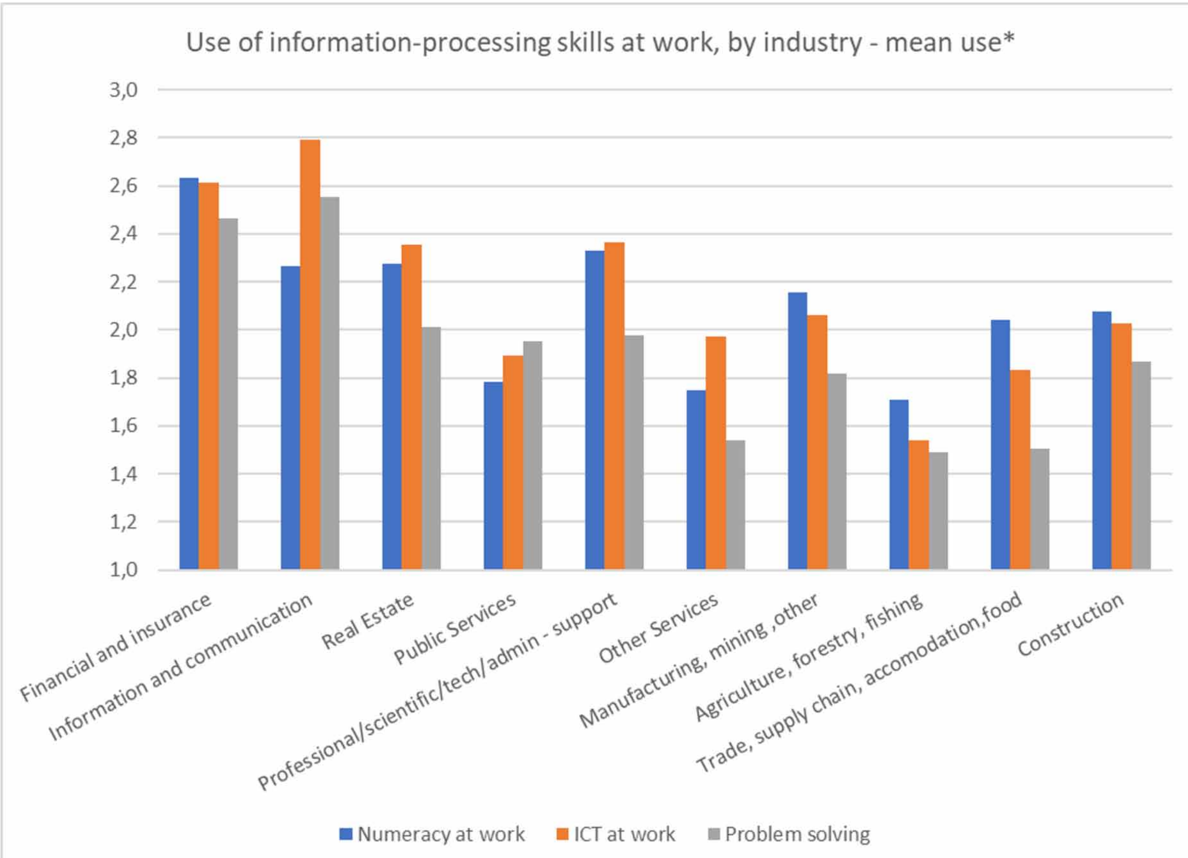


Figure 12 illustrates that as the more complex the organisation gets, the problem-solving utilisation is growing more rapidly than any other measured skills. There is only a 10% difference in utilisation of numeracy skills between small companies (of up to 10 employees) and large corporations (of 1000+ employees). The problem-solving skills are utilised up to 30% more in a similar comparison.

There is also a clear distinction between the skills utilised across various industries, as indicated in figure 13 below, with the ICT sector dominating the scale and labour-intensive manual jobs at the far end in skillset utilisation.

Figure 13. Skillset utilization at work –industry distribution
Source: Survey of Adults Skills (PIAAC) (2012), Table A4.19.
**Average use of information-processing skills, by SNA/ISIC industry, in the OECD countries participating in the Survey of Adult Skills (PIAAC)*
Notes: Skills use indicators are standardised to have a mean of 2 and a standard deviation of 1 across the entire survey sample.

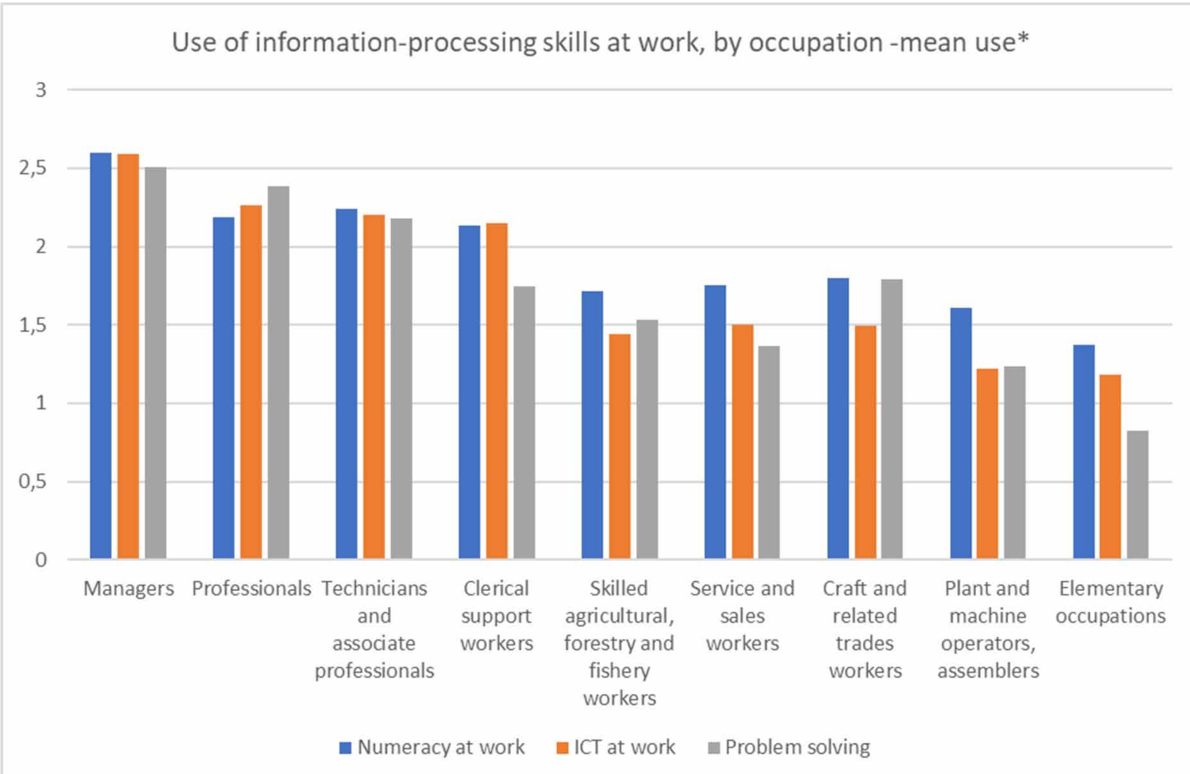


Main forerunners in utilizing skill sets required for the digital economy are the finance and ICT sectors. The agriculture sector, on the other hand, utilises about 40% less of these skills. Manual, labour-intensive industries are not expected to encounter dramatic changes in upcoming decades as per the utilisation of information-processing skills in technology-rich environments. Public services, however, are expected to encounter rapid growth of digital solutions, and hence the structure of the jobs is likely to shift towards higher utilisation of such skills (Pesti & Randma-Liiv, 2018).

Similar distribution diversity in the utilisation of digital economy skills is observable across various occupations, as depicted in figure 14 below.

On average, managerial professionals utilise problem-solving skills up to three times more than elementary occupations. Moreover, numeracy skills are utilised about two times more in a similar comparison. As presumed by many, skill utilisation is likely to change across professions (Gates, 2017; Brynjolfsson 2014; Ford, 2015). Hence, similar research presented in graphs 13 and 14 might yield a different outcome if carried out in future decades.

Figure 14. Skillset utilization at work –occupation distribution
Source: Survey of Adults Skills (PIAAC) (2012), Table A4.17.
**Average use of information-processing skills, by ISCO-1-digit occupation, in the OECD countries participating in the Survey of Adult Skills (PIAAC)*
Notes: Skills use indicators are standardised to have a mean of 2 and a standard deviation of 1 across the entire survey sample.



The above observations outline the future situation in the job market regarding qualification workforce supply. Since their job market, education, and business sector demand are dynamic and flexible across the decades. It. It is impossible to further future model situations in the country and the central European region. However, the above-presented findings provide a clear overview of the current situation and data-based estimations for expected future development. Noted observations come of high value, especially for top management, government officials, and key stakeholders in the education, ICT, and industry sectors.

KEY STUDY FINDINGS AND CONCLUSION

While the Czech Republic might lack workforce supply throughout 2018 and 2019 (CSO, 2019), the supply itself is highly qualified - making the country a strong competitor on the European and global market (PIAAC, 2012). The Czech Republic still retains a slight cost advantage, and with the rising popularity of tertiary education, skill quality will likely improve in the future (Eurostat, 2012).

Within the EU, Czechia ranks among the top nations in metrics tracked by the Eurostat. Placing it close to Scandinavian and west-central European states, or so-called "digital forerunners" and just above other "digital challengers" in the European region (McKinsey & Company, 2018). A high ratio of the ICT sector on GDP and employment (Eurostat, 2019) provides a solid fundament for further growth of the country's digital capabilities. The same goes for the high problem-solving skills of the Czech population (OECD, 2013; PIAAC, 2012). The growth trend is persistent across the population, regardless of gender and educational or national background (CSO, 2019).

The goal is to sustain digital economy growth and enable its acceleration. To achieve it, the inclusion of a Czech diverse workforce comes as a critical factor (Czech Unemployment office, 2018). As well as a closure of the productivity gap between Czechia and its western neighbours (McKinsey & Company, 2018). The study suggests this should be the case, as the Czech Republic scores better in many analysed areas than other central European states (OECD, 2018; Eurostat 2019; PIAAC, 2012).

As the importance and utilisation of problem-solving skills grow alongside the demand for STEM majors graduates (Frey & Osborne, 2017), it is paramount to enable the population to acquire such skill sets. Hence the education in tech and ICT comes a key to further digital enablement of the country and region. Suggestions on efficient educational innovation and practice come as an open question out of scope of managerial field, however, comes at utmost importance to education practitioners and stakeholders. Overall statistics summary suggests that The Czech Republic is among the top countries that already managed to shift workforce skillset toward digital enablement (CSO, 2019; OECD, 2018; Eurostat, 2019; PIAAC, 2012).

AREAS FOR FURTHER RESEARCH

The digital transformation presents a fast-growing and, in many aspects, uncharted research area (Gates & Bremicker, 2017). Any study that contributes by solid data-based observations comes as a valuable addition to the current discourse. Also, as the global work and job market undergoes turbulent changes towards a digitally-enabled economy, it is highly desirable to research the impact of these changes on various business operations (Manyika & Chui, 2017).

OECD plans to publish updated results of its PIAAC global skill set research. The next generation of the research will enable the first historical comparison of data gathered by the same methodology and allow precise observations on the actual development of examined skill sets in OECD countries.

Furthermore, digital technologies incorporation come with multitude of risks factors that need to be addressed accordingly such as:

1. Data security ………….. 5. Social disconnect ………… 9. Copyright
2. Crime/terrorism ………. 6. Work overload ……………. 10. Anonymity
3. Complexity …………… 7. Digital manipulation ……… 11. Over-reliance
4. Privacy concerns ……… 8. Job security ……………….. 12. Addiction

Finally, it is vital to research digital readiness on various nationwide levels, as the governments are key players in enabling further development of this crucial economic sector (Brunet-Thornton & Martinez, 2018). As well as more detailed investigation of newly emerging educational areas such as AI, machine learning and advanced robotics.

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KEY TERMS AND DEFINITIONS

Digital Capabilities: Is the term used to describe the skills and attitudes that individuals and organisations need if they are to thrive in today's world. At an individual level we define digital capabilities as those which equip someone to live, learn and work in a digital society.

Digital Economy: Refers to an economy that is based on digital computing technologies, although we increasingly perceive this as conducting business through markets based on the internet and the World Wide Web. The digital economy is also referred to as the Internet Economy, New Economy, or Web Economy.

Digital Technologies: Are electronic tools, systems, devices and resources that generate, store or process data.

ICT Sector: Information and communications technology (ICT) is an extensional term for information technology (IT) that stresses the role of unified communications and the integration of telecommunications and computers.

Numeracy Skills: Refer to the ability to use, interpret and communicate mathematical information to solve real-world problems.

Problem-Solving Skills: Are connected to a number of other skills, including analytical skills, innovative and creative thinking, lateral mindset and adaptability and flexibility.

Tertiary Education: Also referred to as third-level, third-stage, or post-secondary education, is the educational level following the completion of secondary education.

Chapter 4
Digitalisation and Financial Service Innovation in Banking:
A Global Perspective

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ABSTRACT

The banking environment has become highly competitive today. The banking sector is undergoing the process of radical transformation due to excessive competition of foreign and private players and changes in tastes, preference, and habits as well as expectations of customers for newer products. India has a diversified financial sector undergoing rapid expansion, both in terms of strong growth of existing financial services firms and new entities entering the market. The Government of India has introduced several reforms to liberalise, regulate, and enhance this industry. The Government and Reserve Bank of India (RBI) have taken various measures to facilitate easy access to finance for micro, small, and medium enterprises (MSMEs). Also, the advancements in technology have brought the mobile and internet banking services to the fore. Thus, many banks launched contact-less credit and debit cards in the market. These types of cards, which used to near field communication (NFC) mechanism, allowed customers to transact without having to insert or swipe.

INTRODUCTION

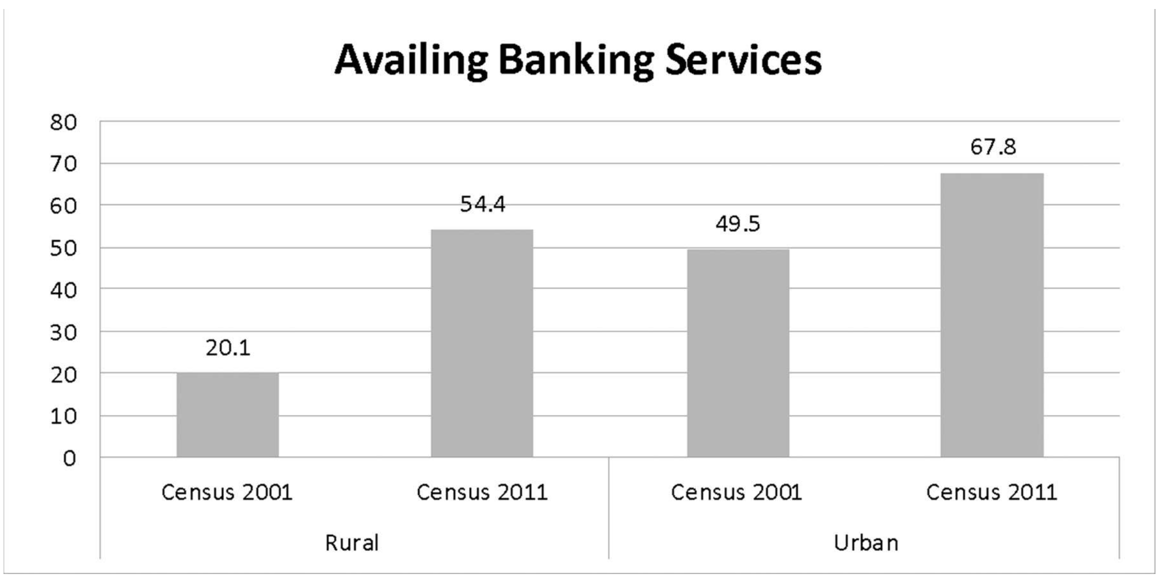
Banking environment has become highly competitive today. The Banking sector is undergoing the process of radical transformation due to excessive competition of foreign and private players and changes in tastes, preference and habits as well as expectations of customers for newer products. The traditional view of business which was the right product must be available in the right place at the right time is replaced now by a more dynamic and flexible concept that any product should be available at anytime and anywhere (Aditi, 2013). To be able to survive and grow in the changing market environment globally, banks are going for the latest technologies, which is being perceived as an enabling resource that can help in developing more flexible structure that can respond quickly to the dynamics of a fast changing

DOI: 10.4018/978-1-7998-2402-2.ch004

global market scenario (Research Gate, 2018). It is also viewed as an instrument of cost reduction and effective communication with people and institutions associated with the banking business.

Over the years, the Banking Sector in India has seen a number of changes. Most of the banks have begun to take an innovative approach towards banking with the objective of creating more values for customers and consequently the banks. E-Banking enables the people to carry out most of their banking transactions using a safe website which is operated by respective banks. With the emergence of Privatisation, Globalisation and Liberalisation in India, banks are focusing on Research and Development and applying various innovative ideas and technology such as ECS, RTGS, NEFT, EFT, ATM, Retail Banking, Debit and Credit cards, mobile application and many more (Neha Yajurvedi, 2015). Therefore, there is a close relationship between the development of banking sector and the new innovations in technology and Electronic data processing. The Indian Banking has finally worked up to the competitive dynamics of new Indian market and its relevant issues concerning the various challenges of Globalisation. Hence the banks that employ IT solutions are perceived to be futuristic and proactive players capable of meeting the multifarious requirements of large and multi level customer base.

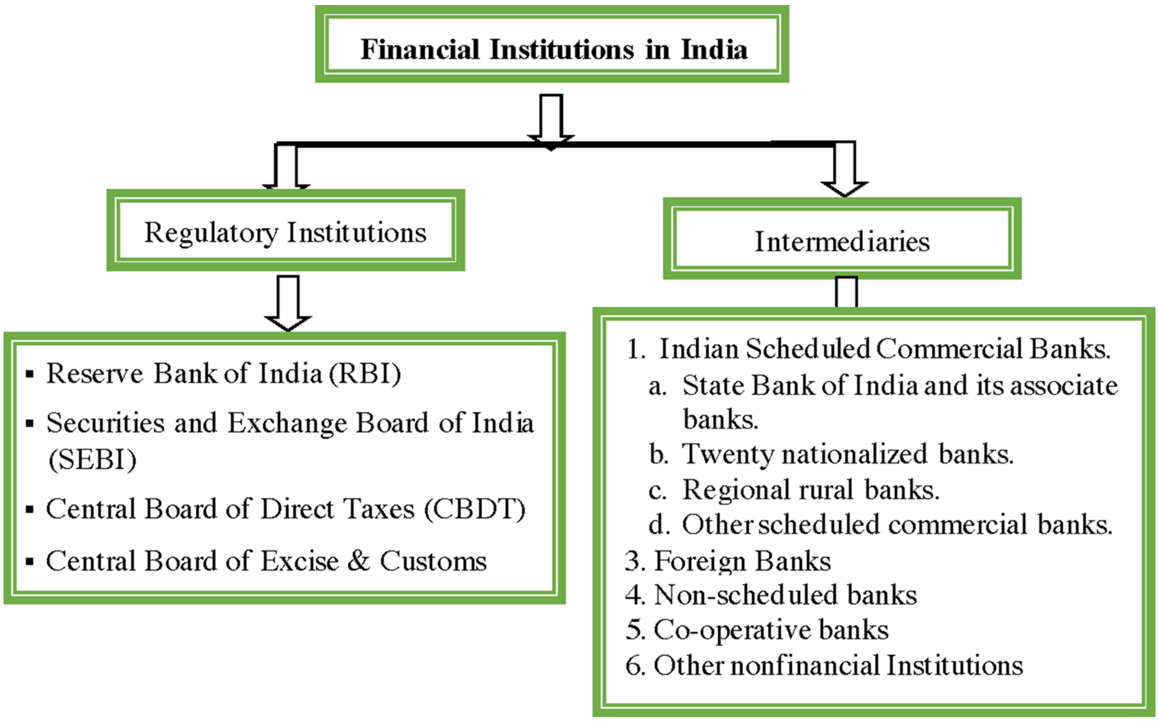
Figure 1. Percentage people availing banking services
Source: Department of Financial Services, GOI.



Financial Institutions in India

The financial institution in India is divided into two categories. The first type refers to the regulatory institutions and the second type refers to the intermediaries. The regulators are assigned with the job of governing all the divisions of the Indian financial system. These regulatory institutions are responsible for maintaining the transparency and the national interest in the operations of the institutions under their supervision.

Figure 2.



Banking and International Banking Services

The Uruguay Round of trade negotiations has paved the way for the deregulation of financial services in many developing and developed countries and has led to a significant increase in the volume of international financial services activities and also that provided opportunities for many financial institutions to expand their business activities globally. It is noteworthy that further negotiations on trade in financial services continued, after the completion of the Uruguay Round, with a new Agreement reached under the General Agreement on Trade in Services (GATS) in December 1997. The Agreement covers many facets of the financial service sector including insurance, securities companies as well as the banking sector (Fariborz Moshirian, 2004). All these commitments and deregulations are leading to a greater increase in the international financial services products and the emergence of more consolidated financial institutions at the global level as well as India.

India has a diversified financial sector undergoing rapid expansion, both in terms of strong growth of existing financial services firms and new entities entering the market. The sector comprises commercial banks, insurance companies, non-banking financial companies, co-operatives, pension funds, mutual funds and other smaller financial entities. The banking regulator has allowed new entities such as payments banks to be created recently thereby adding to the types of entities operating in the sector (RBI, 2018). However, the financial sector in India is predominantly a banking sector with commercial banks accounting for more than 64 per cent of the total assets held by the financial system.

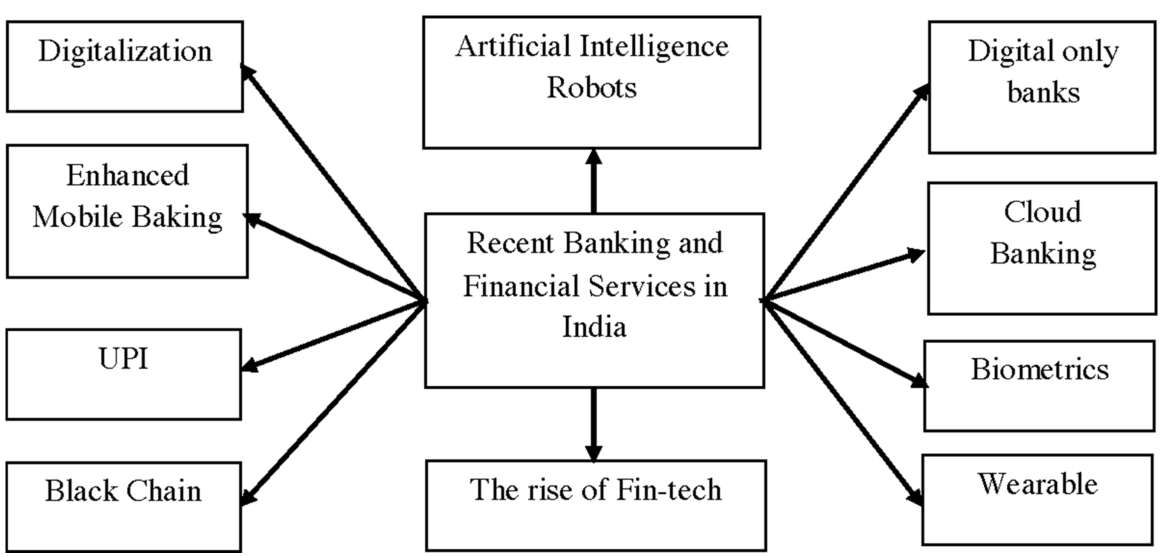
The Government of India has introduced several reforms to liberalise, regulate and enhance this industry. The Government and Reserve Bank of India (RBI) have taken various measures to facilitate easy access to finance for Micro, Small and Medium Enterprises (MSMEs). With a combined push by both government and private sector, India is undoubtedly one of the world's most vibrant capital markets. In 2017,a new portal named 'Udyami Mitra' has been launched by the Small Industries Development Bank of India (SIDBI) with the aim of improving credit availability to Micro, Small and Medium Enterprises' (MSMEs) in the country. India has scored a perfect 10 in protecting shareholders' rights on the back of reforms implemented by Securities and Exchange Board of India (SEBI) (Reserve Bank of India, 2018).

As per the Reserve Bank of India (RBI), India's banking sector is sufficiently capitalized and well-regulated. The financial and economic conditions in the country are far superior to any other country in the world. Credit, market and liquidity risk studies suggest that Indian banks are generally resilient and have withstood the global downturn well. Indian banking industry has recently witnessed the roll out of innovative banking models like payments and small finance banks. RBI's new measures may go a long way in helping the restructuring of the domestic banking industry. The digital payments system in India has evolved the most among 25 countries with India's Immediate Payment Service (IMPS) being the only system at level 5 in the Faster Payments Innovation Index (FPII). As a result, Global payments solution giant Master card has launched its first technology lab in Pune, which will enable India to move towards digital economy and financial inclusion and four metro cities of Delhi, Mumbai, Bangalore and Chennai can reap benefits of US$ 7.2 billion annually by increasing payments through digital means. As a result India is today one of the most vibrant global economies, on the back of robust in banking sectors (AMFI,2018).

Recent Banking Services in India

The Banking institutions in India are vital sectors of economy development. The development can impact the growth of the country in an incredible way. In the recent years the Government of India has introduced many schemes and some of the important schemes are listed here.

Figure 3. Recent banking services in India



Digitization

The digital technology in the world has rabidly increased past two decades and it became imperative for banking and financial services in India to keep up with the changes and innovate digital solutions for the tech-savvy customers. Besides the financial institutions, insurance, healthcare, retail, trade, and commerce are some of the major industries that are experiencing the enormous digital shift. To stay competitive, it is necessary for the banking and financial industry to take the leap on the digital bandwagon. In India, it all began not earlier than the 1980s when the banking sector introduced the use of information technology to perform basic functions likes customer service, book-keeping, and auditing (Deolalkar, 2010). However, the transformation began in the 1990s during the time of liberalization, when the Indian economy exposed itself to the global market. The banking sector opened itself for private and international banks which is the prime reason for technological changes in the banking sector. Today, banks and financial institutions have benefitted in many ways by adopting newer technologies. The shift from conventional to convenience banking is incredible.

Modern trends in banking system make it easier, simpler, paperless, signatureless and branchless with various features like IMPS (Immediate Payment Service), RTGS (Real Time Gross Settlement), NEFT (National Electronic Funds Transfer), Online Banking, and Tele-banking. Digitization has created the comfort of "anywhere and anytime banking." It has resulted in the reduced cost of various banking procedures, improved revenue generation, and reduced human error. Along with increased customer satisfaction, it has enabled the customers creating personalized solutions for their investment plans and improve the overall banking experience.

Enhanced Mobile Banking

Mobile banking is one of the most dominant current trends in banking systems. As per the definition, it is the use of a smartphone to perform various banking procedures like checking account balance, fund transfer, and bill payments, without the need of visiting the branch. This trend has taken over the traditional banking systems. In the coming years, mobile banking is expected to become even more efficient and effortless to keep up with the customer demands. Mobile banking future trends hint at the acquisition of IoT and Voice-Enabled Payment Services to become the reality of tomorrow. These voice-enabled services can be found in smart televisions, smart cars, smart homes, and smart everything (Deolalkar, 2010). Top industry leaders are collaborating to adopt IoT-connected networks to create mobile banking technologies that require users' voice to operate.

Unified Payments Interface (UPI)

Unified Payments Interface has changed the way payments are made. It is a real-time payment system that enables instant inter-bank transactions with the use of a mobile platform. In India, this payment system is considered the future of retail banking. It is one of the fastest and most secure payment gateways that is developed by National Payments Corporation of India and regulated by the Reserve Bank of India. The year 2016 saw the launch of this revolutionary transactions system. This system makes funds transfer available 24 hours, 365 days unlike other internet banking systems (Neha, 2018). There are approximately 39 apps and more than 50 banks supporting the transaction system. In the post-demonetization

India, this system played a significant role. In the future, with the help of UPI, banking is expected to become more "open."

Block Chain

Blockchain is the new kid on the block and the latest buzzword. The technology that works on the principles of computer science, data structures and cryptography and is the core component of cryptocurrency, is said to be the future of banking and financial services globally. Blockchain uses technology to create blocks to process, verify and record transactions, without the ability to modify it. NITI Aayog is creating IndiaChain, India's largest blockchain network, which is expected to revolutionize several industries, reduce the chances of fraud, enhance transparency, speed up the transaction process, lower human intervention and create an unhackable database (Neha, 2018). Several aspects of banking and financial services like payments, clearance and settlement systems, stock exchanges and share markets, trade finance, and lending are predicted to be impacted. With its strenuous design, block chain technology is a force to be reckoned with.

Artificial Intelligence Robots

Several private and nationalized banks in India have started to adopt chat bots or Artificial intelligence robots for assistance in customer support services. For now, the use of this technology is at a nascent stage and evolution of these chat bots is not too far away. Usage of chat bots is among the many emerging trends in the Indian banking sector that is expected to grow. More chat bots with the higher level of intelligence are forecasted to be adopted by the banks and financial institutions for improved customer interaction personalized solutions (RBI, 2017). The technology will alleviate the chances of human error and create accurate solutions for the customers. Also, it can recognize fraudulent behavior, collate surveys and feedback and assist in financial decisions.

The Rise of Fin-Tech Companies

Previously, banks considered Fin-tech companies a disrupting force. However, with the changing trends in the financial services sector in India, fin-tech companies have become an important part of the sector. The industry has emerged as a significant part of the ecosystem. With the use of financial technology, these companies aim to surpass the traditional methods of finance. In the past few decades, massive investment has been made in these companies and it has emerged into a multi-billion-dollar industry globally. Fin-tech companies and fin-tech apps have changed the way financial solutions are provided to the customers. Besides easy access to financial services, fin-tech companies have led to a massive improvement in services, customer experience, and reduced the price paid. In India, the dynamic transformation has been brought upon by several important elements like fin-tech start-ups, established financial institutions, initiatives like "Start-Up India" by Government of India, incubators, investors, and accelerators (Union Budget, 2017). According to a report by National Association of Software and Services Companies (NASSCOM), the fin-tech services market is expected to grow by 1.7 times into an $8 billion market by 2020.

Digital-Only Banks

It is a recent trend in the Indian financial system and cannot be ignored. With the entire banking and financial services industry jumping to digital channels, digital-only banks have emerged to create paperless and branchless banking systems. This is a new breed of banking institutions that are overtaking the traditional models rapidly. These banks provide banking facilities only through various IT platforms that can be accessed on mobile, computers, and tablets. It provides most of the basic services in the most simplified manner and gives access to real-time data. The growing popularity of these banks is said to be a real threat to traditional banks. ICICI Pockets is India's first digital-only bank (RBI, 2017). These banks are attractive to the customers because of their cost-effective operating models. At the same time, though virtually, they provide high-speed banking services at very low transaction fees. In today's fast lane life, these banks suit the customer needs because they alleviate the need of visiting the bank and standing in a queue.

Cloud Banking

Cloud technology has taken the world by storm. It seems the technology will soon find its way in the banking and financial services sector in India. Cloud computing will improve and organize banking and financial activities. Use of cloud-based technology means improved flexibility and scalability, increased efficiency, easier integration of newer technologies and applications, faster services and solutions, and improved data security. In addition, the banks will not have to invest in expensive hardware and software as updating the information is easier on cloud-based models.

Biometrics

Essentially for security reasons, a Biometric Authentication system is changing the national identity policies and the impact is expected to be widespread. Banking and financial services are just one of the many other industries that will be experiencing the impact. With a combination of encryption technology and OTPs, biometric authentication is forecasted to create a highly-secure database protecting it from leaks and hackers attempts. Financial services in India are exploring the potential of this powerful technology to ensure sophisticated security to customers' account and capital.

Wearable's

With smart watch technology, the banking and financial services technology is aiming to create wearable's for retail banking customers and provide more control and easy access to the data. Wearable's have changed the way we perform daily activities. Therefore, this technology is anticipated to be the future retail banking trend by providing major banking services with just a click on a user-friendly interface on their wearable device. These are some of the recent trends in the banking and financial sector of India and all these new technologies are predicted to reshape the industry of business and money. The future is going to bring upon a revolution of sorts with historical changes in traditional models. The massive shift in the landscape has few challenges. Nonetheless, the customers are open to banking innovations and the government is showing great support with schemes like "Jan Dhan Yojana," which aims at proving a bank account to every citizen (RBI, 2017). Meanwhile, the competition from the foreign and private sector banks have strained the government regulators, nationalized banks and financial institutions to adopt new technology in order to stay relevant in the race.

CONCLUSION

To this end, Mr Bill Gates, Co-founder of Microsoft Corp, has stated that India will move quite rapidly to a digital payments economy in as little as seven years, based on the introduction of digital payment banks combined with other things like direct benefit transfers, universal payments interface and Aadhaar (RBI, 2018). Enhanced spending on infrastructure, speedy implementation of projects and continuation of reforms are expected to provide further impetus to growth. All these factors suggest that India's banking sector is also poised for robust growth as the rapidly growing business would turn to banks for their credit needs. Also, the advancements in technology have brought the mobile and internet banking services to the fore. The banking sector in India is laying greater emphasis on providing improved services to their clients and also upgrading their technology infrastructure, in order to enhance the customer's overall experience as well as give banks a competitive edge. Thus, many banks were launched contactless credit and debit cards in the market. These types of cards which used to near field communication (NFC) mechanism that allowed customers to transact without having to insert or swipe.

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Chapter 5
Impact of the Digital Transformation Process on Bank Relationships With Customers

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ABSTRACT

Modern world digitalization is inevitable. The role of digitalization in the banking sector has altered customers' preferences and demands. The latest innovation and developments in the digital era have affected the banking industry and the effects on the relationship between customers and banks. The banks' new digital focus has to be aligned with other factors in the banks for them to function effectively. The purpose of this study is to investigate how the banks' relationship with customers is affected by this digital focus. It indicates that the relationship with customers has become less personalized and more automated. It also shows that an alignment in the bank has contributed to increased satisfaction among digitally oriented customers.

INTRODUCTION

The introduction of the most recent digital developments in the banking industry implies that retail banks' role in the financial sector has changed. The pace of digital developments and the fact that the industry is becoming more digital-oriented have opened the way for new competitors to establish themselves in the financial services market. For years, retail banks were protected by the industry's high entry barriers. However, the development of digital technologies has lowered the entry barriers for more innovative businesses to capture parts of the incumbent banks' value chain. This has made it possible for non-financial competitors to establish themselves in the industry by offering more niche and customized financial services and products.

Recent innovations in digital technology have resulted in increased competition from innovative firms, but it has also sparked a change in consumer preferences and demands that have altered the relation-

DOI: 10.4018/978-1-7998-2402-2.ch005

ship between the consumers and retail banks. Consumers are today more willing to conduct their bank errands through digital platforms.

Digital transformation may look different in every industry. It requires the integration of digital technology into every area of an industry or a business. This integration of technology brings fundamental changes in the operation of the business and delivers value to its customers. Digital transformation in banking has helped in reducing costs and simplifying the process. It has made banking easy and convenient. The end-to-end integration helps in ensuring a seamless and engaging customer experience.

THEORETICAL BACKGROUND

For the current article digital transformation is understood as a multilevel technology-based change in the firms that includes both the exploitation of digital technologies to improve existing processes and their efficiency and the exploration of digital innovation, which can potentially transform the business model. Transformation refers to a fundamental change within the organization, which has a major impact on organizational strategy and structures and the distribution of power. For this article digital transformation is referred only to as Banks' Relationship with Customers.

Traditionally the banking industry has conducted its businesses with consumers through face-to-face interactions. However, as of late, retail banks have increased their use of digital platforms as supplementary channels to branch offices to offer their products and services to consumers. These supplementary channels allow banks to offer more personalized service at any time and anywhere geographically more effectively. The idea is that by using more digitalized platforms, the customers' involvement will increase and, therefore, create a more loyal customer base. This increase in involvement among customers allows the banks to operate more effectively and more cost-efficiently since customers can perform their errands through the bank's digital channels, such as the internet bank.

LITERATURE REVIEW

In this study, the literature has been used to get an understanding of how the current situation looks like in the areas of interest for the study and to discover the theoretical perspectives that are of relevance for the study. This was done to gain an insight into the subject, but also to raise awareness of different angles in the relevant areas (Saunders et al., 2016).

Rather than providing a complete summary of the relevant theories, they've instead been focused on the most relevant parts. This is because customer relationship management and digital strategy are very large areas, and not everything in them was of interest in the study. The chosen method is reminiscent of a narrative literature review that has a narrow scope that only includes the relevant part of the literature (Saunders et al., 2018).

The transformation of the digital world has an impact on the financial industries nowadays, reshaping the banking business model. The steps towards digital banking include business process developments, new business models, and an entire change of the banking value chain, with predilection on six interest areas: the banking operational processes, the banks' clients, the revenue models, the digital platforms, data-base driven models and banking value chain (Gasser et. al., 2017).

Through this literature review, a theoretical model that was based on the literature could be created for the use of analyzing the Digital Transformation Process on Banks' Relationship with Customers.

CHALLENGES OF DIGITAL TRANSFORMATION IN BANKING

The future of banking with digitalization looks promising, and it is expected to change the image of traditional banks and bring more services to the customers. However, there are certain challenges faced by banks that need to be addressed.

- Competition with Non-Financial Institutions

Various non-financial institutions provide banking facilities to the customers. They allow the customers to make transfers directly into other people's bank accounts, thereby leaving banks out of the picture. However, it may be noted that banks are more regulated; therefore, they are more secure.

- Online Payments

Every bank doesn't support online or contactless payments. The reason why they can't provide is that they don't have a secure online platform, resources, etc. to make it possible.

- Technologies

The banking system that provides online banking services must be continuously updated so that they may have an adequate security level. The banks must set up a detailed strategy and select appropriate technologies to turn ideas into reality. The process of digital transformation is endless as technologies continue to enhance each day; therefore, it's important is to stay updated. This could be a challenge with digital transformation. New technologies will bring about new services that must be upgraded and continuously supported.

DIGITAL TRANSFORMATION BENEFITS IN BANKING

- Customer Service

The customers have been benefitted the most from it. Having a device and internet connectivity can allow a customer to access his bank account and conduct transactions from anywhere and at any time. It saves time and expenses as the customer doesn't require going to bank branches, and they don't require standing in the queues for getting their work done. It has made things more convenient and customer-friendly.

- 24/7 Availability

Digital switchover of the banking industry has ensured that the banks are available for customers 24/7. The customer can avail his or her bank account to check records anytime and can access several banking services round the clock.

- Instant Banking Services

Another positive impact has been the luxury of instant banking which doesn't require waiting for a considerable period. It has helped in saving a lot of time for the customers.

- Lower Overheads

It has also lead to reduced operating costs for the banks. Lower operating costs mean more profit for banks.

- Banking Benefits

The convenience that is offered by banks has increased the number of customers of banks. This is due to the convenience and reduction in human error in calculations. Records of transactions are maintained electronically, which allows the generation of reports and analysis of data anytime for different purposes.

DISADVANTAGES OF DIGITAL TRANSFORMATION IN BANKING

The benefits of digital transformation may be impressive, but certain disadvantages follow the process.

- Security Concerns

This is one of the most critical concerns with the digital switchover of the banking sector. Various companies and institutions have found cybersecurity as a concern that they have not been able to overcome completely. The use of sophisticated software that aims to protect data is not able to provide 100% security from phishing, scammers, hackers, etc.

- Services

Right now, there are not too many banks that provide a variety of online services. They may still require your physical presence at the traditional bank branches.

- Transactions

For making complex transactions, your physical presence may be required at the bank branches. Moreover, international transactions are still not possible with all digital banks.

CUSTOMER RELATIONSHIP MANAGEMENT IN BANKING

A relationship between a bank and a customer requires interplay from both parties for it to function. Like many other relationships, it takes time and delicate care to develop this relationship. In a highly competitive bank industry, there are a lot of different options for the customers to choose from, so to retain a customer, it is important that the customer also wishes to continue the relationship with a specific bank. According to Grönroos (2004), there are a lot of benefits in maintaining a positive relationship with customers. Through the relationship customer satisfaction can be improved which might lead to increased customer loyalty, and the relationship aids the parties in mediating important information to each other.

Customer relationship management is a specialized model aimed at learning more about consumers' and existing customers' demands, preferences, and expectations. With this information, it is then possible to affect the relationship with customers in various ways. CRM is an approach with the purpose to understand and influence customer behaviour to improve customer loyalty, profitability, and acquisition. While the pressure is on the banks to develop the customer relationship, it is the customer that evaluates the relationship, and communication is, therefore, necessary for the bank to assess the services used in the relationship. Due to the purpose of the study, including CRM in the theoretical framework was important to capture the bank's relationship with its customers as it is through CRM that the interaction with customers occurs (Swift, 2001).

As technology in society advances, so do the possible channels for banks to interact with customers. Peelen (2005) lists websites, e-mail, and telephones as possible channels to interact with the customer. Regardless of channel used the heart of CRM lies in maintaining the relationship with current customers through customer loyalty, the acquirement of new customers, and the customer profitability of customer groups (Swift, 2001).

- Acquiring New Customers

The process of interacting with customers starts with the acquirement of new customers and continues with the process of retaining them. To succeed with this, an offensive strategy has to be employed by targeting the demands and preferences of the consumers the bank is looking to acquire (Peelen, 2005). At first, this requires knowledge of what the consumers are seeking. Through processes in the organisation that allows for the gathering of data whenever the bank interacts with the consumer, the bank can gain this information. The next step is then to analyse the information gained which can then be used to change the customer service in the organisation in accordance with the analysed information.

The final part of the information gathering process is to apply the analysed information to consumer groups. By interacting with the consumers through either personal channels or less personal channels, depending on their preferences, and offering the products and services that are in demand, the hope is that the consumer will discover a satisfying experience and decide to become a customer (Sawyer, 2002). The CRM components of gathering information, analysing it, and then interacting with consumers based on the information should start a strong new relationship (Sawyer, 2002).

- Customer Loyalty

Attracting new customers is costlier than retaining old customers, and it is, therefore, important to have a customer service that focuses on satisfying the current customers. This also requires the bank to constantly gather information about its customers to be aware of changes in customer behaviour and react accordingly. A defensive strategy focused on customer satisfaction is suitable, but it also benefits from having specific processes in place to gather information from customers that are leaving the bank in order to learn of weaknesses in the bank and be able to adjust them (Peelen, 2005).

Customer loyalty refers to the commitment of a customer to buy a product or service from a specific firm. A key factor in customer loyalty is customer satisfaction. If a customer is not satisfied with the product or service offered by a bank, it is unlikely that the customer will continue doing business with the bank if other options are available (Oliver, 1997). However, customer satisfaction is not a permanent condition, but rather something that can quickly shift to dissatisfaction. A continuous focus on working to exceed customer expectations is, therefore, important to ensure that the customer is satisfied and for the relationship with the customer to develop.

A major hurdle in developing the relationship with current customers is that different customer segments do not always have the same preferences. Information gathering is here a very important aspect of CRM. It can be possible to find small common denominators within the different customer segments by analysing the information, and by focusing on these denominators it can be possible to develop the relationship with multiple segments at the same time.

- Customer Profitability

At times, it will not be possible to find common denominators within the customer segments, and satisfying all customers at the same time will not be possible. However, different segments conduct varying amounts of business with the bank. Customer profitability refers to how profitable different customer segments are based on the costs associated with retaining the customer relationship (Gordon, 1998). At times the costs of retaining certain customers might exceed the revenue, making the customer unprofitable (Gordon, 1998).

The processes of gathering and analysing within CRM have the purpose of identifying which preferences and demands of customer segments are feasible for the bank to satisfy (Gordon, 1998). By identifying this, the bank can work on starting and improving the relationship with customer segments that are profitable for the bank. In the perspective of CRM, customer profitability is measured across the lifetime value of the customer. Therefore, it can be beneficial to satisfy customer preferences and demands that have been identified as unprofitable in the short term but with the possibility of being profitable in the long term.

- Opposite Ends

There are no guidelines on how to implement CRM into an organisation as all organisations are unique in their circumstances. While the general purpose of CRM is uncontroversial, the implementation is more often than not unsuccessful. When the implementation fails, CRM will create annoyed and unsatisfied customers, which is the exact opposite of what CRM sets out to accomplish. This shows that while the model itself has potential for good, it is also perilous and organisations need to be careful when implementing the CRM model.

DISCUSSION

Customer relationships are fickle, and it is not unusual for customer behaviour to change. Due to digital advancements in society, banks are starting digitalisation processes in order to digitally transform themselves. In this study, it is evident that the digitalisation process within the case bank has affected its relationship with its customers. As the digital strategy is the main driving force for digital transformation in an organisation, the alignment of the digital strategy with the business strategy and CRM in the case bank has led to the bank being able to notice changes in customer behaviour quicker. This provides the case bank with more time to react to the changes, and be able to satisfy the new customer preferences and demands faster.

The effect of this on the relationship is positive, as it avoids making customers unsatisfied for long due to their new preferences not being fulfilled. However, the case bank has issues with integrating new systems into the organisation, which makes the reaction time slow, despite the early notification on changes. This is an indication that the digital transformation is misaligned with a factor that lies outside the scope of this study. Furthermore, the alignment of the factors has led to the case bank outsourcing some of its digital developments in order to be able to focus its resources better. A more focused use of resources allows projects to be finished faster, which aids the case bank in being able to satisfy new customer preferences and demands in case of changes in customer behaviour. This is an effect on the case bank's relationship with customers as it enables the case bank to satisfy the customers faster, which affects the relationship positively. Lastly, the digitalisation process in the case bank has also split the customer base into two groups: customers who primarily use the digital platforms, and customers who primarily visit the branch offices. The former group's satisfaction has increased along with the digitalisation process in the case of banks, whereas the latter group has not had an increase in satisfaction. This indicates that the digitalisation process only positively affects customers that are digitally oriented. As a result of the increased usage of digital platforms, the case bank's relationship with customers is becoming less personal and more automated.

CONCLUSION

Embracing digital transformation in banking is not a matter of option anymore. It is going to shape the future of the banking industry, and it has already started. Changing customer behaviour, increasing expectations, Customer Relationship Management and the digitalization of business and society has begun a digital race in the banking sector. Banks have realized that investments in digital technologies are the way forward for serving customers better.

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Chapter 6
Prospects, Challenges, and Opportunities of Digital Financial Services in Developing Countries

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ABSTRACT

The chapter aims to show the challenges and opportunities of digital financial services (DFS) in emerging markets like India and to show how the adoption of innovative DFS marketing can support the outreach of its large population. The chapter reveals the digital marketing priorities of these forces powered by new digital technologies to drive the rapid transformation of financial sector marketing function into a cash cow position. The implication of this research supports the institutions to formulate the framework to overcome the challenges and create an advantage by grabbing the opportunities. The results reveal the gaps, adjusting the organizational digital strategy for companies across sectors.

INTRODUCTION

Asia is reflected as one of the largest markets with the majority of its population considered as financially excluded due to a lack of well-established economic, monetary and societal foundation. With a large population market, most of the countries have scarce resources and a slow growth rate. The majority of countries have a pretentious history leaving the country with dark financial stability. Due to this very reason, the large population believes in long-term financial saving which can be used during the needed times. With globalization, the institutions have adopted digital technology to market its product and services to the large providing utilities and services at the click of the fingertip. However, after the economic liberalization, the entire financial sector has undergone a seesaw change with institutions

DOI: 10.4018/978-1-7998-2402-2.ch006

adopting digital mode reaches their customers around the world. Now, newfangled financial instruments are entering daily which can be called digital financial creativity/ innovation.

The majority of the Indian population believes in risk aversion and saving, making the country a risk aversion culture with a large amount of cash being preserved in the banks protecting the customer from cash storage at home and office. Economic liberalization and technological advancement helped the financial institution to reach large and replace the physical cash movement with cashless transactions providing flexibility in payment and real-time service with lowering the risk and time. Presently, digital financial services have become vital for the economic development of any country. Mobile banking, fund transfer, online payments, etc. are very common in an emerging market like India serving the mass with customized services. Mobile/ digital marketing of the financial product has become a common practice among the financial institution to promote its product/ services and interconnection among participants in monetary activities.

Globally, digital financial services (DFS) are the significant transformation for incorporating financial inclusion (Buckley and Malady, 2015) in their day-to-day activities. DFS provides faster digital financial services using the digital platforms with electronic money models (Scott et al., 2017; David-West et al., 2018) that otherwise take a long time and process for its delivery. Digital platforms and specific channels that allows access to services to the potential desirable parties, benefiting consumers and the financial service providers with low cost and personalized services (Baker et al., 2007; Alam and Imran, 2015; Tarhini et al., 2016; AFI Global, 2017; Thorseng and Grisot, 2017) and categorized others with restriction. Digital technology countenances people lacking the most elementary banking services to move or digitally transfer the assets from them to the desired consent party within no time allowing the smoother, timeless and safer transaction.

The reach and accessibility of DFS are large that provide access to various facilities like banking, insurance, health, retail, moneylending, etc. giving power to its clients for financial transactions using digital media. According to the Global Financial Inclusion Database of World Bank, 2.5billion people across the world have no access to any financial institution. This critical situation of lack of accessibility and reach restricts them to make any financial transactions. For this very reason, the population depends on cash and ways of informal transactions to meet their everyday financial requirements (Gates Foundation, 2017). Moreover, the women populations involved in jobs or entrepreneurship are mostly from the rural area are worse affected due to lack of financial services and need to depend on males in the family for procuring daily needs (Mathew, 2010). DFS will be a vital channel to provide the most deprived families for any financial transactions using electronic media. Additionally, Women entrepreneurship (Mathew, 2016) will be highly benefited from the exposure of the DFS in MSME and home-based businesses.

It is assumed that the biggest challenges for the financial institution in most of the emerging Asian markets like India, Indonesia, etc. are that the population has either no accessibility or has no connection to the financial institution. According to the Global Findex Database (2017), 1.7 billion adults remain unbanked globally. Among this 56% are women and 44% are men without an account in any financial institution and bank. As per the data, China has the world's largest unbanked population 13%, followed by India with 11% (i.e. 190 million), Pakistan with 6% (100 million), and Indonesia 6% (95 million). From the total, women make up nearly 60 percent of unbanked adults in China and India. While in Bangladesh with a high of 65 percent and Colombia 56 percent of unbanked adults are women (Global Findex Database, 2017).

With the introduction of information and communication technologies with far-reaching networks and huge mobile-cellular systems extends reach to rural India the scope of DFS has been extended to new heights. According to Measuring the Information Society Report (2017), 95 percent of the world's population resides in the mobile-cellular network areas while almost 50 percent only have access to the Internet and online connectivity. The main aim of introducing the DFS is to connect the unbanked population of the society and overcome the challenge of ensuring that the population actively participates with the financial sectors on regular basis (David-West et al., 2018). In the developing and emerging market economies, the ongoing problem of informal and cash-based business has introduced unaccountable transactions affecting negatively the growth.

In this modern world, the mobile application has become the most popular model for managing financial inclusions. It is estimated that by 2020-21, mobile phone users in India will be reaching 250 million. Yet, there are still great challenges that need to be addressed (Srivastava and Sharma, 2017). Various national and international companies are focusing on providing added value services for faster and reliable payment. However, the shortage of mobile wallets in emerging markets (Patil et al., 2017; Asongu and Nwachukwu, 2018; Sharma et al., 2018) reduces the feasibility and usage of DFS. Other drawbacks include cultural factors i.e. preference and trust for cash transactions that can be seen in developing countries like India, China, etc. Despite large mobile networks with 60 percent of the population using mobile are not connected to the banking system. Rather, the statistics show very few percent of the population uses credit or debit cards for financial payments and transfers.

Research Gaps

Currently, DFS permits the providers to produce value-added services to its consumers, while consumers can deal with unpredicted events and capitalize on fresh and creative dealings. DFS can be used by individuals, businesses, government, financial service agencies, and others to handle financial transactions proficiently (Scott et al., 2017; David-West et al., 2018). However, India homes to 190 million unbanked populations next to China with 225 million adults with the world's largest unbanked population (Global Findex database, 2017). Additionally, certain basic infrastructure like availability of the mobile networks, the handiness of mobile connectivity and lack of adequate access to the services (Dara, 2018) are shortly restricting the effort to lose the effectiveness. Moreover, half of all businesses and individuals in developing economies like India have low adoption of technology due to higher costs with lower returns in comparison to their equivalents in developed economies. Very few studies have been done in this regard (Buckley and Malady, 2015; Aaluri et al., 2016; Finau et al., 2016) especially in the context of India (Srivastava and Sharma, 2017) rather than broader outline showing few details in this regard. Very few studies have been undertaken in the past to understand and overview the area of online financial inclusion. This article was motivated to answer this important question that despite having the huge infrastructure of mobile and banking, developing economies in Asia and others use informal way of financial inclusion. Through this study, we have attempted to identify, analyze and address numerous critical challenges about DFS and elaborate opportunities of DFS in developing countries like India that can benefit policy-makers and other agencies to adopt strategies to deliver DFS particularly to the underprivileged section of society having no access to the services.

According to Mazzotta (2014), The Reserve Bank of India and commercial banks face a total of Rs. 21,000 crores (US $3.5 billion) in currency operations costs annually. As per the report from McKinsey electronic disbursing in government services can reduce payment inefficiencies estimated at Rs. 1 lakh crore annually (US $22.4 billion) in India (Ehrbek, et al., 2010). Indian consumers lose more than 2 billion USD every year from time for money transfer (Manyika et al.2016). In this vein, DFS offers a pool of opportunities which can save the cost as well as maintain the efficiency of financial institution and individuals by reducing the use of cash providing safety and security. Additionally, it offers avenues for reaching that deprived section of society having no access to the financial institution for the daily transactions.

Digital Financial Services

In the last decade, financial services have experienced a revolution that had a great impact on all sectors of Indian society. The use of technology and networking system in the digital financial sector has developed a huge potential to transform the future (Mattern and McKay, 2018). This evolution of new business models of DFS has revolutionized the financial transaction assisting to reach and delivering value far beyond the expectation. DFS is the combination of varied technologies of IT and communication enabling the financial solutions to its clients and allow e-payment platforms (David-West et al., 2018). DFS offers a wide range of services managing all activated ranging from banking services to all cashless transactions by using any electronic system. It has the tremendous ability to offer a large number of financial services and can connect among the large population that does not have access and considers susceptible to financial/banking services in the past (Finau et al., 2016). The Digital mode of financial services offers flexible retrieving financial services that can be used to reach the rural population as well as beyond the countries border benefits businesses and individuals around the world to have access to the services.

DFS in India

In developed countries, a very little percent of the total population does not have their bank accounts but the situation in developing countries varies dramatically within the last decade. According to The Global Findex database (2017), about 1.7 billion adults remain unbanked or having a mobile money provider. It is estimated that about 980 million do not have an account, 56 percent of all unbanked adults globally (ib.id) of which 11 percent are from India itself and 13% from China among which women are overrepresented. It has been reported that only 0.3 percent of adults in India use mobile money (Kumar, 2015). Various initiatives have been taken by the Government of India to confirm the opening of bank account and online connectivity for people living in rural areas by connecting them with a high-speed network. Moreover, the government is developing a unified, speedy and secure payment system for the transfer of services (Rani, 2016) to the deprived population.

Detailed data of India (See table 1) shows the unbanked population and few challenges related to India. Hence, there is the massive scope of using innovative technologies for DFS (Ahluwalia & Bhatti, 2017) for creating and delivering financial services to the majority of the disadvantaged population to the bank. Presently inadequate infrastructure, lack of trust, lack of knowledge, additional cost involved, etc. (Dwivedi et al., 2016) need to be addressed immediately.

Digital Services in Developing Countries

Recent studies have revealed that the population in most of the developing countries avoid and have fear to uses digital platforms. Therefore, they often demotivated to use DFS, even though it is available. Literature shows various challenges that often prevent customers to use DFS. Harsh and Wright (2016)

Table 1. Detailed data of India

Year	2014	2017
Mobile money account (% age 15+)	2	2
Mobile money account, young adults (% age 15-24)	1	1
Mobile money account, older adults (% age 25+)	3	2
Credit card ownership (% age 15+)	4	3
Used a mobile or the internet to access a financial institution account in the past year (% age 15+)		5
Account, young adults (% ages 15-24)	43	71
Account, older adults (% ages 25+)	57	83
No account because financial services are too expensive (% without a financial institution account, age 15+)		27
No account because of lack of trust in financial institutions (% without a financial institution account, age 15+)		20
No account because someone in the family has an account (% without a financial institution account, age 15+)		52

Source: Compiled from The Global Findex database, 2017

debated on the complexity of the process, lack of awareness about the services, introduction of new products regularly, transaction cost, limited skills and knowledge about how to operate, lack of digital literacy, serious operational issues like frequent service denial, incomplete and interrupted transactions, inaccessible funds, and challenges related to technology and networking for e.g. network failure, hacking, hidden cost and network speed. Additionally, the threat of privacy and security concerns (Luarn & Lin 2005; Ndubisi & Sinti (2006) and discussed the risk in deploying new technology (Eriksson et.al. 2005) deliberated on the usage of technology and degree of risks in using an innovation (Rogers 2003).

According to Lauer and Lyman (2015) innovative digital transactional platforms used in DFS iinvolvetechnology-related risks like quality, reliability, privacy and security. Other types of risk highlighted are agent-related risks which included operational risks comprise of fraud, error, poor cash management, poor data handling, financial crime risks of fraud and theft, reduce transparency (e.g., on pricing, terms and alternatives), failure to handle customer data confidentially, engage in offensive behavior towards customers (overcharging), hacking of data and misconduct etc. Other scholars discussed lack of knowledge of innovative technology (Kolodinsky et.al, 2004), unavailability of the Internet (Wright et al., 2013). Furthermore, Kuisma et al. (2007) discussed security threats (Sathye 1999; Chiou et.al 2012) and privacy, the possibility of loss or theft with stored data (Coursaris et al. 2003). Fatima (2011) reveals numerous vulnerabilities of internet financial services that are prone to security threats like safety and reliability of the network, security of transactions, unprotected data, privacy issues and authentication issues concerning the clients. Attitudes toward the use of mobile technology (Lin 2011) and adoption of technology and its innovative complexity (Au & Kauffman 2008; Mallat 2007) need to be transformed.

Similarly, other scholars raise issues for e.g. high cost and investments (MicroSave, 2016), dramatic change in technology and agencies are lacking to keep pace with the changing needs and technology (Holley, 2015), lack of training to operators, legal and regulators' concerns (Chauhan, 2015), lack of trust, lack of integration, etc. complexity in use, and design of technology are reported as barriers in a number of studies (Bouwman et.al 2007).

Major Challenges of DFS in Emerging Economies

1. Non-availability of Digital technology: Most of rural India where the majority of the population resides lack basic digital infrastructure and technology. It is very challenging to reach, offer and access DFS in places where mobile technology is pervasive (Haider, 2018).
2. Safety and reliability risk: Most of the DFS agencies struggle from the cyber-attacks and security breaches in various forms, e.g. money transfers, electronic payment system, data of consumers etc. safety and reliability risk against fraudulence and cyber-attacks (Responsible Finance Forum, 2017; Gupta, 2017; Kumar and Goyal, 2016; Tarhini et al., 2016; Rana et al., 2018) creates major challenges to DFS in India
3. Lack of training related to digital operation and usage: Training to agents, network operators to acquire skills to serve the consumers (Kanobe et al., 2017; Nesse et al., 2018) are still lacking reducing the effectiveness and smooth conduct of the digital financial services.
4. Doubt of profitability: Lack of confidence in DFS to earn profitability by most of the agent and mobile money service providers (David-West et al. 2018) creating hesitation to scale up the DFS among the consumers. Lack of trust in DFS to earn considerable profit makes it difficult to penetrate and gain larger market share.
5. Digital security: Digital technology used by DFS generates data sharing security and privacy risks (Responsible Finance Forum, 2017) breached through numerous elements. Also, specific restrictions can defer individuals for specific use (Scott et al., 2017; David-West et al., 2018). Security and privacy risks cause serious threats in the digital environment (Atlam and Wills, 2019).
6. Privacy risks: Stealing or interference of confidential information creates privacy risks. In this vein, the consumer's trust and engagement toward the DFS (Castle et al., 2016; Rana et al., 2018) agencies using digital financial services remain at stake
7. Legal and regulatory factors: Legal and regulatory (Kemp, 2013; Chauhan, 2015; Scott et al. 2017; David-West et al., 2018) restriction discourages consumer to effectively use of DFS. The consumers are scare of restricted binding and their consequences.
8. Adoption of new technologies: Lack of adaptability of new technologies (Scott et al., 2017; Holley, 2015; Das et al., 2018) by various channels negatively influences promotion an growth of DFS.
9. The socio-economic status of consumers: the social and economic status of the consumers and their capability to pay for various services poses a challenge for the adoption of DFS (David-West et al., 2018).
10. Lacks of awareness and market acceptability are common inhibitors of DFS acceptance (David-West et al. (2018)
11. Lack of human resources: Human Capital resources, capabilities and knowledge constraints in the DFS ecosystem (David-West et al. 2018).
12. Technology and networking connectivity: Technological infrastructure constraint (David-West et al. (2018) and regular disruptions of digital channel affect the consumer and agent trust toward DFS (Scott et al., 2017; Harsh and Wright, 2016; Rana et al., 2018; David-West et al., 2018) reducing the acceptability and usage of DFS. Other factors concerning are network quality, supported technology channels, disruption in power supply reduces access and reliability.
13. Involvement of multiple agencies: Involvement of multiple agencies e.g. micro-financing agencies, distribution networks agent, mobile network operators, the regulatory authority (David-West et al.,2018) inhibit the DFS initiatives.

14. Lack of awareness and digital literacy: Lack of basic knowledge and digital literacy about the DFS (Dwivedi et al., 2016; Gabor and Brooks, 2017; Nedungadi et al., 2018; Rana et al., 2018) reduce the scope of DFS to attain growth.
15. Higher cost and stumpy returns: Adoption, installation, and maintenance incur a high cost (Van der Boor et al., 2014) and low return making the process less attractive. High costs attached with small returns (Leeflang et al. 2014) led to unattractive proposition to different entities.
16. Shortage of information: Due to lack of information about DFS and its advantages (Siddiquee, 2016; Gupta et al., 2017; Nedungadi et al., 2018; Rana et al. 2018) reduce the acceptability of DFS among the common.
17. Financial cost: The cost of DFS adoption and process using various channels and networks requires significant operating costs which can be recovered by scaling for which large volume is required (David-West et al., 2018). Transaction volumes are still deficient in many developing countries like India.
18. Perceived image: Difficulty of using new technology is difficult, can be perceived negatively that may have an adverse impression about the innovation in services (Shaw, 2015; Laukkanen. 2016; Natarajan et al., 2017).
19. Accessibility and connectivity: Unavailability of online world web or online network to all places especially in a rural area could be a significant challenge (Wright et al., 2013) for adopting DFS.
20. Lack of mobile payment arrangement for large populations: According to scholar developing countries lack mobile payment arrangement (West, 2015; Foster, 2016) influence DFS reach and attain larger transaction volume.
21. Lack of trust: Lack of trust and authentication issues restricts user from availing DFS (Leeflang et. al., 2014; Shareef et al., 2018)
22. Absence of integration and unavailability of service: Lack of ability of systems to exchange and make use of information reduces the pace of DFS. Unavailability of service facility in all branches providing appropriate support reduces integration (Bourreau and Valletti, 2015, David-West et al., 2018)
23. The occurrence of Error: Incidence of various errors like software errors, networking errors, equipment or technical errors reduce the effectiveness of using DFS (Buckley and Malady, 2015; Gomber et al. 2018)
24. Failure of low-value transaction: DFS have less adaptable to low-value transaction (Buckley and Malady, 2015; Karlan et al., 2016; Gomber et al., 2018) regularly that add cost and diminish the efficacy of using DFS.
25. Failure of handling large volumes: Handling of large volumes of transactions during a particular time or season influences DFS reach and adaptability.
26. Ineffective for non-users of mobile: Non-users of mobile phone or sophisticated high-end smartphones which can undertake particular DFS software/application reduce the operative expansion and success of DFS (Angelow et al., 2016; Chandrasekhar and Ghosh, 2018)
27. Identification challenges: Issues related to the identification of individuals through the authentication process (David-West et al., 2018) influence DFS adaptability and expansion.
28. Affordability from the weaker section: Weaker and low-income groups in the society are most of the time excluded sue to cost, low-income groups and lack of knowledge (Leeladhar, 2005; Raghuram Committee, 2008; Ene et.al.2019) affect weaker section to adopt DFS.

29. Lack of access, fairness, equity and safety in a financial system (Mohan, 2006; Ene et.al.2019) lose trust that affects DFS growth.
30. Difficulty in transactions: Other types of dealing with the financial agencies can be very challenging using DFS, e.g. Opening an account, top-up balances, withdrawal, saving and taking loans, etc. These issues are also reflected in USAID Nethope e-MITRA (2015) and InterMedia (2014) studies.
31. Anxiety towards new technology: Consumers are generally a concern and anxious towards the use of new digital technology, which further influences the acceptance (Yang and Forney, 2013; Shaw, 2014).

DIGITAL PLATFORMS IN INDIA

In the recent past, various scholars through the studies have observed a widening gap between the deepening market complexity in the digital platform sector and the coping with this complexity in organizations. The organization must develop the capacity that comprehends and identify these complexities and able to overcome these for better reach. Studies have shown that Internet usage is the main factor that influences the widening of the gap (Day, 2011) in present rapidly changing and fragmented market. Digital marketing has faced various trials due to the wide use of social media, ease of access to big data, growth of network and channels, shift in environmental factors and change in consumer dynamics.

The growth in internet users in India during the last few years exceeded half a billion people reaching 566 million in the first quarter of 2019 (Economic times 2019) with 40 percent overall internet penetration. Out of the total active users, 293 million are from urban and 200 million are from rural India. Moreover, 97percent of users use mobile phones and have access to the internet on the device (ib.id). Presently, the wide exposition of online C2C, besides B2C and B2B markets, has emerged with considerable realization with a large number of users remain online throughout the day. The rise of online use for various purposes is substantially grown in the last few years from around 10% in 2008 to over 26% in 2015 especially YouTube, Facebook, and Amazon. Other channels like newspapers, TV, and magazines have lost charm during the past years. Hence, the Internet remains the most important marketplaces for transactions.

With the ease of internet access in India, the number of social media users in India stood at 326.1 million in 2018 (Diwanji, 2019). The number of Facebook users in India reached nearly 269 million in 2019 and expected to grow to 320 million by 2021 (Diwanji, 2019). The Facebook penetration rate in India will reach to around 23 percent in 2021 from 15 percent in 2016. The studies forecast that users will continue to grow in the coming years. According to the statistics, global marketing spending on social networking sites reaches about USD 4.3 billion (Williamson, 2011). Social media user follows events, brands, people, etc. which create social media a channel for the marketing of their brands. Therefore, companies are investing in social media promotion of products and services.

Marketing of DFS

In this above-mentioned context, the adoption of the digital process has become vital today for the financial institution to market its product and services. With the outsets of the 2008 global economic downturn, the global financial services industry started changing from the fundamental operating models to a digital-based user-friendly approach to establish credibility and overcome the cost involved in handling the cash-based financial transaction. Institutions are using new and innovative tools and techniques to market and transform the consumer experience in their services by reach, engagement, and enhanced package while few are still airs high challenges for digitalization. Rapid digital innovation in the financial sector is reinforcing changes across the value chain and driving the emergence of alternative banking approaches and supporting consumers.

Presently, with the proliferation of competition, the institutions are struggling to build strategies that can position the brand and create loyalty. Therefore, the institutions are now exploring new opportunities for detailed technologies and resources in related areas of distribution and channel management, the transformation of product life cycle by introducing new products and services, etc. The financial industry in India is undergoing a sea-change with a major revolution in its strategies and competitive approaches. Major marketing shift is to overcome the cost of managing consumers' demand and increasing preference for easy accessibility, connect online and engage via self-service that undermines the profitability of the firm. This change has shaped the opportunities for the financial institution to create and engage digitally to reap profit from the services and actions that are customer-driven. These initiatives delivered targeted, personalized and faster services with the click of a button.

For customer engagement, financial institution market and drive through all channels and developing interactive marketing. Among all, social media marketing is prominently promoting marketing tools adopted by the marketing agencies. Many others are looking beyond social media for two-way communications and diffusion of services. Leveraging these channels enhance the opportunities to attend and gain consumer insights for providing customers with differentiating solutions for their financial needs. Increasingly, financial institutions are realizing brand loyalty as a tool for competitive advantage by engaging their potential customers with the most popular social media channels and maximize the effectiveness in service delivery. Investment and technology are decanted for channel optimization for providing the customer with operative choices and offer ease of use to conduct their financial transactions across multiple devices and platforms. Appropriate use of digital technology is creating differentiated digital customer experiences and helps financial institutions to scale operations to gain substantial and sustainable returns on investment.

With the advent of Marketing through digital media in the financial sector, few challenges like cost of customer engagement have minimized that had a direct impact on revenue. The ability of the institution to measure the value generated at each customer will offer opportunities to create a real-time customized model that significantly improves the experience, quality, relationship, return, and brand acceptability.

Marketing Opportunities for DFS

By the start of 2020, it is estimated that the mobile industry in India will serve more than 250 million supporting DFS. Large opportunities pertain to the agent benefits, service proposition, value creation, ecosystem dynamics; marketing and network management also exist. The characteristics of the service industry especially due to the financial and networking of DFS have enormous scope and opportunities for development. These opportunities of DFS in India include the following:

1. Intangibility. Financial services are providing monetary and intangible characteristic benefits ensuring attractiveness and excellence. Since services are processes and experiences, the impalpable characteristic creates opportunities for the financial institution by providing a superior experience

to its customers. Due to this characteristic, the services lack a substantive physical form and so cannot be seen, felt, compare or tried in advance of purchase an evolving opportunity to the institution to create an experience that can be sensed by positioning the services. From the customer's perspective, the purchase of services provides faster, quicker, personalized services that can be felt at the given point of transaction that is difficult and absent in traditional financial services. Also, at the same service, the experience can be evaluated in terms of quality before buying a physical product. Additionally, consumers can check the fit and style before buying and ensure the credibility of qualities as buying a cloth.

a. Moreover, the comparison property of the product can also be observed with the DFS before buying that helps the consumer to make the best investment decision before the actual transition. Physical evidence of all transitioned items directly associated with service can be possible in DFS. Also, with the characteristics of intangibility, the financial institution has opportunities to offer a compliment to actual physical evidence. Furthermore, reduce the firm has the opportunity to reduce consumer perceived risk and making them feel less uncertain about the outcome by providing appropriate confirmation through various means. This will build confidence reassuring quality to the consumers what they receive. Also, trust, and loyalty due to assurance for their money and business to be safe and secure that can be used by them whenever required.

2. Inseparability: Financial services are produced and consumed at the same time. DFS provides an opportunity to the financial institution to provide the right service at the right place as per the requirement of the customer round the clock. The proximity to customers is not essential with regards to DFS for delivering and the cost of packaging can be reduced as an added advantage. The services can be produced at the specific request made with the involvement of the consumer that can be seen in the case with physical goods. The specific request made by the customer is the input on the needs and wants which help the firm to develop customized service. Because the customer actively engages throughout the process and interacts with the provider providing specific inputs, services are often described as interactive processes. As a result of the interactive nature with greater customer involvement, the process performed may be significant as a self-service program. From a DFS marketing perspective, the interactive and inseparable nature of service provision presents greater opportunities to specify customer requirements, design the process and deliver the service that suits the customer wants that ensure brand loyalty and sustainable growth.
3. Additionally, inseparability empowers staff and the customer due to the receptive and flexible nature of customer interactions. From the DFS marketing perspective, staff satisfaction will earn a high level of customer service guarantees delivering a high degree of service the organization promised. Finally, with the available information and pattern of the customer's involvement, the marketer can identify and design a specific method for facilitating the customer providing value-added services with extended responsibilities.
4. Perishability: the very nature of services that are produced and consumed simultaneously also a means of opportunity for the DFS marketer. Normally, with physical goods, changes in demand due to season or time will directly affect the manufacturer. In this case, extra capacity needs to be stored and managed with risk at bay for loss of demand due to any environmental reason affecting the overall profit. From the DFS marketing perspective, perishability presents opportunities to the organization's strategies by managing variability in demand and supply to make the best use of available capacity regardless of season and time. By assessing and identifying the consumer vari-

ability in demand for a particular financial service during the period, the financial service provider can either change work patterns or some digital automated adaptation that boosts capacity during periods of heavy customer demand.

5. Heterogeneity: survive heterogeneity or variability can be interpreted as services are variable or varying and not standardized like normal physical goods. This heterogeneity can be inferred due to different customer needs and due to delivery time to customers having similar needs. The sources of variability arise due to services are tailored to specific customer needs and the nature of the interface between the customer and service provider may be influenced by facts that are outside the control. From the DFS marketing outlook, heterogeneity presents opportunities to understand that customers' needs vary so the service process needs to be flexible that can adapt to the changes and adjust frequently changing needs. Achieving flexibility through decentralization and delegation process that can change the normal procedure to serve ever-changing customer needs.
    a. Moreover, the variability in quality may also be influenced by external factors. Different customers having different needs, provided by the different service providers influence the quality of service they expect. From the DFS marketing perspective, variability creates an opportunity to deliver the service similarly across the providers for similar needs and varies as customer needs differ. From the customer point of view, the realization of this opportunity helps them to receive the quality service they expect and will support the providers to create better customer relationships and equity.
6. Differentiation: It is realized that financial services are very much alike with the majority of the service providers. With the use of DFS, the service providers have opportunities to vary and differentiate services depending on the needs and the demand. The providers can differentiate the services based on market, geography or needs that help to generate customer satisfaction and earn profit.
7. Trust: DFS provide vital opportunities to develop an intimate relationship between the provider and the consumer through mutual trust. Generally, financial relationships with the stakeholders are often built over some time especially with DFS due to the intangibility of services. DFS provides mutual trust which helps to balance the optimal level of delivery.
8. Geographic dispersal: With the use of DFS, geographic reach is not the limit. The DFS has ample opportunities that can reach any customer around the world with no boundary of wide branch network delivering doorstep services that ensure the satisfaction of customers' needs at the regional and local markets.
9. Data sharing and coordination: With the opportunity of geographic dispersal, the DFS market can share information across the channel members reducing the organization the errors at the various locations being repeated and coordinates the service access the market ensuring the quality at each time. Recent high-tech developments like internet banking, DFS provide a wide range of services across the globe for efficiency with the help of data sharing.
10. Balanced Risk: DFS has a huge opportunity to streamline the system and procedure with the growth balancing with the capacity of a financial institution that will avert risk. Financial products like loans, credit cards, etc. involve the risk that can be reduced by enduring safety procedures balancing the risk guarding the interests of the investors.
11. Labor intensive to digital intensive: The financial service sector is highly labor-intensive that required larger expenses and space. Digitization of processes keeps the provider at a cutting edge to achieve efficiency and deliver the service effectively. With the digitalization of the procedure, the

customer can directly achieve the desired service without the involvement of front-line staff. E.g. use of an ATM is a classic example that is different from the traditional banking system. Also, the operational cost to the customer and the provider will be drastically reduced with the transformation to digital services.

a. Additional opportunities for DFS in India are:
    i. It allows interoperability for financial businesses between different banks. E.g. mobile transactions between the banks.
    ii. Remittance with minimum cost to the customer and effective coordination between different banks.
    iii. Opportunities to small businesses in remote areas having no daily links with formal financial institutions by using DFS.
    iv. Opportunities to penetrate among the young population in India (fifth largest), a large majority of whom are tech-savvy (CGAP, 2013) and need financial service on a click.
    v. Opportunity to have low-cost accessibility an effective transaction from the government to government, bank to bank, B2B, B2C, C2C, and C2B.
    vi. Opportunities for collaboration through digital channels beneficial to all parties
    vii. Portal development and mobility to engage various stakeholders for educational and training purposes.
    viii. The system provides the worldwide linkage for disbursement (RBI, 2013) as per the requirements and ensures that transfer or delivery of funds securely reaches the intended beneficiary.
    ix. Informal sectors and small businesses having no links with a financial institution can be formalized (RBI, 2013).
    x. Support insurance by providing a powerful safety net (RBI, 2013) to individuals and businesses from any unforeseen events.
    xi. Mobile-based banking system helpful for reaching household with low income and whilst reducing cost, interest rates, and premiums
    xii. Opportunity for domestic and international remittances reducing hawala (illegal money transfers).
    xiii. Secure and reliable saving customers time and money (Centre Microfinance 2011).
    xiv. Easy to upgrade and can expand in the DFS product and services offering will enhance and facilitate more access to finance.

Challenges and opportunities that are regularly observed in India related to DFS

CONCLUSION

Based on the review related to the adoption of digital financial services in developing countries, it can be estimated that the institutions are not able to achieve expected result due to many barriers. Also, institution anticipates attracting many organizations and consumers to avail and use digital financial services. Henceforth, the domain of DFS requires to be given due consideration from the financial and related industry to improve technological infrastructure to reduce physical cash movement and providing flexibility in payment at real-time service to the deprived for any financial transactions using electronic

Table 2.

Challenge	Opportunities
Generally, mindset of common man in India – not to trust digital mode of transaction	Growth in Mobile users and application based purchasing
Low use of cards – restricted or less counter to swipe card	Well-developed IT base
Limited amount of card transition – restricted amount for each card	Government support for digital India
Low awareness about the DFS	Exposure to International market with high usage DFS
Majority of small businesses have low links with formal financial institutions	Majority of Indian population is young and techno savvy.
Low card penetration and minimal availability of transaction machines and ATM beyond urban areas.	Huge banking system with regulated market
Majority of population lacks access to basic financial services	Domestic remittances are preferred in cash or informal ways.
High cost of financial transaction	Efficiency can be achieved using technological development
Informal sector are predominant over formal financial system	Recently, Indian government is enforcing its citizen to open bank account for each individual.
Funding leakages, incurring cost, delays and corruption	Young population are adopting smartphones and mobile applications (Economist, 2013) having connectivity 24/7
Network connectivity is not available in all places especially in rural area.	Sharp growth of Telecommunication sector in India
smartphone technology is required at micro level for implementing DFS	Intense competitiveness (Economist, 2013) among the players increases and forces them to adopt better and faster delivery of financial services.
Physical infrastructure such as availability of electricity and mobile networks is essential for implementing DFS.	Government payments are directed through DFS or other formal method encouraging individual to have formal financial transaction.
Digital Financial infrastructure is needed in large	Branchless banking, mobile technology and online banking has tremendously decreased costs, increase accessibility and improved efficiency of the payment process
Technology usage related to financial services need to be tailored to the needs	Switching cost from traditional banking to DFS is low.
Technology in DFS may create challenge with first-time users, or population having low literacy, language and numeracy skills.	Mobile and branchless banking with the use if DFS can increase delivery of credit within shorter time, provide savings and insurance products to low income households and businesses (RBI, 2013) reducing the risk of loss.
Appropriate legal rules and regulation need to be in place. Governments need to ensure that appropriate regulations for consumer protection and safeguards	Time consumption in traditionally banking provide opportunity to switch to DFS
Service providers might not address large transaction or not able to address mistrust.	Opportunity for easy and faster domestic remittances
Un-banking population might face challenge with DFS	DFS offer the cheapest method for financial transaction that are difficult to travel and need authentication. Digitizing system of financial transaction can improve their efficiency by increasing the speed of payments
Protection rules to safeguard people from fraud and abuse.	digitizing payments can reduce the cost of disbursing and receiving
Inexperienced population like women and low income people may be have disadvantage for handling DFS	digital channels increase transparency and reduce corruption
Targeted financial literacy and capability training might be required for large population in India	substantially increases formal saving than informal
	Digital system of financial transaction is indeed better than the cash-based in terms of safety, affordability, security and transparency.
	Low documentation requirements
	Opportunities to increase account ownership
	Easy and speedy movement regular cash payments into accounts

media. The opportunities due to its characteristics of DFS in India include intangibility, inseparability, perishability, heterogeneity, differentiation, trust, geographic dispersal, data sharing and coordination, the balance of risk, labor-intensive to digital intensive and many others that need to be explored and added to the services. With the additional saving time and cost advantage of DFS to its stakeholders, adding new values added services for adapting services will enhance the overall experience. DFS will have a significant impact on customers' attitudes about how they transact and adopt the service in regular use.

With the use of technology, the possibility of change in society and consumers especially in the rural area will have a huge change in financial and non-financial services in India. Further, the study also suggests various challenges that may come across the development of DFS minimizing the usefulness of the system in day-to-day life. Hence, it is very necessary to pay attention to the technological adoption of banks and other financial institutions focused on the development to ease of use and usefulness of DFS that helps the institution offer cost, time, and accessibility to the larger population society enabling digital financial inclusion.

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Chapter 7
Digital Marketing in the Context of Consumer Privacy: An Insight

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ABSTRACT

The development of technology adds advantages to corporations, allowing them to revamp their marketing strategies digitally. Digital marketing is formed by various techniques and tools and uses electronic media to promote the products and services in the market. This chapter attempts to explore whether the digital marketing has significant effects on customer privacy as it assesses the customer profile voluntarily or involuntarily, saving them from cybercrime. The primary data were collected from 100 samples, which consist of both males and females of different age groups. The considered hypotheses were tested, and it was observed that there is a significant impact of digital marketing on customers' privacy in terms of personal information and consumption of energy and money. Thus, corporations have to limit the number of advertisements, seek permission prior to sending advertisements, while respecting and protecting customers' privacy. Corporations could follow government guidelines and regulations strictly in the line of digital marketing, which in turn enable them to earn loyal customers.

INTRODUCTION

Digital Marketing has gained as a new tool of marketing due to reduction in expenditure on marketing activities on one hand and it carries the message about the product and services swiftly to the customers on other. It is able to counter the marketing strategies of corporate at any elevated level of competition. The main objective of digital marketing is to reach customers as quickly as possible, than its competitors. On the process, it assesses the personal profile in absence of customers' knowledge. Hence, digital marketing needs to verify and identify the potential customers, to be trusted worthy before advertisement messages are send to them. Furthermore, the issues of improper information collection, improper monitoring and confidentiality need to be checked to ensure customers' privacy (Wang et al, 1998). This

DOI: 10.4018/978-1-7998-2402-2.ch007

paper attempts to explore the present scenario of digital marketing whether it misuses the customers' information and protect the customers from cyber crime.

MEANING OF CONSUMER PRIVACY

The term privacy is usually described as "the right to be let alone" and is related to solitude, secrecy and autonomy of customers. However, when associated with consumer activities that take place in the arena of digital marketing, privacy usually refers to personal information interpreted as the unauthorized collection, disclosure, or other use of personal information as a direct result of electronic commerce transactions (Wang et al, 1998). The most crucial issues of digital marketing is fear and distrust regarding loss of personal information associated with the control of dissemination and use of customers information, but not limited to demographic, search history, and personal profile. The recent survey undertaken by Equifax and Harris(1995) found that over two-third of potential customers considered privacy as their main concern while purchasing products on online (Kakalik et al,1996, Wang et al, 1993). Since cyber crimes are increasing day by day, protection of customers' privacy need to be addressed by concern players while executing digital marketing practices.

MEANING OF DIGITAL MARKETING

Digital Marketing is the utilization of electronic media by the marketers to promote products and services into the market economically. Digital marketing in a broad sense refers to various different promotional techniques deployed by corporate to reach customers via digital technologies. It consists of Internet Marketing, Social Media Marketing, Search Engine optimization etc. Digital marketing is a form of direct marketing which links consumers with sellers electronically using interactive technologies like emails, websites, online forums and newsgroups, interactive television, mobile communications etcetera (Kotler and Armstrong, 2009).

COMPONENTS OF DIGITAL MARKETING

Digital Marketing is formed by various techniques and tools adopted in the execution of marketing practices with the help of internet and electronic devices. Digital marketing includes *online advertising, email marketing, social media, text messaging, affiliate marketing, search engine optimization, pay per click* (Yasmin et al, 2015). The most important elements of digital marketing are given below:

Online Advertising

Online advertising is a very important part of digital marketing. Publishers put about their products or services on their websites so that consumers get free information. Advertisers place more effective and relevant ads online (Yasmin et al, 2015).

Email Marketing

It is a type of marketing in which messages about the products and services are sent through email to the potential consumers. These ads are sent to build brand and customer loyalty, to build customer trust and to make brand awareness (Yasmin et al, 2015).

Social Media

Social media marketing is one of the most important digital marketing channels. This media of marketing networks include Facebook, Twitter, LinkedIn and Google through which company promote events concerning about product and services comply with the guidelines of the social media and explore new opportunities (Yasmin et al, 2015).

Text Messaging

It is a type of marketing in which messages about the products and services are sent through SMS (Short Message Service) and MMS (Message Service). Under this technique, companies can send marketing messages to their customers in real-time, any time (Yasmin et al, 2015).

Affiliate Marketing

Affiliate marketing is a type of performance-based marketing in which a company rewards affiliates for each customer that they bring by marketing efforts create on behalf of company (Yasmin et al, 2015).

Search Engine Optimization

Search engine optimization (SEO) is the process of affecting the visibility of a website or a web page search results. In general, a website appears in the search result list more frequently (Yasmin et al, 2015).

Pay Per Click (PPC)

Pay-per-click marketing is a way of using search engine to generate clicks to website rather than "earning" those clicks naturally. It is the best way for company's ads since it brings low cost and greater engagement with the products and services (Yasmin et al, 2015).

LITERATURE GAP

Literature review shows that sufficient amount of research work is done on Digital Marketing in respect of technology, consumer behavior, sales, advertisement, marketing expenditure and tools and technique of marketing. But there is a limited study on impact of digital marketing in respect of consumer privacy, how consumer privacy is exploited in digital marketing. Protecting the customers' information from cyber crimes need to be addressed by marketer. The research works in respect of these areas are limited. Hence the impacts need to be studied. Campbell, (1997) has carried research on consumer attitudes towards information privacy but fail to focus on the impact of digital marketing on consumer privacy. Even Kakalik et al (1996), in their research advised the corporate to respect the customers' privacy but the impact was not studied. Another author Lee (1993) has come up with new legislation that protects customers' privacy before studying the impact of digital marketing. But Milberg et al (1995), advocate that values of personal information and regulatory approaches are needed to protect customer privacy but skipped the impact of digital marketing. Bloom et al. (1994) in their research answered two key questions of marketers, suggesting that a company should be allowed to acquire and store information about individuals with their knowledge and should be allowed to disclose information about individuals to other parties with their knowledge. These points were discussed in the line of legal area. But how to protect the personal information from cyber is not addressed. This study here is carried to fill their gap by exploring the impact of digital marketing and the protection of customers' privacy.

STATEMENT OF THE PROBLEM

Digital marketing holds a remarkable potential for businesses and consumers in respect of creating awareness about the product and services offered by producers, but it may also cause privacy violations while sending advertisement and assessing the customers personal information, to send messages. The rise of the Internet permits companies to obtain information about customers more easily than before which has increased the number of cyber crime. The information revolution, moreover, opens up important public policy issues as companies are increasingly building comprehensive consumer databases and applying sophisticated data-mining techniques to target consumers. There data are sometime mis used by some of the marketer which needs to be addressed. The present study limits to explore the impact and perception of customers on digital marketing before suggesting concrete policy.

OBJECTIVE OF THE STUDY

This study objective attempts to shed light on the impact of digital marketing on customer privacy. Based on the literature gap, the following objective is established for the purpose of the study.

1. To review the impact of Digital Marketing on Consumer Privacy in terms of personal information, time and energy and disparate Customers

HYPOTHESES

Given the objective, survey of literature and scope, the following hypotheses are established for the purpose of the study.

H_1: There is no significant impact of Digital Marketing on Customers Privacy in terms of personal information as perceived by the Customers.

H_2: There is no significant impact of Digital Marketing on Customers Privacy in terms of time and energy as perceived by the Customers.

H_3: There is no significant impact of Digital Marketing on Disparate Customers as perceived by the Customers.

RESEARCH METHODOLOGY

A survey was conducted in Dimapur District of Nagaland. The data pertaining to digital marketing and customers' privacy where collected by considering four variables with the help of 5 Point Likert Scale were collected. 100 samples which consist of both male and female were considered for the study, is presented in Table No: 1.

Table 1. Demographic details of the sample

Age	10 - 20 years	21 - 30 years	31 -40 years	40 - 50 years	50 years and above	Total
	5	**42**	**29**	**9**	**15**	**100**
Sex	Male	Female				
	60	**40**				**100**

Source: Compiled from Survey Data

LATENT VARIABLE CONSIDERED FOR THE STUDY

1. **Degree of 'Digital Marketing'-** this variable has been considered to measure the degree of or intensity of digital marketing practices adopted by different organization for promoting the sale. Customers' perception in respect of digital marketing is considered. (Items considered are in Table 12 of the Appendix)
2. **Degree of 'Customers Privacy in terms of personal information'**- this has been used to measure the degree of customers privacy in terms of personal information, how does the digital marketing affect the customers privacy in terms of personal information. (Items considered are in Table 13 of the Appendix)
3. **Degree of 'Customers Privacy in terms of time and energy'**- this has been used to measure the degree of customers privacy in terms of time and energy, how digital marketing affect the customers privacy in terms of time and energy. (Items considered are in Table 14 of the Appendix)
4. **Degree of 'Disparate Customers' –** this has been used to measure the degree of disparate customers, how does the digital marketing reach unrelated customers, how it affect them.(Items considered are in Table 15 of the Appendix)

From the above Table No 2, it is observed that scale considered for the study are reliable since calculated **Cronbach's Alpha values are more than 0.70**. It is concluded that data is true for the sample as well as in the population.

Table 2. Reliability statistics

	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
Degree of Digital Marketing	.953	.993	10
Degree of 'Customers Privacy in terms of personal information'	.894	.883	10
Degree of 'Customers Privacy in terms of time and energy'	.764	.720	10
Degree of 'Disparate Customers'	.778	.795	10

Source: Compiled from Survey Data

RESULT AND DISCUSSION

Impact of Digital Marketing on Customers Privacy in Terms of Personal Information

Table 3. Regression model [summary[b]] of digital marketing on customers privacy in terms of personal information

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.388[a]	.150	.142	.27646	.150	17.339	1	98	.000	.218
a. Predictors: (Constant), Degree of Digital Marketing										
b. Dependent Variable: Degree of 'Customers Privacy in terms of personal information'										

Source: Compiled from Survey Data

From the above Table 3, it is discerned that R value represents the simple correlation and is 0.388 which indicates the moderate degree of correlation between digital marketing and Customers Privacy in terms of Personal Information. The R^2 i.e. 0.150 indicate how much of the total variation, customers privacy

Table 4. ANOVA[a] regression model of digital marketing on customers privacy in terms of personal information

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	1.325	1	1.325	17.339	.000[b]
	Residual	7.490	98	.076		
	Total	8.816	99			
a. Dependent Variable: Degree of 'Customers Privacy in terms of personal information'						
b. Predictors: (Constant), Degree of Digital Marketing						

Source: Compiled from Survey Data

in terms of personal information can be explained by the independent variable, digital marketing. In this case 15.0% can be explained which is very small.

The next table, Table 4 indicates that the regression model predicts the dependent variable significantly well. The ‘P value’ indicates the statistical significance of the regression model that was run. Here, P = 0.000, which is less than 0.05, indicates that overall regression model statistically significant predicts the outcome variable is a good fit for the data.

The coefficient table provides the necessary information to predict customers’ privacy in terms of personal information from Digital Marketing, as well as determines whether digital marketing is statically significant to the model by looking at the ‘P value’. Furthermore the value in the “B” column under the “Unstandardized Coefficients” column as shown below:

to present the regressive equation as:

Table 5. Coefficient of regression model of digital marketing on customers privacy in terms of personal information

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.090	.373		5.604	.000
	Degree of Digital Marketing	.418	.100	.388	4.164	.000

Source: Compiled from Survey Data

Personal Information = 2.090 + 0.418 (Digital Marketing)

Since the P value is less than the table value of 0.05 in the sample data, which provides enough evidence to reject the null hypothesis. Hence, there is a significant impact of Digital Marketing on customers’ privacy in terms of personal information.

Table 6. Regression model [summary[b]] of digital marketing on customers privacy in terms of time and energy

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.421[a]	.177	.169	.31997	.177	21.062	1	98	.000	.273
a. Predictors: (Constant), Degree of Digital Marketing										
b. Dependent Variable: Degree of ‘Customers Privacy in terms of time and energy’										

Source: Compiled from Survey Data

Impact of Digital Marketing on Customers Privacy in Terms of Time and Energy

From the above Table 6, it is discerned that R value represents the simple correlation and is 0.421 which indicates the moderate degree of correlation between digital marketing and Customers Privacy in terms of Time and Energy. The R^2 i.e. 0.177 indicate how much of the total variation, customers privacy in terms of time and energy can be explained by the independent variable, digital marketing. In this case 17.0% can be explained which is very small.

The next table, Table 7 indicates that the regression model predicts the dependent variable significantly well. The 'P value' indicates the statistical significance of the regression model that was run. Here, P ≤ 0.000, which is less than 0.05, indicates that overall regression model statistically significant predicts the outcome variable is a good fit for the data.

Table7. ANOVA[a] of regression model of digital marketing on customers privacy in terms of time and energy

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	2.156	1	2.156	21.062	.000[b]
	Residual	10.034	98	.102		
	Total	12.190	99			
a. Dependent Variable: Degree of 'Customers Privacy in terms of time and energy'						
b. Predictors: (Constant), Degree of Digital Marketing						

Source: Compiled from Survey Data

The coefficient table provides the necessary information to predict customers' privacy in terms of time and energy from Digital Marketing, as well as determines whether digital marketing contributes statically significantly to the model by looking at the 'P value'. Furthermore the value in the "B" column under the "Unstandardized Coefficients" column as shown below:

Table 8. Coefficient of regression model of digital marketing on customers privacy in terms of time and energy

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.595	.432		3.695	.000
	Degree of Digital Marketing	.533	.116	.421	4.589	.000

Source: Compiled from Survey Data

to present the regressive equation as:
Time and Energy = 1.595 + 0.533 (Digital Marketing)

Since the P value is less than the table value of 0.05 in the sample data, which provides enough evidence to reject the null hypothesis. Thus, there is a significant impact of Digital Marketing on customers' privacy in terms of time and energy.

Impact of Digital Marketing on Disparate Customers

Table 9. Regression model [summary[b]] of digital marketing on disparate customers

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.445[a]	.198	.190	.23250	.198	24.230	1	98	.000	.628
a. Predictors: (Constant), Degree of Digital Marketing										
b. Dependent Variable: Degree of 'Disparate Customers'										

Source: Compiled from Survey Data

From the above Table 9, it is discerned that R value represents the simple correlation and is 0.445 which indicates the moderate degree of correlation between digital marketing and Disprate Customers. The R^2 i.e. 0.198 indicate how much of the total variation, disparate customers can be explained by the independent variable, digital marketing. In this case 19.8% can be explained which is very small.

The next table, Table 10 indicates that the regression model predicts the dependent variable significantly well. The 'P value' indicates the statistical significance of the regression model that was run. Here, $P \leq 0.000$, which is less than 0.05, indicates that overall regression model statistically significant predicts the outcome variable is a good fit for the data.

Table 10. ANOVA[a] of regression model of digital marketing on disparate customers

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	1.310	1	1.310	24.230	.000[b]
	Residual	5.298	98	.054		
	Total	6.607	99			
a. Dependent Variable: Degree of 'Disparate Customers'						
b. Predictors: (Constant), Degree of Digital Marketing						

Source: Compiled from Survey Data

The coefficient table provides the necessary information to predict disparate customers from Digital Marketing, as well as determines whether digital marketing contributes statistically significant to the model by looking at the 'P value'. Furthermore the value in the "B" column under the "Unstandardized Coefficients" column as shown below:

Table 11. Coefficients[a] of regression model of digital marketing on disparate customers

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.916	.314		6.109	.000
	Degree of Digital Marketing	.415	.084	.445	4.922	.000
a. Dependent Variable: Degree of 'Disparate Customers'						

Source: Compiled from Survey Data

to present the regressive equation as:
Time and Energy = 1.916 + 0.415 (Digital Marketing)

Since the P value is less than the table value of 0.05 in the sample data, which provides enough evidence to reject the null hypothesis. Hence, there is a significant impact of Digital Marketing on Disparate Customers.

LIMITATIONS

This research paper has taken negative effects of digital marketing on customer's privacy as perceived by the customers only. The sample considered for the study is small and may not reflect the real picture of the effect of digital marketing on customers' privacy. No feed backs were collected from any organizations that adopt digital marketing.

CONCLUSION

Digital Marketing is new benchmark strategies of marketing adopted by corporate industries in respect of promoting sales. Privacy protection on the digital marketing demands a multi-tier approach, involving organizations, industries, governments and individual customers. The present development of technology though adds advantage in executive marketing digitally with least expenditure, ignoring customer privacy could be avoided. It is discernible from the present study that (a) there appear to be significant impact of Digital Marketing on Customers' privacy in terms of Personal Information and Consumption, Energy and Money since the internet service provider share the information with marketer, use customers electric gadgets for marketing and pay price specific service but get advertisement which is included in the price. (b) There appear to be significant impact of Digital Marketing on Disparate Customers as it reaches untargeted or unrelated customers which have no impact on sale.

These above mentioned issues need urgent attention on the part of corporate in respect of advertising their product and services digitally. They have to limit number of advertisement, seek prior permission before sending advertisement while respecting and protecting customers' privacy. Corporate could follow Government guidelines and regulation strictly in the line of digital marketing which in turn enable them to protect the customers from cyber crimes on one hand and earn loyal customers on other.

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APPENDIX

Table 12.

S.No.	Statement
1.1	I receive advertisement as I browse internet
1.2	I receive various types of advertisement in my email
1.3	I receive various types of advertisement in my social media accounts
1.4	I receive various types of advertisement SMS in my mobile phone
1.5	I receive various types of advertisement in my TV
1.6	I receive various types of advertisement in the form of discount and offers
1.7	I receive unrelated advertisement in my email
1.8	I often called by promoter to buy product
1.9	As I browse internet for particular purpose it opens some advertisement
1.10	Web advertisements are received

Table 13.

S.No	Statement
2.1	Data are collected from browser history
2.2	Data are collected from cookies
2.3	Data are collected while opening account
2.4	Data are collected from promotional advertisement
2.5	Data are collected from service provider
2.6	Data are collected social group
2.7	Data are collected from online shopping
2.8	Request information over phone for convenience
2.9	Data are collected from pre order form
2.10	Data are collected from warranty card

Table 14.

S.No	Statement
3.1	Protecting of Collected Personal data is questionable
3.2	Customers pay price for TV service but advertisement consume lot of time
3.3	Customers pay electric charge for given advertisement
3.4	Marketer use customers electronic gadgets for advertisement
3.5	Customers data recharge is consumed for advertisement
3.6	Repeated advertisement affect the mind set up of the Customers
3.7	Marketer approach customers repeatedly inappropriate time
3.8	Marketer send large number of cookies which waste time and energy
3.9	Advertisement disturbs customers while consuming particular service
3.10	While Browsing Internet takes lot of time in uploading the page due to advertisement

Table 15.

S.No	Statement
4.1	I receive unnecessary advertisement as I browse internet
4.2	I receive various types of unnecessary advertisement in my email
4.3	I receive various types of unnecessary advertisement in my social media accounts
4.4	I receive various types of unnecessary advertisement SMS in my mobile phone
4.5	I receive various types of unnecessary advertisement in my TV
4.6	I receive various types of unnecessary advertisement in the form of discount and offers
4.7	I receive unnecessary unrelated advertisement in my email
4.8	I receive unnecessary calls by promoter to buy product
4.9	As I browse internet for particular purpose it opens unnecessary some advertisement
4.10	Unnecessary web advertisements are received

Chapter 8
The Transformation of Traditional TVs Into Digital Platforms:
A Strategic Marketing Analysis on Turkish Market

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ABSTRACT

Digital transformation means developing new business models, unforgettable customer experiences, and competitive strategies by using digital technologies, thus creating efficiency in business processes and providing better customer value. While digital transformation is one of the important business decisions, more specifically, the pandemic and the increase in time spent at home have created a substantial growth opportunity for digital broadcast service providers. In this regard, the fact that an already growing market has increased its growth momentum with the effect of the pandemic has made the digital transformation of traditional TV media inevitable. In this study, digital broadcasting sector in Turkey has been examined in the context of strategic marketing management. In this way, by conducting the situation and competition analysis, suggestions were made regarding marketing strategies for Turkish digital platforms that have just entered the market.

INTRODUCTION

Digital transformation means developing new business models, customer experiences and strategies by using digital technologies in line with a specific goal, thus creating efficiency in business processes and providing better experiences. In other words, digital transformation is more strategic than a technological transformation, and the focus is on the customer (Genç, 2020). Until this time, the necessity of digital

DOI: 10.4018/978-1-7998-2402-2.ch008

transformation has been emphasized by industry experts, academics, businesspeople and even government officials (Mergel, Edelmann and Haug, 2019). However, it should be noted that the pandemia has accelerated the digital transformation process. Changing business models, changing customer expectations and habits in this period will largely not return to the past, even if the pandemic ends.

Within the scope of the measures taken by almost all countries, digital media tools have become the most important channels for people staying at home to receive information, communicate, socialize and have fun. More specifically, the pandemic and the increase in time spent at home have created a growth opportunity for digital broadcast service providers (Iivari, Sharma and Venta-Ollonen, 2020). The fact that an already growing market has increased its growth momentum with the effect of the pandemic has made the digital transformation of traditional TV media inevitable.

In this context, specifically the popularization day by day in the world of digital broadcasting platform is important to examine the state of competition in Turkey from a strategic marketing perspective. Indeed, Turkey consumes content offered by digital broadcasting platform with a rate of 62% in the We Are Social 2020 Digital Report; thus Turkey is becoming a very attractive market. More importantly, what kind of a competitive position of the Turkey-based new digital platforms it will take against global digital publishing platforms is a matter of curiosity.

In this study, digital broadcasting sector in Turkey has been examined in the context of strategic marketing management. Thus, it is intended to shed light on the competitive situation of the Turkey-based digital broadcasting platforms. In this sense; situation analyses (SWOT, Porter's five forces) and competition analysis are carried out in the perspective of strategic marketing planning and recommendations are made on marketing strategies to be established afterwards. Within this framework, the following titles are included in the study.

- From Old Media to New Media
- The Transformation of Traditional Tvs Into Digital Platforms
- An Investigation on The Competitiveness of Turkish Digital Platforms in the Industry
- Recommendations for Marketing Strategies

BACKGROUND

From Old Media to New Media

Media are consistently evolving and getting faster. In that vein, old media is in decline, while new media is blowing up worldwide (Sanz and Crosbie, 2016). In fact, an inverse curve is not mentioned here. New media does not suppress or destroy old media. On the contrary, the new media seems to be a complement to the old media. In fact, old and new media work side by side to achieve the goals of an individual, a company, or a civil society organization (Friedman and Friedman, 2008). For example, while a newspaper is available in print in the newsstand, it can also provide up-to-date news flow on the website. In addition, a columnist can publish his articles both in print and in his social media accounts and personal blogs. An author's book can be found both in print in bookstores and on e-book sites.

New media transforms old media into digital. At this point, although theorists have made different definitions regarding the new media concept (Table 1); in this study, new media is regarded as digital media. In this context, it is necessary to mention the basic features of new media.

Table 1. Definitions of new media

Manovic (2002)	…digitally composed (reconstructed, arranged by combining parts) movie, virtual 3-D environments, computer games, the hypermedia Website or the Web, that is, the entire internet environment.
Bennett (2003)	…emerging information and communication technologies and applications such as mobile phones, the Internet, streaming technologies, wireless networks, and the high-quality publishing and information-sharing capacities of the World Wide Web.
Pavlik and McIntosh (2004)	…the combined use of media, telecommunications and computing technologies in the digital environment.
Flew (2008)	…the interconnection of media contents, information technologies and communication networks.
Lister et. al. (2009)	…a comprehensive change in the processes of media use, production and distribution.
Aday et. al. (2012)	…digital communication formats but also to old forms of media reconstituted and redistributed as digital media content over the Internet to personal computer, cellular phones, iPods, and so on.
Valentini and Kruckeberg (2012)	…applications in digital environments that provide innovative ways of relating, communicating, and interacting.

Firstly, the new media environment consists of *numerical codes and algorithms*. Thus, data such as text, video, sound, and photograph, which must be physically transported and protected beforehand, can be stored on computer and internet. In this way, hard disks or cloud technology can be used instead of rooms full of photo films or video tapes (Timisi, 2003). Thus, businesses can perform big data analysis; meaningful information can be produced from all scattered data. Netflix uses data processing software and traditional business intelligence tools such as Hadoop and Teradata, as well as its own open-source solutions such as Lipstick and Genie, to gather, store, and process massive amounts of information. These platforms influence its decisions on what content to create and promote to audiences (Sadeh, 2019).

Secondly, new media offers the opportunity to use data from more than one medium in the same content. Thanks to the tools called *multimedia*, the narration is strengthened by using multiple media such as text, photograph, video, sound in the same content, and the contents can be made much more interesting (van Dijk, 2004). In this sense, companies' digital advertisements are more interesting, while traditional billboards have turned into vehicles with animated ads, special effects, and colourful graphics.

As the third, *hypertextuality*, which enables connect between links, is another important feature of the new media. Especially with the transfer of the media to the digital environment to a large extent, the hypertext feature has played a very important role by being used by many new media tools such as internet newspapers, digital platforms, and social media platforms (Oblak, 2005).

The *interactivity* feature of the new media means that the party consuming the content also contributes to the content and participates in the formation process (Oblak, 2005). There was a power outage for 34 minutes during the Super Bowl XLVII. Meanwhile, the Oreo brand posted a tweet with a simple message: "Power out? No problem. You can still dunk in the dark!". This single tweet attracted more attention than Oreo's "cream vs. cookie" ad in the first quarter of the game. The message of "You can still dunk in the dark!" was retweeted 16000 times in about an hour, receiving millions of positive interactions. Oreo achieved impressive results by taking advantage of the interaction power of new media with its real-time marketing work (Kotler and Keller, 2018).

Finally, thanks to *convergence* in new media, it can produce and distribute data processed with sound, images, text and other elements. As a result of digitization and convergence, it became possible to broadcast all kinds of communication elements such as text, sound, video, graphics, animation, photography, music on a common platform at national and international level. This process enables information to be produced in a versatile way and to be distributed/presented with the same versatility (Yüncüoğlu, 2019).

The Transformation of Traditional TVs into Digital Platforms

Since 1926, which was the first broadcast date of television, it can be said that the broadcasting industry has a dynamic structure with the continuous change and development of broadcasting activities (Bray, 1995). Especially in recent years, developments in information technologies that form the basis of digitalization and the rapid spread of internet-based technologies have led to significant changes in television broadcasting and watching habits. Media that can be called as the new generation broadcasting or digital broadcasting platform have an important competitive power due to the great advantages they have over traditional television broadcasting. Moreover; television watching habit and behavior, which is a multidimensional and dynamic process, changes and transforms with digital broadcasting, and content production suitable for digital television broadcasting comes to the fore (Okmeydan, 2020).

Digital broadcasting platforms; it is becoming increasingly popular with its features such as i) accessing productions that do not contain any advertisements, ii) being able to watch these productions whenever they want, and iii) finding productions that they have to leave unfinished for various reasons from where they left off or when they want to watch them again. In addition, digitalized television broadcasting offers a more interactive communication platform to the audience. For example, consumers who are not physically in the same place but share similar tastes have begun to unite around the social network-based communities they have created and the broadcastings they prefer (Mikos, 2016). Such advantages and with more specifically the pandemic, digital broadcast platforms, which have achieved a great increase in the number of members, stand out against traditional television broadcasting day by day.

The worldwide momentum of digital broadcasting has led to the emergence of many digital broadcasting platforms. The process that started with the establishment of Netflix in 1997 and returning its system, which started as DVD distribution to homes, to the subscription system, dates back to today (Kotler and Keller, 2018). After Netflix spread to the world market and reached a large audience, many companies started to create their own digital broadcasting platforms. Netflix after the company first Amazon and then YouTube Red, Amazon Prime, Hulu, MUBI and Apple companies have entered the international market then the market in Turkey (Sarı and Sancaklı, 2020). Netflix also then opened to users in Turkey in 2016, Doğan Media and Doğuş Groups founded “Blu TV” and “Puhu Tv”, respectively. In digital broadcasting platform in Turkey while two platforms that produce Turkish content currently broadcasting content, in 2021, Acun Media’s EXXEN and Gain Media’s Gain TV digital platforms made an assertive entrance to the market.

MAIN FOCUS OF THE CHAPTER

The main focus of this chapter is to examine the competitiveness of the Turkish digital broadcasting platforms against global competitors with current situation analysis (e.g. BCG matrix, Swot analysis, Porter's five forces) in strategic marketing framework and thus making strategic suggestions to increase market share.

An Investigation on the Competitiveness of Turkish Digital Platforms in the Industry

In this chapter, competitiveness of the digital platform in Turkey are examined on the basis EXXEN. Because Acun Media, the founder of EXXEN, is also the owner of the traditional television channel TV8. Thus, it is thought that the competitiveness of Turkish media channels in the process of transformation into digital platforms will be understood more deeply.

Strategic Marketing Planning Process

Goal Formulation

Digital platforms operating in Turkey market (e.g. Netflix, Amazon Prime) has a strong global brand awareness and brand image. Although it seems disadvantageous to introduce itself as a new digital platform against these platforms that are positioned in the minds of the audiences, it is seen that Acun Media successfully uses its traditional TV experience. EXXEN was introduced to the market with the slogan of "Turkey's digital platform". This slogan ensures EXXEN's distinctive positioning in the minds of the audience as a Turkish digital platform against global digital platforms.

Acun Media explains the mission of EXXEN with the expression "We are here to entertain everyone and have a good time for everyone.". The fact that the traditional TV channel TV8 is mostly "reality shows, competition programs, sit-com series" increases the belief of the audiences in EXXEN's mission.

The vision of the EXXEN being primarily market leader in Turkey, then is to spread globally. Here it can be concluded that EXXEN has determined its competitive position as a market challenger in the growing market. The market challenger aggressively wants to steal market share from the market leader and concentrates on differentiation and invests time and money in creating competitive marketing programs (Yannopoulos, 2011). Here, an important difference is seen that sets the digital platform market apart from other competitive markets. This difference is that viewers tend to subscribe to more than one digital platform simultaneously. Therefore, the primary goal of a market challenger in this market is not to grab the members of the leader unlike others, but to make the audience members of the leader into their own members.

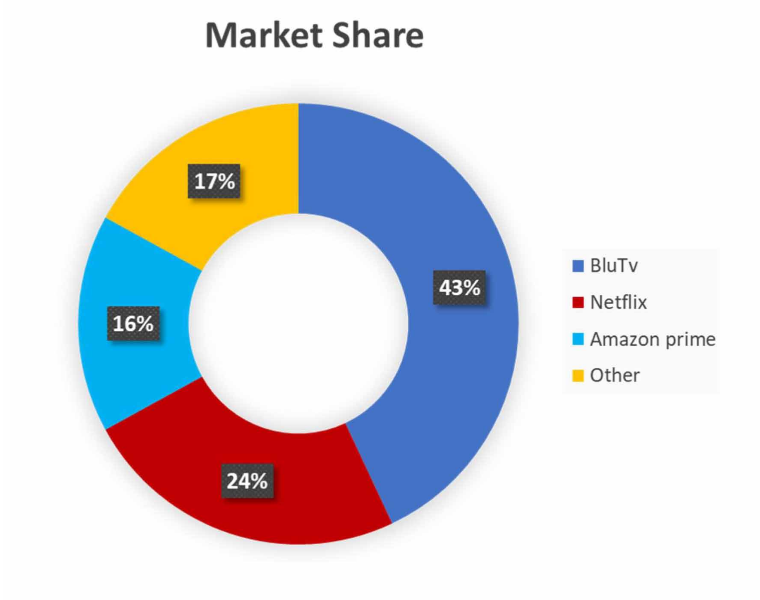
Situation Analysis

Before internal and external environmental analysis, it is important to reveal EXXEN's current competitive position against its competitors.

According to the latest research of JustWatch showing the interest of users in digital platforms in Turkey (Figure 1), as of the last quarter of 2020, Blutv's market share is 44% and Netflix's market share is 25%. On the other hand, Amazon Prime is in third place with a market share of 18% (JustWatch.com, 2020).

Based on BCG matrix, while its main competitors are in the star position on the axes of growth rate and relative market share of the market, it can be said that Acun media is included in the question marks part of EXXEN and Gain Media as a strategic business portfolio (Figure 2). The life cycle of the

Figure 1. Digital platform market in Turkey Q3 2020
Source: JustWatch.com



digital broadcasting industry is in the growth phase and EXXEN's relative market share is low when considering the competitors. However, it is important to note that that this situation is a result of its new entry into the market. In the question marks segment, brands either retract their investments or challenge their competitors by investing (Wheelen et. al, 2017). Acun media invests in EXXEN and challenges its competitors in order to have a greater share in the growing market.

In the process of internal and external environmental analysis, SWOT analysis and 5 power analysis of Porter analysis were carried out. While SWOT analysis reveals EXXEN's strengths and weaknesses against its competitors, it also reveals environmental opportunities and threats (Table 2).

Figure 2. BCG Matrix of digital platforms in Turkey market

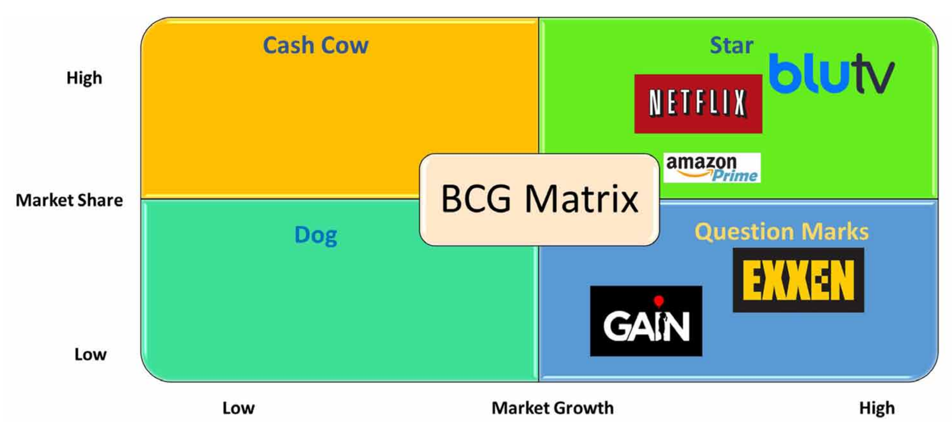


Table 2. Swot analysis of EXXEN

Strengths • Know-how in Turkey's market of Acun Media • Conducting intensive communication activities on the traditional TV channel (Tv8) which has high rate of view. • Owned by a strong media group • Strong social ties in the market • Incorporation of successful local content on different platforms • Content differentiation with different types of productions (competition programs, reality shows) • Addressing different age segments	**Aspects Needing Improvement** • Technical flaws in user experience • Relatively late entry to the market • Contents predominantly targeting the total audience group • Limited content compared to its competitors • Content of the market remained limited with Turkey (absence of foreign TV series content) • Lack of different language options
Opportunities • Market growth rate • Competitors to produce less content during the pandemic period • Lack of a Turkish digital platform dominating the sector	**Threats** • Legal regulations •Imitable business model • Competitors that are well positioned and held in the market • New rivals • Pirated websites • High content creation and copyright costs • Low profit margins compared to TV productions

Porter's five forces analysis helps a company to be aware of the actors around the industry and understand their strength deeply, while showing how the company can stand more profitably and with resilience against attacks (Wheelen et. al., 2017).

1. Competition in the Sector*:*

The digital broadcasting platform market is a growing market and increases its growth rate with the effect of the pandemic in 2020. As seen in the SWOT analysis, there are very tough competitors in the market such as Gain Medya, Puhutv, Blutv, Netflix, Amazon prime video and even Youtube Premium. To achieve a higher market share in Turkey's market, it is important to discover strategic gaps that competitors overlook or cannot do, quickly seize strengths and market opportunities, and eliminate threats.

2. The Power of Audiences*:*

Especially with the Covid-19 epidemic, it is seen that people spend more time at home, and the attention of the audience has shifted to digital broadcasting platforms. The high number of digital broadcast platforms that can be preferred in the market increases the bargaining power of the customer. There are no big differences in price between digital broadcast platforms and audiences are not subject to a contract for membership. Many audiences pay monthly with the option to cancel subscriptions at any time and thus increases the power of the audience. At the same time, it is the content quality that is essential for the audience. Especially with the globalization of the TV series and film industry, audiences want to watch international broadcasts simultaneously with the world, while also not wanting to miss ambitious local production content. For this reason, the rate of change in the preferences of the audiences for digital broadcast platforms is high. Based on this information, it can be said that the power of customers in the market is high.

3. Strength of Suppliers:

The suppliers of digital broadcasting platforms are content producers. Digital broadcasting platforms cannot always produce internally produced content due to high costs. The selectivity of the audiences in their content preference makes it compulsory for digital broadcast platforms to have interesting, assertive and quality content. In addition, digital content is consumed much faster than traditional broadcasts, which forces platforms to remain dynamic. For this reason, there is dependence on content producers. When evaluating the scope of EXXEN, global series and movies as ambitious as Netflix is difficult to obtain financing with its own resources or suppliers but especially Acun Media is a leader in Turkey in the competition and reality show programs. Especially, their ability to adapt this kind of global content to attract the attention of the Turkish audience constitutes the basis of their success. On the basis of this information, it is concluded that the bargaining power of the suppliers is high, but the contribution of the good relations with the suppliers that Acun Media has developed for years will be seen.

4. Threat of Substitutions

The substitute product threat of digital broadcast platforms is traditional media content providers and websites, blogs and other web channels that offer similar products through online streaming. Audiences can also participate in entertainment and leisure activities other than watching online streaming and media content. In a market where signing up and unsubscribing is simple, customers tend to constantly switch between alternatives. The customer prefers platforms with their favorite TV series, movies, actors and content. In addition, as people consume content quickly with the effect of the Covid-19 pandemic, users will turn to substitute products if new content is not produced to keep users on the platform. Based on this information, it can be concluded that the threat of the substitute product is moderate.

5. Threat of New Entrants

While 20 digital broadcast platform which are potential market operating in Turkey, several factors that affect the threat level of potential new competitors to enter the market can be mentioned. The first is that market entry barriers are not high. Secondly, Turkey is not interesting market. Third, many viewers prefer to subscribe to more than one platform. Therefore, on the basis of this information, Turkey market may reach the conclusion that both global and national levels in an attractive market for media companies.

Recommendations for Marketing Strategies

In this section, strategies that will contribute to the better positioning of Turkish digital platforms in the growing market by harmonizing the 4P of marketing with Lauterborn (1990)'s 4C will be proposed.

Product-Customer Value Strategies

While creating product and service content, it should be value-oriented (Kotler and Armstrong, 2012). While easy access to the service, ad-free environment and content quality are important in choosing a paid platform, free platforms stand out with their content diversity. According to the audience, the competition between platforms increases the number of content and decreases the quality of the original content produced. Here, Turkish digital platforms should focus on creating original content that will appeal to the audience, using their market-related know-how. Especially Acun Media should carry its expertise in programs such as original content competitions and reality shows to digital platforms. At the same time, it is striking that viewers in Turkey tend to watch nostalgic TV series and programs. In this sense, it can be said that re-broadcasting the previously watched TV series by increasing the resolution quality or shooting new versions of the old series can be advantageous in terms of attracting the attention of the audience.

Price-Customer Cost Strategies

According to the research of KPMG Turkey (2020), the price sensitivity of the audience in Turkey is high. Therefore, Turkish digital broadcasting platforms should improve their content to earn wallet share and increase their revenues. They should also take advantage of customers' ideas and habits in creating a strong pricing strategy and question how the pandemic leaves a mark on customer habits. At the same time, sales incentives (price discounts, campaigns, etc.) should be focused on in order to create brand awareness in the audience.

Place-Customer Convenience Strategies

Ease of access is one of the important factors affecting the digital broadcast platform preferences of audiences. Especially when EXXEN entered the market, it was exposed to negative feedback from many audiences. The issues that audiences complain about the most; not being able to access the content despite being a member, not having multiple entries from different devices such as TV, tablet and phone, and insufficient customer service in solving problems. Especially, with the pandemic process, individuals tend to turn to reliable online channels, making it necessary for the digital platform to find solutions to these negative feedbacks in a short time (Eryiğit, 2021).

Promotion-Brand and Customer Communication Strategies

In the report published by Delotte at the end of 2020, the increase in trust between the brand and the customer shows that it has a direct positive effect on the consumer's consumption behavior. According to the HX TrustID analysis, humanity, transparency, capability and reliability turn into consumer footprint. For example; consumers prefer to buy from brands that are described as humane and compassionate 1.6 times more than other brands. Consumers from brands that clearly state what size of service they can offer promise that they will repeat the purchase 2.4 times more. If the brand is reliable, customers are twice as likely to recommend the brand to their friends (https://www.deloittedigital.com). In this perspective, no matter how strong the competitors of Turkish digital platforms are, brand positioning studies based on these four elements will have a place in the minds of the audience.

SOLUTIONS AND RECOMMENDATIONS

This chapter aims to create a framework and method to gain competitive advantage for Turkish digital broadcasting platforms, which are struggling against global competitors. Here, it is suggested that the basis of mental models and tools is strategic marketing planning. One of the most important contributions of the chapter; it sheds light on the problem that while each firm has a strategic plan in general, they do not have enough information about strategic marketing planning. While the strategic plan includes long-term strategies for organizational processes for the future of the institution and its structural changes, strategic marketing planning gives its full attention to the resources and changing dynamics in the market. In addition, strategic marketing planning creates a roadmap that aims to seize the competitive advantage in the market from the first input to the end user. The strategic marketing plan systematizes the efficient use of resources by predicting the changes in market and end-user trends, minimizing the risks of threats and while doing this, organizing in-house talents and making economic savings. In other words, it shows the resources and methods necessary for a company to reach its targets in a specific target market (Cooper, 2000; Wilson 2010; Torlak and Altunışık, 2018). Especially in digital broadcasting platforms where the idea of "hand in hand with technology" gains importance, the need for a strategic marketing planning that will act as a bridge between technology, content producers and audiences is clearly emerging. McDonald and Rogers (1998) argue that without taking into account the basic tools of marketing, a firm has little chance of developing strategies that will provide sustainable competitive advantage. In this context, thanks to the analysis in strategic marketing planning, companies can identify the internal processes, market dynamics and technological opportunities and threats presented by the environment. Then, in the light of this information, they will obtain a strategic roadmap where they can take the most suitable competitive position for the future.

According to the analysis results, EXXEN and Gain Media are in the question marks based on the BCG matrix. In this sense, these platforms should continue their investments and challenge digital platforms such as Netflix and Blu TV, which are stars. Strategies they can use include developing superior product technology, content differentiation, expanding the content pipeline, offering high-quality customer relationships and relatively low prices (Torlak and Altunışık, 2018). At the same time, based on SWOT analysis, strengths and market opportunities should be approached, weaknesses and market threats should not be confronted. In particular, relations with industry forces identified in Porter's five forces analysis should be strengthened.

FUTURE RESEARCH DIRECTIONS

This study has some limitations that offer opportunities for further research. Primarily, researcher collected data from secondary data. The secondary data collection from various sources, such as the digital transformation of old media and digital broadcast platforms related literatures, news, magazines, internet news, forums, web site, and so on. With the secondary data, researcher can able to has a basic understanding about digital broadcast platform sector in Turkey including who are the players in the sector what are the important factors to sector, and how the micro and macro environmental factors foster this sector, and so on. However, researcher does not know what are the networks and among players yet and how do they exchange or share knowledge with each other and what do they feel about competition (Lin, 2011). To close these gaps, future studies can collect the primary data that expected to answer questions mentioned above.

In this study, BCG matrix, SWOT analysis and Porter's five forces were performed. In this regard, the competitive structure of the sector can be examined with other important analysis (PESTEL, value chain analysis etc.) in greater detail. Thereby, future studies can quite successfully realize any interpretation and generalizations of this study's findings to different companies.

CONCLUSION

Digital transformation creates significant changes on individuals, society, public institutions and businesses. Especially the prolongation of the pandemic process causes these effects to become permanent. On the other hand, growing markets achieve a faster growth. The digital broadcasting platform industry is one of them. Traditional media owners see it inevitable to include digital transformation in their future designs. In a sense, they seek not to miss the future. Looking at the Turkish market, it is seen that global actors are intense and a few Turkish digital broadcasting platforms are active. This study has been investigated especially in the context of EXXEN. Because EXXEN is the digital transformation brand of a media organization that owns traditional TV and the effects of this transformation process are better understood through this brand. In the study, by conducting the situation and competition analysis, suggestions were made regarding marketing strategies for Turkish digital platforms that have just entered the market.

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KEY TERMS AND DEFINITIONS

BCG Matrix: An approach pioneered by the Boston Consulting Group that attempted to portrays differences among sector players in terms of relative market share position and industry growth rate.

Digital Broadcast Platform: On-demand online entertainment source for TV shows, movies, and other streaming media such as Netflix, Hulu, Amazon Prime, EXXEN, Gain media.

New Media: A form of mass communication using digital technologies, that is, any internet-related form of communication such as newspaper articles and blogs, music and podcasts, website or email, and streaming apps.

Old Media: Means of mass communication that are not digital and interactive such as television, radio, and print media.

Porter's Five Forces: A powerful tool that companies use in order to identify the competitive intensity (threats of new competitors, bargaining power of suppliers, power of buyers, the threat of substitutes and rivalry among existing competitors) in a certain sector.

Strategic Marketing Planning: A company-wide planning, based on internal factors that give a company main advantages and disadvantages, as a way of responding to market opportunities and threats, competitors, and target audiences.

SWOT Analysis: A market research analysis technique that a company performs to find strengths and weaknesses, market-related problems, or opportunities.

Chapter 9
The Role of Technological and Institutional Affordances in Open Innovation:
An Integrative Framework

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ABSTRACT

This study aims to advance studies on open innovation, digital technologies, and institutional infrastructures by building on extant research in the field. Most research to date focused on digital technologies and digital affordances, while institutional infrastructures and affordances are less explored. To provide a background for such an approach, this study identifies and integrates two major issues—technological affordances and institutional affordances—that enable or constrain open innovation practices within firms. The framework developed indicates that the degree of openness of the innovation practices is related to the availability of digital technologies and institutional infrastructures in a specific context and the practices of incumbent firms in mobilizing these structures.

INTRODUCTION

Nowadays, in line with the upsurge of knowledge-based economy, the major driver of economic growth has been innovation capacity rather than capital accumulation. In the knowledge economy, the creation, use, and diffusion of knowledge are critical for enhancing a firm's competencies in the innovation process and thus gaining a competitive advantage.

Digital transformation (Brennen & Kreiss, 2016) enables innovation in new products/services and the creation of new business models, new industries, and the transformation of existing industries such as education, transportation, insurance, finance, health, and agriculture. Furthermore, digitization and various implementations related to digitization has provoked engagement of various actors in politics, social realm and business. Supranational organizations like EU started to develop initiatives (for ex-

DOI: 10.4018/978-1-7998-2402-2.ch009

ample, digital single market) for enhancing the growth of digital economy. The indicators of digital transformation in a specific country, region and around the globe can be listed as, investment intensity in information communication technologies (ICT), increasing number of start-ups and venture capitalists in information industry, increasing numbers of formal appropriations (patents and copyrights) in ICT. Despite these transformations “digital divide” remains as a salient issue. It is expected that by developing internet infrastructure availability and affordability will be improved and by drafting appropriate policies in education the skills to use internet, to develop content will be improved so that a more inclusive digital transformation will take place.

Digital transformation due to digital innovations brings new actors, structures, and practices that change the prevailing ways of doing business and are shaped by introducing new digital technologies, platforms, and digital infrastructure. New digital technologies, lower production, and transaction costs increase innovative products’ fluidity (OECD, 2020) and promote productivity gains in innovation (Nambisan et al., 2019). Platforms as data silos, intermediate different users, produce ‘network effects’, provide tools that facilitate users to develop their own products/services and provide a space where a diverse set of users are connected (Srnicek, 2017). Platforms and efficient digital infrastructures reshape the prevailing innovation paradigm by enabling new actors’ participation, new knowledge inputs, and processes.

In today’s business world, firms that can accelerate their innovation cycles, reach large data sets from various sources, and facilitate various actors’ collaboration are more likely to create a competitive advantage. The open innovation (OI) model can be instrumental in realizing such a turn. Extant literature shows that OI improves firms’ innovation effectiveness by offering a vast knowledge pool and generating commercialization opportunities (for example, Chen & Liu, 2018). As opposed to closed innovation, the open innovation model assumes that firms can make use of external and internal ideas for exploration (inbound knowledge flows) and use external and internal paths (outbound knowledge exchanges) to the market-exploitation (West & Bogers, 2014). Thus, the degree of openness of a specific firm is related to its ability to identify and absorb external innovations and expand markets that will utilize the innovations (Chesbrough et al., 2006). In the open innovation paradigm, innovation is taken as a mass activity, and it is expected that by creating synergies between inbound knowledge flows and outbound knowledge exchanges, the innovation capacity of a specific firm will be improved. Extant studies on open innovations and digital transformation explore the relation between platforms, digital technologies and open innovation (Nambisian et al., 2018; Bogers et al., 2018; Urbinati et al., 2020; Nambisan et al., 2019; Yoo et al., 2012) and explain the changing nature of innovations and the innovation process.

This Chapter, based on secondary resources and extant research, aims to develop a framework explicating the impact of digital technologies, platforms, and infrastructure on open innovation. More specifically, the Chapter focuses on the enabling role of digital and institutional affordances in developing open innovation strategies. Affordances (Gibson, 1977; Norman, 1999) can facilitate and constrain the innovation process. The proposed framework studies platforms and digital technologies as the provider of technological affordances. Institutional affordances and constraints provide a basis where the actions taken by various actors in a specific context can be transformed to open innovation initiatives. For institutional infrastructures, governance of the open innovation initiatives, control over inbound knowledge flows (for example, generativity in incorporating heterogeneous knowledge resources, usage of open data in enabling cooperation between various actors) and outbound knowledge exchanges (for example, the development of various types of intellectual property arrangements that enable the development of different paths to market) are studied.

The Chapter is organized as such; the first part explains open innovation and affordances. Then in the second part, digital infrastructures and digital technology affordances are studied with a focus on characteristics of digital technologies that promote openness. This part is followed by institutional infrastructures and affordances at micro and macro level.

OPEN INNOVATION

Currently, the open innovation phenomenon has been the focus of researchers working on innovation management (Cheng & Huizingh, 2014) and practitioners. More and more companies' approach to innovation management is drifting from in-house innovation (Appleyard & Chesbrough, 2017) to a more collaborative innovation model that incorporates customers, suppliers, universities, start-ups to the innovation process (Faems et al., 2005; Mention, 2011). Idea of openness in innovation dates back to von Hippel study (1986) on user-led innovations and customer co-creation concept (Prahalad & Ramaswamy, 2004). The term, open innovation was coined in 2003 by Chesbrough and can be defined as "as a distributed innovation process based on purposively managed knowledge flows across organizational boundaries, using pecuniary and non-pecuniary mechanisms in line with the organization's business model" (Chesbrough & Bogers, 2014, p. 13). The open innovation model is based on creating interaction between inbound knowledge flows and outbound knowledge exchanges which deems efficient management of outside-in and inside-out processes.

Inbound knowledge flows by enabling the usage of external knowledge sources enrich a firms' innovation capacity. Firms can search for external ideas, knowledge, intellectual property, and know-how (Lopes & Carvalho, 2018) from customers, users, suppliers. According to Chesbrough and Crowther (2006), for a successful usage of outside-in processes (inbound flows), top management, in a top-down manner should encourage open innovation practices and focus on the type of initiatives that are in line with the goals of the firm. Furthermore, for sourcing purposes, firms should build networks with other constituencies in their environment. Similarly, the major goal is to search, identify and bridge value-adding innovations. The presence of an integrative organization culture also enables efficient inbound of knowledge flows (Naqshbandi et al., 2015). Outbound knowledge exchanges in the open innovation model occurs when firms export technical know-how, intellectual property, brand out-licensing and knowledge to their environment (Lopes & Carvalho, 2018). In the inside-out process (outbound knowledge flows), firms search for other firms that can commercialize a technology (Chesbrough & Crowther, 2006) by providing access to their markets or exploit spin-off opportunities for developing new markets. In both cases, well developed, strong appropriation regimes at the institutional level promote an efficient open innovation ecosystem. According to Chesbrough et al. (2006), outbound knowledge exchanges reduce R&D costs and improves the success rate of innovation. Furthermore, outbound open innovation can improve company revenues by licensing fees and promote non-monetary benefits like the establishment of industry standards for the focal firm (Lichtenthaler, 2009; Greco et al., 2016; Li et al., 2020).

Currently, developments in digital technologies, platforms enabled the contribution of various, distributed constituencies to co-produce innovative products/services. These technologies are instrumental in promoting an open innovation model for firms. On the other hand, opening the boundaries of a firm to inbound and outbound knowledge flows depend on micro (firm) and macro institutional infrastructures. Micro level institutional infrastructures can be classified as various governance mechanisms developed by a specific firm to govern its relations with knowledge and market providers. The macro level institutional infrastructures are formal and informal arrangements that promote the proliferation of digital technologies (for example, government support to information communication technologies, scientific research, venture funding) and legal systems (laws and their enforcement) that enable appropriation of innovations. Thus, it is expected that firms operating in different institutional infrastructures will be supported by different conditions that enable/disable open innovation practices. Also, firms experiencing the same institutional infrastructures can develop different practices to govern their relations with external constituencies.

AFFORDANCES AND OPEN INNOVATION

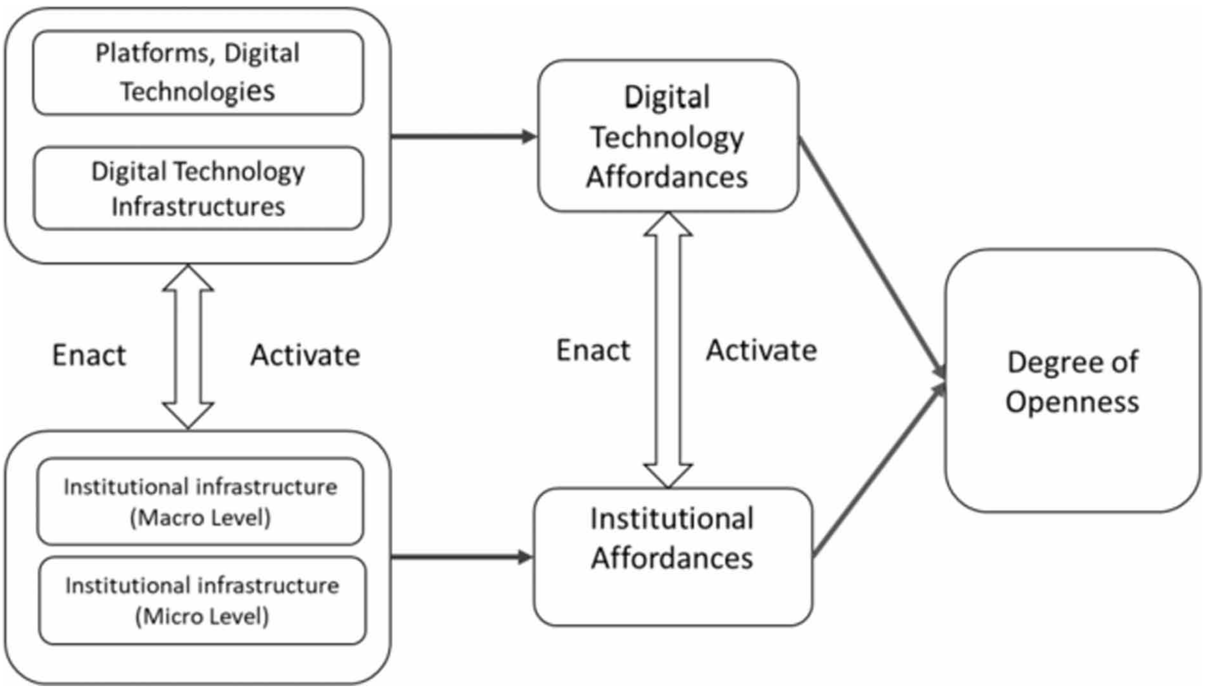
As explained by Gibson (1977), the term affordance is related to the action possibilities of animals in relation to the offerings of the environment. Affordances are the properties of an object and allow the object to function. By binding, the organism and the object, affordances indicate what can be done with an object. In other words, the affordances of objects arise from the perceptions of their users. According to Gibson (1977), perceptions of objects also imply the possible actions associated with the object. In recent years, management information systems (MIS) and innovation studies researchers have adopted the concept to study the relationship between technology and various social and entrepreneurial practices. These studies replace the environment with technology in explaining the relation between actors (individual or organizational) and technological objects. Another stream of research (Zeng & Yu, 2014; van Dijk et al., 2011) by focusing on institutional environment studies the role of institutional affordances on innovations. In this study, a framework is proposed (Fig. 1) to explain both technological and institutional affordances in facilitating open innovation practices and influencing the degree of openness of a firm. The relation between digital technology infrastructures and institutional infrastructures is relational, i.e., they activate and enact each other. As the scale and scope of digital technologies in use increase regional and national governments develop institutional infrastructures to promote their utilization, firms develop various mechanisms to instrumentalize these technologies in their inbound and outbound knowledge flows. These initiatives at macro and macro level contribute to their enactment as viable and pervasive digital technologies to be utilized in the open innovation model.

DIGITAL INFRASTRUCTURES AND TECHNOLOGICAL AFFORDANCES

Platforms, Digital Technologies

Platforms are “digital infrastructures that enable two or more groups to interact” (Srnicek 2017, pp. 26). As intermediaries, platforms connect different actors and provide a ground for these different actors to develop products/services, markets collectively. The concept of the platform has been studied from different perspectives in innovation, technology management and entrepreneurship research. From the engineering design perspective, platforms are studied as a technological design based on a modular architecture, promoting modular product innovations (Gawer, 2014; Gawer & Cusumano, 2014). Building on modular architectural features platforms facilitate the participation of various different actors and allow them to bring in their knowledge and capabilities in the production and reproduction of certain products/services (Nambisan et al., 2018). Affordances of platforms that rely on modular technological

Figure 1.



architecture have an essential role in developing innovations characterized by generativity, i.e., unprompted change driven by a diverse set of actors (Yoo et al., 2012). Modularity is instrumental in eliminating the complexity of a system.

Furthermore, due to modularity, the amount of knowledge and information required to carry a specific task is confined to narrowly defined job requirements. In other words, modularity allows the division of work and specialization, promoting a situation where each module has an innovation capacity. On a broader scale, each module's innovative capacity can be recombined with the capacities of other modules. The modular design features allow platforms to create value by achieving economies of scope in supply and innovation (Gawer, 2014), where innovation costs decrease due to co-innovation.

Another feature of platforms is explained as "network effects" (Gawer, 2014; Srnicek, 2017). Since platforms as intermediaries facilitate the interaction of distributed users and silo the data collected from these diverse groups, increasing their user base is important in value creation. The value creation of a platform depends on its ability to increase its user base. Thus, by implementing efficient pricing strategies and cross-subsidization, owners try to expand their user base (Srnicek, 2017). Furthermore, by drafting and implementing various governance mechanisms (rules, incentives, rewards), platform owners encourage users and complementors to join the network with their unique resources and capabilities. The competitive advantage mainly relies on its degree of "openness" in attracting divergent actors by its architectural interface specifications. Openness can be explained as the accessibility and usability of information, data available in a platform's interface to external actors (Langlois & Robertson, 1992). The degree of openness is shaped by the technological features and organizational capabilities of a platform. The openness of a platform influences innovations positively by bringing in a wide range of divergent skills and capabilities and distributed knowledge sources (Chesbrough, 2003).

Platforms as digital technologies are also characterized by generativity-a capacity to produce "unprompted change by large, varied, unrelated, unaccredited and uncoordinated audiences" (Zittrain 2006, p. 1980). Because of their reprogrammable nature, digital technologies, enable distributed users to work on, improve, and modify products and artefacts. Thus, artefacts and products always remain unfinished and are open to constant revisioning, which can fork into different directions as by-products. This implies that digital technologies are dynamic, i.e., they are open to change and prompt change in the functioning of an organization (Yoo et al., 2012).

A generative technology encompasses features such as, leveraging, adaptability, ease of use and accessibility (Zittrain, 2006). Generative digital technologies have a capacity to facilitate activities that would not be performed in their absence. As the number of activities performed by a digital technology increases so does is generative capacity. For example, the same digital technology can be used for education, entertainment and communication between the members of a firm. A generative digital technology is adaptable, i.e., it can be used for other purposes other than its original intent. Easy use of a generative technology enables the participation of a wide group of actors with various skills and competencies in its usage. Finally, accessibility of a technology influences its generativity. The availability and affordability of a technology is important in attracting various constituencies involved in its production and consumption. For example, in some countries or regions, internet services are not available or even if these services are provided, they are expensive. In such cases, the usage of internet is limited to a specific group and their skills. Based on these features Zittrain (2006) argues that generativity is the source of innovation. Generativity allows large and varied actors (individuals, groups and organizations) to collaborate and co-create innovative products/services/content. Generative technologies enable the participation of dispersed audiences in the innovation process which leads to openness of innovations. In such an ecosystem not only professionals but also amateurs, hobbyists and enthusiasts, who possess talent but are not accredited, can participate to the co-creation process. According to Surowiecki (2004) the knowledge collectively created rather than a single expert can provide a richer set of ideas in solving a specific problem. Dispersed users and producers can contribute to the innovation process by bringing in their private information, know-how which is shaped independently.

Although generativity of digital technologies promoted an environment for the proliferation of innovations, their pervasive usage led to the development of certain initiatives by consumers, governments and firms. Issues related to security and stability of the technology, regulation and taxation concerns of governments, attitude of firms towards appropriation of their R&D outcomes, limit the adoption and utilization of digital technologies in open innovation. Furthermore, firms employing open innovation model have to develop strategies and practices to manage their boundaries for involving dispersed audiences in the innovation process and protecting their intellectual property. Thus, the generativity of digital technologies leads to a fundamental transformation in governance models, which deems the development of new types of contracts, control mechanisms and new organization structures that by-pass the domination of a single unit in the decision-making process.

Digital Technology Affordances

Digital technologies and digitization facilitate open innovation and change the innovation landscape in terms of participants, governance mechanisms, resources provided by different participants and outcomes (Nambisan et al., 2019). Majchrzak & Markus (2013) define technology affordance as "an action potential that is, to what an individual or organization with a particular purpose can do with a technology or information system" (p. 833). Similarly, the authors define technology constraint as various ways technology can repress an agent in pursuing and reaching a specific goal. Neither affordances nor constrains are the properties of technologies and actors but they can be explained in terms of the relations between actors and technology.

One of the major characteristics of digital technologies is the inclusion of digital capabilities in physical objects. Digital technologies that have properties like programmable functionality and data homogenization (Yoo et al., 2012) influence the innovation process for new products/services, business models and organizational forms. Digital technology affordances enable distributed users to share their experiences and contribute to the development of shared products. Similarly, by incorporating digital materiality into physical objects, digital technologies enable creating "smart" objects, leading to many other affordances (Yoo et al., 2012). Furthermore, the production and consumption of these "smart" objects also reshape the industry structures; currently, we see more networked industries where multiple organizations interact. The success/failure of one of them drastically influences the rest of the players in the industry. In networked industries, competition is not between firms but between networks of firms.

Digital technology affordances influence and reshape the innovation process. It is claimed that by allowing distributed actors from different geographies with different knowledge resources to participate in the innovation process, digital technologies democratized the innovation process (von Hippel 2006). Actors (individuals, firms) freely sharing their knowledge and innovations create intellectual commons which can develop new products, services and novel solutions for overcoming social problems (von Hippel, 2006). As is the case with open innovation, innovation is no more an activity limited to big companies' initiatives located at the center of economic activity. Open innovation models based on digital technology affordances are becoming more inclusive and open to heterogeneous knowledge resources.

INSTITUTIONAL INFRASTRUCTURES AND AFFORDANCES

Institutional Infrastructures

Generativity and modularity of the digital technological infrastructures requires a set of institutional infrastructures to promote the utilization of open innovation model. These infrastructures should enable the usage of digital technologies and secure the ownership rights of various participants. Furthermore, the availability, affordability and efficiency of institutional affordances is influential in determining the degree of openness of the innovations both at outside-in and inside-out processes.

Outside-in or inbound innovation processes is based on the premise that knowledge flows from clients, suppliers, customers, users and rivals can enrich the knowledge base of a firm and can influence positively its innovation capacity (Enkel et al., 2009). It is expected that firms operating in environments that are characterized as rich in terms of external sources of knowledge and information will develop a more open innovation strategy. Thus, degree of openness of innovation strategies depends on the availability of vigorous environment conducive to innovations. Inclusion of external sources to the innovation process by a firm can be secured with sourcing and acquisition (Dahlander & Gann, 2010). The major difference between these two ways of opening up is the underlying pecuniary and non-pecuniary motives. However, in both cases it is important that the firm has developed an absorptive capacity to leverage its existing capabilities with those of the external environment.

On the outside-in or the inbound knowledge flows, macro level institutional infrastructures that are shaped by governmental (regional and national) policies are instrumental in enabling participation and enhancing innovation capacity of firms. These policies also promote a vigorous knowledge production ecosystem. Institutional infrastructures enabling participation of distributed actors is important in improving the scale and scope of open innovation practices. Investment strategies of governments to information communication technologies (ICT) can improve conditions for access and connectivity. Provision of subsidies by governments for R&D in ICTs and availability of venture capital funds for start-ups promote an ecosystem that enables the development of digital technologies. Availability of an efficient venture funding system will enable the proliferation of knowledge-intensive firms with business ideas based on new technologies, i.e., new technology-based start-ups. If uncertainty about funding can be reduced by policies drafted by governments these start-ups can have a pivotal role in the open innovation process. Finally, institutional infrastructures that promote production and sharing of basic and applied scientific research have a positive impact on open innovation. Governments can develop policies to enforce and develop systems that facilitate to share the outcomes and data bases of projects funded. This will enable free access to scientific knowledge that can be used for furthering new research. Such policies can also be instrumental in promoting co-production of novel products/services between universities, research institutes and firms.

Availability of these institutional infrastructures enables firms to have access to the knowledge, creativity and capabilities of diverse set of constituencies (users, clients, suppliers, rivals) and thus, improve their knowledge base. In other words, the availability of these institutional infrastructures will influence the degree of openness in the innovation process. Firms located in regions and nations characterized by insufficient and inefficient institutional infrastructures are likely to be less *open* in the outside-in processes and will have less means to enrich their knowledge base.

On the outbound knowledge flows, firms externalize innovation, offer ideas they have developed to constituencies outside their boundaries and sell intellectual property. In so doing they shift exploitation of the innovations outside the boundaries of the firm. Openness of outbound innovation can be in two major ways: revealing and selling (Dahlander & Gann, 2010). In *revealing* firms reveal internal knowledge sources without expecting an immediate financial gain. The gain expected from such an approach is rather non-pecuniary. Firms either voluntarily or unintentionally open their innovations in new technologies so that they can attract the cooperation of others. In selling type of openness, the expectation is pecuniary returns and firms develop mechanisms to sell or license-out their innovations. However, firms involved in selling their innovations and technologies have to deal with the disclosure paradox (Dahlander & Gann, 2010), i.e., the licensor have to reveal some information to the licensor prior to sales. Such a situation can lead to asymmetric power relations between the licensor and the licensee. It is highly possible that due to market failures and high transaction costs selling or licensing innovations can be less efficient. In such cases formal appropriation mechanisms like patents, copyrights can be helpful in overcoming problems related to disclosure. Institutional infrastructures related to taxation, contract arrangements and intellectual property rights will have a pivotal role in shaping the inside-out processes. Besides laws drafted to balance the rights of parties involved the efficiency of law of enforcement will be influential in promoting openness. The quality of legal system in a specific region or nation is an important factor determining how a firm will be able to open up its knowledge transfer process to other parties. Legal arrangements designed to secure the rights of licensors and licensees in contracts and the way this legislation is enforced will have a positive effect on the openness of the innovation process. Appropriation regimes designed for the development and implementation of formal protection mechanisms (patents, utility models, copyrights, industrial designs and trademarks) are important in promoting an open innovation ecosystem. Furthermore, the process of getting a patent (costs for application, time for inspection) and costs related to litigation are also influential in motivating firms to open their inside-out process. It is expected that firms operating in strong intellectual property regimes will implement more open in their outbound knowledge transfers.

Since open innovation goes beyond the boundaries of a single organization, institutional infrastructures that govern and regulate the relations between different actors are to be developed. Institutional infrastructures such as governance mechanisms can influence the decisions of different actors to cooperate and be part of the open innovation system. For example, in the case of platforms, rules of participation, value appropriation, value distribution, transparency and platform architecture are instrumental in defining the leadership positions, roles of the participants, authority structures and coordination mechanisms (Hinings et al., 2018). Different types of technology platforms have different governance patterns (Gawer, 2014) depending on their degree of interface openness. As the openness of a platform increases, there will be more opportunities for dispersed actors to be part of the platform ecosystem, which will lead to the accumulation of complementary innovative capabilities. However, this group of autonomous innovative actors' coordination deems the development of novel institutional infrastructures (Gawer & Cusumano, 2008; Gawer, 2014). Value capture in open innovation depends on how firms manage their interdependency with external actors and coordinate transactions with their partners (Zobel & Hagedoorn, 2020). For example, in inbound open innovation firms develop and utilize incentive mechanisms like contests (Felin & Zenger, 2014) and similarly, in outbound open innovation, novel intellectual property practices such as compartmentalizing and disassembling are utilized.

Institutional Affordances

Institutional affordances refer to the possibilities of action that actors perceive in institutional infrastructures in line with their goals. Affordances are not the property of the infrastructure and the actor involved; instead, they are the relation's properties. Thus, actors construct affordances that merge their goals and available institutional infrastructures, and in turn, these affordances activate the development of institutional arrangements. Actors' actions in response to the existing institutional infrastructures can be either compliance or exploitation. In case of compliance, the existing institutional infrastructure is produced and reproduced with the involved actors' recursive actions. However, actors can also see the institutional infrastructure as an opportunity and strategically can exploit them, leading to the enactment of institutional affordances. Studying five innovation trajectories in two companies, van Djik et al. (2011) explain how micro-institutional affordances provide potential resources and enable strategic responses to overcome problems associated with radical innovations. The study identifies three affordances, multiplicity, heterogeneity and ambiguity, that afford/constrain strategic responses for shaping innovations.

Research employing the relation between digital technologies and affordances perspective also focuses on the role of institutions, institutional logics on the technological affordances at various levels of analysis. Faik et al. (2020) develop a framework for explaining the mutual relationship between digital technology and institutional logics. The study takes technology affordances as a bridge between institutional logics and digital technology. The study suggests that technology affordances are enacted by the use of technology and activate institutional logics. Furthermore, widespread usage of technology affordances can lead to societal change as they change institutional logic's prevailing arrangements. Following this line of explanation, Oborn et al. (2021) study, by focusing on telemedicine, explain how different institutional logics direct newly emerging practices in times of crises. Zeng & Yu (2014) study, at a societal level, shows how actors exploit technological affordances in a specific institutional context in the formation of institutional innovation. At the organizational level, the Zammuto et al. (2007) study explains the emergence of new organizational forms in relation to affordances that are the outcomes of technology, organization and management intent.

CONCLUSION

This Chapter aimed to develop an integrative framework for explaining the role of technological and institutional affordances on open innovation practices adopted by firms. The primary objective of this framework is to integrate the enabling and constraining capacities of both technological and institutional affordances in promoting an open innovation model. Extant research employing affordance perspective focused on either technological affordances or the institutional. However, given the conception that affordances are relational, they activate and enact the technology and the institutions, an integrative framework can provide a holistic approach in explaining how inbound and outbound open innovation practices of firms can be shaped.

The degree of openness of the innovation process is dependent on the availability of digital technologies and institutional infrastructures. Digital technologies due to their structural features like modularity and generativity enable companies to incorporate a wider audience (customers, suppliers, distributors as well as those that are not directly related to the firm) to their outside-in and inside-out innovation processes. This inclusion is beneficial for firms in enriching their knowledge base on the inbound knowledge flows and increase their market coverage, revenues at the outbound know-how flows. However, availability of digital technologies in a given region or nation depends on the availability of institutional infrastructures that enable their access and utilization. It is expected that institutional infrastructures like public investments in ICT industry, venture capital opportunities, a vigorous scientific research milieu, will enable a firm to benefit from inbound knowledge flows. Similarly, institutional infrastructures that accommodate legal arrangements (laws and their enforcement) that safeguard appropriation and commercialization of the innovations, will enable firms to extend their boundaries to outbound knowledge flows. Thus, the degree of openness of the innovation model adopted by a firm is dependent on both digital technology infrastructures and institutional infrastructures in which the firm is embedded. Furthermore, how these infrastructures are perceived and instrumentalized by a specific firm i.e., digital technology affordances and institutional affordances, also shape the scale and scope of its open innovation practices.

Such a framework can also provide insights to practitioners in evaluating prevailing institutional infrastructures and technological means as a constraint or an opportunity. More specifically, the Chapter highlighted how open innovation practices (like degree of openness) of firms can be influenced by digital technology and institutional affordances and what type of managerial practices (contracts, hybrid governance mechanisms, boundary management techniques) can be developed to create value in inbound open innovation and value capturing in outbound open innovation. The managerial practices implied is not an inclusive list, but the goal is to show the interconnected nature of these two affordances.

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Chapter 10
Indian Digital Transformational Initiatives in the Higher Education System:
An Analytical Study

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ABSTRACT

Globally, the developmental process primarily originates from creative and innovative thinking of an individual. Undoubtedly, higher education promotes the academic quality and research in a country. In order to disseminate knowledge to the aspirants in educational and research institutions, the information and technology has been put to use widely across the world. The digital transformation gained importance in the field of education to accelerate the wheels of world economy. During its period of transition, there are multifarious managerial issues. They ought to be tackled prudently by the government or policymakers. Otherwise, digital transformation in higher education can never be considered as a boom but bane. Hence, it necessitates an efficient management for yielding better fruits. The current study has been undertaken to examine the Indian digital initiatives in the higher education system, identify the crucial managerial issues, and suggest remedies for improvement of the Indian higher education system via digital transformation.

INTRODUCTION

Globally, developmental process primarily originates from creative and innovative thinking of an individual. Undoubtedly, Higher Education promotes the academic quality and research in a country. In order to disseminate knowledge to the aspirants in educational and research institutions, the Information and Technology has been put at use widely across the world. The digital transformation gained importance in the field of education to accelerate the wheels of world economy. During its period of transition, there

DOI: 10.4018/978-1-7998-2402-2.ch010

are multifarious managerial issues. There have been a lot of initiatives undertaken by the Government of India for improving the quality of higher education and research. The effectiveness of such initiatives ought to be evaluated and the burning issues to be tackled prudently by the government or policymakers. Otherwise, digital transformation in higher education can never be considered as a boom but bane. Hence, it necessitates an efficient management for yielding better fruits.

Thus, education becomes very important for growth and development of any country. It shapes the personality of an individual. Eventually, the collective and productive efforts of individuals enable a country to compete with other counterparts socially and economically in the long run. As per the key results of the AISHE Report 2015-16, the Higher Educational Institutions are categorised into three levels viz; Universities, Colleges and Stand-Alone institutions. The Gross Enrolment Ratio (GER) in Higher Education is 24.5 per cent amongst 18-23 age group. Digital tools have started gaining acceptance but yet to pick up in Colleges and Universities. Yet, the digital technology started changing the way of learning amongst the students.

Such digital Transformation is an integration of digital technology into all areas of a business, fundamentally changing how it operates and delivers value to customers. It is, therefore, imperative for all business enterprises, irrespective of its size.

According to a survey by Tech Pro in the year 2018, only 22 per cent of respondents expressed that their companies have a comprehensive digital strategy in place. As reported, 49 per cent of them responded that they were working on it. More interestingly, 21 per cent said that their business enterprises had no such strategy.

Digitalization can optimize legacy and emerging functions. Such transition process may require an overhaul of every aspect of an enterprise. However, it was a complex task and challenge before the corporate leaders to develop and implement the shift. Hence, before launching a project, they need to consider a lot of factors such as integrating legacy and digital assets, overcoming digital change hesitation, managing the shifting risk landscape and keeping pace with innovation.

Such transformation process involves several steps viz., clarification of culture, assessment of the project, programme or process and cross-corporate collaboration. Thus, it becomes a continuous process which will never end in the course of preparation of an enterprise for its subsequent periods.

Thus, globally, developmental process primarily originates from creative thinking of an individual. Education plays a vital role in shaping the personality of a child. Thus, the quality of education for an individual becomes very essential. Simultaneously, its easy accessibility by all the aspirants should also be ensured by the Government, especially in Higher Education. According to a Legatum Prosperity Index, India ranks 92 in education among the 145 countries. In 2015, the index reveals that it ranks 99 among 142 countries in terms of its economic development, entrepreneurship development, education, health, safety, security etc. As compared with other developing countries like USA, Malyasia, Philippines etc., India is lacking behind which draws the attention of the policy makers and government. The managerial functions of successful planning and implementation ought to be performed by the Government efficiently. In this context, in order to compete with other counterparts, India has been taking initiatives to provide an integrated digital platform to its citizens. Indirectly, it will also lubricate the wheels of Indian economy in the long run.

Keeping in view, the current study has been undertaken to examine the Indian digital initiatives in Higher Education System, identify the crucial managerial issues, and suggest remedies for improvement of the Indian Higher Education System via Digital Transformation.

STATEMENT OF THE PROBLEM

Undoubtedly, in the face of acute competition to boost the socio-economic growth across the world, the quality of education is very essential. The development of any nation originates from the quality of creative and innovative thinking of an individual. This leads to innovations on various sectors, irrespective of their nativity. With the Liberalization, Privation and Globalization processes, the trade and commerce started flourishing without any restrictions. Free movement of capital, technology, labour, entrepreneurial competence across the globe ensures economic interdependence amongst the countries. Such a global outlook gains importance with the quality of education and dissemination of knowledge through digital tools. On one hand, quality of education is essential for development. On the other hand, the evaluation and a constant monitoring of digital transformation in any filed become inevitable. During the transitional process, there are several managerial issues one has to face, be it an individual manager or firm or institution. If it is not efficiently managed within an organization, the very purpose of digital initiatives will be defeated in a country. Thus, it is a double-edged sword which ought to be used with utmost care by the users. It is, therefore, obvious that a research study on this front is the need of the hour throughout the world. Proper planning and implementation of the digital technologies and initiatives will certainly yield good results. If not so, post-implementation of digitalization will create confusion and chaos on the part of the management. Needless to say that effective management of digital transformation in modern global corporations or organization will result in faster and balanced socio-economic growth. The Indian Higher Education system is not an exception on this front. Many agencies of higher education in India have been initiating this digitalization process such as the University Grants Commission (UGC), the Ministry of Human Resource Development (MHRD) etc. As a matter of act, the quality of goods and services in all sectors relies heavily on the quality of human resources. In turn, the quality of human resources in terms of knowledge and skills/efficiency depends on the quality of education and research to which the manpower is exposed to.

Many research studies have been undertaken on the digital initiatives in higher education worldwide. Learning needs interaction and group activities besides teaching-learning process The study of Hein 1991 examined the interaction theory evolved all types of exchanges amongst the learners. (Roblyer & Wiencke, 2003) invested into an integrated educational technology into teaching. Technology delivery on ICT made it possible for the students to collaborate in real time and construct knowledge, according to (Proserpio & Gioia, 2007). (Chaudhary P & Sharma K.K 2019), in their conference paper on the topic entitled, ‘Implementation of digital strategy in Higher Educational Institutions in India,’ pointed out that lack of implementation was a major challenge to the technology-driven Higher Education in India.

In this context, the quality of higher education and the role of digitalization process thereon are felt necessary. Keeping in view, the current study has been undertaken to present the initiatives launched in Indian higher education system and its crucial operational issues extensively.

OBJECTIVES OF THE STUDY

The primary objectives of the study are:

- To present and examine the digital initiatives in Indian Higher Education System

- To analyze its Strengths,Weaknesses. Opportunities and Threats associated with the digital initiatives.
- To provide suggestions for improvement of the quality of higher education for achieving the broader goals of education and economy as well.

RESEARCH METHODOLOY

The current study is based purely on secondary data. The data has been collected from the secondary sources such as internet, newspapers, magazines, research articles, etc. Then, the collected data has been analysed by using SWOT analysis for interpretation.

COMPUTERIZATION AND DIGITALIZATION: A BRIEF THEORITICAL BACKDROP

Pre-Digitalization Phase: Computer Science Education in India

- **First Computers in India**

The earliest electronic digital computers in the globe were special purpose computers developed in England during the Second World War particularly for the purpose of code breaking. The first electronic digital computer in the world was the ENIAC developed at the Moore School of Engineering in Philadelphia, Pa. This became operational in 1945-46. Simultaneously, a number of research centres mounted efforts to make their own computers. The next decade saw the development of a dozen or so designs. Also the main drawback of the ENIAC, the lack of any sizeable memory, was overcome with the effective development of the Mercury Delay the Magnetic Drum Memories. At the large expensive end, were machines like EDSAC (Cambridge, UK), the whirlwind (MIT), the ACR (NPL, Teddington, UK), the LEO (London, UK), the Whirlwind (MIT), the ACR (NPL, Teddington, UK), the LEO (London, UK), and a number of others. At the low end was a virtually lone effort by AD booth at the Birkbeck College in London. The machine developed there in 1954 was licensed to the then British Tabulating Machine Company Limited (BTM), later absorbed in International Computers Limited (ICL), the makers of the Hollerith brand of unit record machines, for commercial exploitation.

One of the first customers and certainly the first from India was the Indian Statistical Institute, Calcutta (ISI). The team at the helm of ISI realized early the tremendous potential of the fast, massive computational capabilities that would open up in the electronic era. As early as 1953, the ISI had mounted its own modest research efforts in this direction. But, the technology overseas moved faster and ISI went in for a purchase as well.

As far as the computer science education is concerned, the Indian Institute of Technology (IIT) has started a postgraduate programme in Computer Science leading to M.Tech and Ph.D. The stress in the graduate programme will be on computer design and software engineering. It is often thought, rather wrongly, that computer science is meant only for students of Electrical Engineering and Mathematics. In fact, computer science is open to students of all branches of Engineering and Service. It is envisaged that a computer scientist with basic training in a discipline will interface between the discipline and computer science for the benefit of both fields. Over the years, the influence of computers on our life pattern has increased and it is inevitable that computer education will become a part of general education even at the school level. IIT is interested in participating in a pilot project to introduce computers at the school level (Utpal K.B.).

Digitalization Phase

In olden days, universities taught various computer science courses and industry cried for 'systems analysts', software developers', etc. Now, industry calls for specialists in graphics user interfaces, client/server systems, object-orientation, systems integration, software quality, etc. and again the university responds with the user computer science programs with some of these topics inserted in tiny slots to assure the world that they were not omitted. The fact is that the university regards these trends, which are the facts of life, as lacking in intellectual content which could be justifiable due to a market drift from knowledge-intensive system to skill-intensive ones. The power and flexibilities of Windows do not lend themselves to academic treatment, but are fully understood only through rigid training and experience.

Post-Digitalization Phase

The digitalization and its constant transition necessitate the creation of awareness amongst the prospective users. Appropriate training and development for the personnel are necessary in order to provide necessary skills and knowledge in their respective assigned tasks. In the present context, from the bird's eye view, the digital transformation in the field of education alone is insufficient. Consequent upon the launching of digitalization, opportunities for extending educational avenues to the aspirants and imparting training programmes go on mounting up year after year in every nook and corner of the country. Both the educational institutions and the quantum of educated youth in terms of number have been also showing an inclining trend through digitalization. However, the quality of education through digital transformation needs a continuous assessment for its success.

Intensification of Teaching Process and Use of Computers

The dynamic growth of science, communication and technology leads to several problems in the intensification process of teaching. It necessitates the use of computers and thereby many countries are tying to solve these problems by means of modern computer-aided instruction systems. (CAIs). With the help of computers, students are able to learn any subject by referring online tutorials and materials which improves their knowledge and efficiency aptly. The student can, therefore, have an access to e-books, journals, films and lectures.

A centralized design of standard online tutorials for various levels of education is a crucial problem for the Indian Education system. Appropriate solutions to such problems will certainly cut down the outlays for the use of tutorials while imparting education. A long term programme for computerization of, especially, higher educational system needs considerable materials and resources. It affects the sphere of education and day-to-day activities of human beings. As a result, the integration of teaching and learning process with the digitalization is expected to enhance the quality of learning amongst the students. Similarly, the digital transformation in Higher Education system also substantially improves the quality of research not only in education but also in all the sectors. As an old slogan says, 'the machine makes a man's work easier'. However, a man must not become a captive of automation but continue to be the prime-mover of progress.

DIGITAL INITIATIVES IN INDIAN HIGHER EDUCATION: AT A GLANCE

In order to enhance the quality of, especially in Higher education, there are several initiatives undertaken by the Government of India. A few of significant initiatives have been presented below;

1. SWAYAM

The Government of India has launched an integral platform and portal known as 'Study Webs of Active Learning for Young Aspiring Minds' (SWAYAM). Under the Digital India Initiatives, the Government has also provided another platform, Massive Online Open Courses.

2. SWAYAM PRABHA

Under this initiative, there is a group of 32 DTH channels for telecasting high-quality educational programmes on 24 X 7 basis using GSAT-15 satellite. There will be a new content everyday atleast for 4 hours. It would be repeated 5 more times in a day. In this way, the students will be able to choose their convenient time for learning. These channels are uplinked from BISAG, Gandhinagar. However, the contents are being provided by NPTEL, IITSs, UGC, CEC, IGNOU, NCERT and NIOS. The maintenance of the web portal has been vested with the INFLIBNET.

3. National Academic Depository (NAD)

The NAD was initiated for providing an online storehouse of all 24 X 7 academic awards such as diplomas, certificates, mark-sheets. All the academic institutions and educational institutions have been digitalized. Apart from facilitating the process of easy access to and retrieval of an academic award, it validates and ensures safe storage of the awards. The NAD is classified into two depositories viz.,CDSL Ventures Limited (CVL) and NSDL Data Management Limited (NSML). Further, for smooth and secured operationalization of NAD, it guarantees the necessary hardware, network and software of stipulated quality.

4. National Digital Library of India (NDL, INDIA)

It is an all-digital library which stores information relating to different types of digital contents including books, articles, audios, videos, educational materials and thesis. It extends a single-window search facility to access digital contents currently existing in India under a single umbrella.

5. E-Shodh Sindu (eSS)

It was formed by the MHRD, Government of India, by merging three consortia initiatives namely, UGC-INFONET Digital Library Consortium, NLIST and INDEST-AICTE Consortium to provide access to peer-reviewed journals and a number of bibliographic, factual and citation databases in multifarious disciplines to the research and academic community in India.

6. Virtual Labs

The MHRD has initiated under the aegis of National Mission on Education through Information and Communication Technology (NMEICT). The project is predominantly a consortium activity of around twelve participating institutes. IIT, New Delhi is acting as a coordinating institute. It is a paradigm shift in ICT-based education. Under this project, more than 100 Virtual Labs comprising approximately over 700 web-enabled experiments were designed for remote operation and viewing.

7. e-YANTRA

The IIT, Bombay has initiated this project for spreading education in embedded systems and robotics. It was sponsored by the MHRD through the National Mission on Education through ICT (NMEICT)

8. Talk to a Teacher Program

This project was coordinated by the IIT, Mumbai, funded by the MHRD under the Indian Government's National Mission for Education. Under this project, the Information and Communication Technology (NME-ICT) and various other projects in Virtual Labs, Haptic and Natural Language Processing were used. Notably, Across the nation, A-VIEW has been used at many IITS, NITs and other leading educational institutions.

9. E-Acharya

The National Mission of Education has developed this project through the ICT. Under this project, a portal was developed to host all the e-content projects. In this way, there are more than 70 projects on e-content under NME-ICT developed in various disciplines such as Arts, Sciences, Social Sciences, Engineering etc. A learner can have an access to the desired learning or textual materials through a single interface. In this portal, features of faceted search, 'my space', personalized learning experience with a provision for 'my account', syllabus-based search have been incorporated.

10. E-Kalpa

The Ministry of Human Resources and Development (MHRD) has launched this project, as a part of the National Mission in Education, through Information and Communication Technology. It was meant for creating digital-learning environment for design, known as 'e-Kalpa'.

11. FOSSEE (Free/Libre and Open Source Software in Education)

In India, the FOSSEE was initiated for improving the quality of education in our country. It promotes the use of FLOSS tools which curtails the need for proprietary software in educational institutions for promoting academic and research activities. This project was also launched by the MHRD, as a part of the National Mission on Education through Information and Communication Technology.

12. VIDWAN

It is an important database of profiles of scientists and researchers/faculty members working in academic and other R & D organizations associated with teaching and research in India. Under this database, the information on the subject experts' background, their accomplishments, publications, talents and skills, identity etc. is made available for access. Many committees or taskforces established by the Government of India used to select panels from this database for evaluating and monitoring purposes.

13. Spoken Tutorial

It is a 'Talk to a Teacher Activity of the National Mission on Education through ICT, initiated by the MHRD, Government of India. The tutorial is multi-award winning educational content portal. It assists the learners to have an easy access to the learning materials at any time and in any language of their choice. It has presently being developed by the IIT, Mumbai for the MHRD.

14. BAADAL

The IIT, New Delhi has developed, as NME-ICT Cloud, and maintaining this software for academic purposes. Therefore, it is a cloud orchestration and virtualization management software launched by the MHRD under NMEICT scheme. It helps to utilize the infrastructure optimally and speed up the process of development and deployment of eGov applications for meeting the academic requirements. It has been hosted in NIC data-centre. The prime features of BAADAL include the facilities for suspending, resuming, and specifying the resource requirements of virtual machines. It assists the dynamic resource scheduling and power management. It is an open-source project for setting up private clouds by the Government or Semi-Government institutions for accommodating their infrastructural needs. By doing so, their precious time on managerial issues is being saved.

15. Global Initiative of Academic Networks (GIAN)

This project aims at tapping the talents of scientists and entrepreneurs worldwide for augmenting the academic resources, accelerating the pace of quality reforms and elevating the scientific and technological capacity to the global excellence. For the purpose of garnering the best international experience into the Indian system of education, the interaction of students with faculty members and experts is a must. It is needed for sharing their experiences and expertise with the students which motivates the students to work on the country-related issues.

16. National Institutional Ranking Framework (NIRF)

This project was initiated by the MHRD on 29th September, 2015. It provides the appropriate methodology to rank the educational institutions across the nation. Under this initiative, broad parameters for ranking various educational institutions and universities are identified. It includes teaching and learning resources, research and professional practices, graduation outcomes, outreach and inclusivity and perception.

17. IMPRINT-(IMPACTING RESEARCH INNOVATION AND TECHNOLOGY)

This project was launched by the MHRD to address the major science and engineering challenges in India for attaining inclusive growth and self-reliance. It aimed at developing new engineering education policy and creating a road map to pursue engineering challenges. It provides the overarching vision which guides research into areas that are socially relevant.

18. Sakshat:A One Stio Education Portal

This project was launched on 30th October, 2006 for facilitating the lifelong learning of the students, teachers and aspirants in pursuit of knowledge at free of cost. The task of its content development was assigned to the Content Advisory Committee (CAC) for the respective subjects. The committee comprises the representatives from various educational institutions like Kendriya Vidyalaya Sangathan (KVS), IGNOU (Indira Gandhi National Open University), New Delhi, Navodhaya Vidyalaya Sangathan (NVS), National Institute of Open Schooling (NIOS) and National Council for Educational Research and Training (NCERT) and eminent personalities in the field. Some NGOs have also been providing the contents developed by them for this portal.

The vision of this project is to cater to the learning needs of more than 50 crore people under the National Mission in Education through ICT. It also aims at extending connectivity to all the educational institutions of higher learning globally in the cyber space, to enhance the potential of ICT, to provide right e-contents with high quality knowledge modules. It has also a provision for certifications of competencies of human resources acquired through formal or non-formal means. Under this portal, the database of profile of human resources has also been developed and maintained.

19. Atal Ranking of Institutions on Innovation Achievements (ARIIA)

The MHRD, Government of India has initiated to rank all the major higher educational institutions and universities systematically in India on the indicators relating to 'Innovation and Entrepreneurship'.

The major indicators for consideration are as under;

The assessment of innovation and startup ecosystem in HEIz can be based on various parameters with some weightages allocated as follows;

1. Budget, expenses to support and revenue earned – 20 marks

2.Activities concerning awareness creation for promoting idea generation and innovation – 20 marks
3.Promotion and Support to Entrepreneurship Development – 20 Marks
4.Generation of Intellectual Property (IP), Commercialization and Technology Transfer – 14 Marks
5.Innovative Learning courses and methods – 10 Marks
6.Innovations in governance of institutions

20. Know Your College

This initiative was also considered one of the important milestones in digitalization process of Higher Education System in India.

21. Digilocker

It is a platform for issuing and verifying the documents and certificates digitally. It eliminates the use of physical documents. Anyone can sign up for an account in digi-locker and get a dedicated space for storage which is linked to their Aadhaar (UIDAI) number. The organisations registered with digi-locker can drive electronic copies of documents and certificates viz; Voter ID, driving license, school certificates) to the citizen lockers directly. The account holders can also upload scanned copies of documents in their accounts. Such documents can also be electronically signed by using the eSign facility.

The main components of the DigiLocker system are;

a. Repository: Collection of e-documents which is exposed through standard APIs for secure, real time access.
b. Access Gateway: Securing online mechanism for requesters to access e-documents from various repositories in real-time using URI (Uniform Resource Indicator).
c. DigiLocker Portal: Dedicated cloud based personal storage space, linked to each resident's Aadhaar for storing e-documents, or URIs of e-documents.

22. The National Programme on Technology Enhanced Learning (NPTEL)

The NPTEL was initiated by the Indian Institutes of Technology in Mumbai, Kanpur, Delhi, Chennai, Kharagpur, Roorkee and Guwahati, along with the Indian Institute of Science, Bangaluru in 2003. In addition, five more disciplines were identified viz; civil engineering, electrical engineering, computer science and engineering, mechanical engineering, electronics and communication engineering and around 235 courses in web or video format were developed in this phase.

The primary objective of NPTEL Phase II (2009-14) was to build on the engineering and core science courses launched earlier in NPTEL Phase I. Over and above, 600 web and video courses were also created in all the major branches of engineering, physical sciences at the UG and PG levels and management courses at PG level. Thereafter, a lot of improvements were also implemented like indexing of all video and web courses, keyword search etc.

23. OSCAR (OPEN SOURSE COURSEWARE ANIMATIONS REPOSITORY)

This project provides a repository of web-based interactive animations and simulations, popularly known as learning objects (LOs). These learning objects include topics in science and engineering the UG level and maths and science at the school level. The teachers and students can view, run and download these learning objects.

24. Shodhgangotri

Under this initiative, the research scholars and research supervisors in the Universities have been requested to deposit their electronic version of approved synopses and theses of Ph.D programmes. On one hand, the repository would reveal the trends and directions of research being conducted in Indian

Universities. On the other hand, it would also avoid duplication of research. Later, these synopses have been mapped to full-text theses in 'ShodhGanga'. Once the full-text thesis is submitted for a synopsis, as such, a link would be provided for accessing those full-text theses from ShodhGangotri to 'ShoadhGanga'.

25. Virtual Learning Environment (VLE)

It is an online environment of e-resources which caters to several disciplines taught at UG and PG levels. The environment is an initiative of Institute of Life-Long learning, University of Delhi. The VLE boasts the state of art material that addresses urging requirements of a diverse students body, not only of Delhi University but other Universities as well. The multi-media interactive contents loaded on VLE are categorized discipline-wise, drawing from several successful Moodle models.

The lessons are being developed by the highly qualified faculty members across the Universities and are continually edited and reviewed. The discipline-expert fellows have been vested with the task of editing and reviewing, apart from coordinating the contents. The contents go through multifarious levels of rigorous peer-reviewing and academic vetting to ensure quality and standardization. The VLE contains multimedia repository in the form of audio, video and short films to expose students to new technologies in pedagogy.

26. Text Transcription of Video Content

Since the text of video lectures has been obtained through manual processes, it error-prone. As such, there is no claim to accuracy on the text content provided in this site. Under this initiative, many professors are engaged for correction of their lecture transcripts so that they can become both verbatim transcripts as well as readable text assistance. Especially, it is a help for those who have bandwidth limitations and cannot download full video courses. An audio file is provided as download, along with the transcript of each file. Such transcribed files given as pdf are also being used to provide subtititles to the video and can be used in the future for providing local language translations.

The text will be used to create metadata and search index and the time coding on the video will be used to provide markers on the video for easy search of the video content. These activities are in progress. This project provides the transcription of all videos published by NPTEL.

27. SOS Tools

The Software and Simulation packages are useful tools for analysis of systems and solving problems by the students of Science, Social Science, Engineering and management-related disciplines. These software packages are, however, quite costly which needs annual license fee for their updating and maintenance.

The primary objective of this project is to develop software tools for analysis of systems and computations, create adequate manpower to teach the students to use open source software and to develop simulation tools. The developed software is user-friendly and properly documented. Such packages are tailored to suit the needs of the students and then they are ported on Sakshat for ensuring free accessibility by the teachers, students and institutions.

28. e-PG Pathshala

It is an initiative of the MHRD under its National Mission on Education through ICT (NME-ICT) which is being executed by the UGC. The contents have been developed by the subject experts working in Indian Universities and other R & D institutes across the country. These e-contents include the curriculum-based and high-quality materials of about 70 subjects across various disciplines like social sciences, arts and humanities, linguistics and languages etc.

DIGITAL INITIATIVES ON HIGHER EDUCATION SYSTEM: A SWOT ANALYSIS

Based on the data so collected on the initiatives undertaken by the Government of India for enhancing the quality of Indian higher education, a SWOT analysis has been made as under;

ISSUES AND CHALLENGES TO DIGITAL TRANSFORMATION: A BRIEF ACCOUNT

There are several managerial and operational issues and challenges right from launching of digitalization in the field of education. It will be very effective only provided the users are trained as techno-savvy. Awareness may have to be also created, along with the easy accessibility to the information pertinently. Constant monitoring of the initiatives and their remedial measures in time become very complex issue.

FINDINGS OF THE STUDY

The following are some of the key findings of the study;

There is a lack of monitoring of digitalization process in the field of higher education.

Quality of higher education needs improvement in India.

Managerial issues, especially operational problems, in relation to digital transformation are complex.

Potential man power is the strength but the lack of awareness becomes a major weakness in the country.

Infrastructure for management and implementation of digital process in higher education is comparatively more expensive.

There have been several projects in operation aiming at dissemination of knowledge and education, apart from enhancement of quality of higher education and research

SUGGESTIONS AND RECOMMENDATIONS

Based on the analysis, the following suggestions are put-forth for improvement of the digitalization process in higher education;

Proper monitoring of digitalization process is needed in the field of higher education.

Quality of education may be improved through appropriate educational and digital transformation policies and schemes in India.

Managerial and Operational concerning the digital transformation in higher education need to be addressed more efficiently.

Table 1. Digitalization process in indian higher education: A SWOT analysis

Sl.No.	Initiative	Strength	Weakness	Opportunity	Threats
1.	SWAYAM	Easy access and Exposure to Education, Training and Research	Inadequate awareness amongst the aspirants and infrastructural facilities are the obstacles	Better knowledge and skills enhancement will augment the efficiency of human resources and productivity	Lack the face-to face interaction between the teachers/trainers and taughts.
2.	SWAYAM PRABHA	Convenient Time for Learners, Substantial dissemination of knowledge		Increase in Knowledge and skills of Human resources entails augmentation of productivity in goods and services	Low accessibility to such knowledge in odd hours may lower the productivity as the cost of infrastructure remains constant
3.	NATIONAL ACADEMIC DEPOSITORY (NAD)	Online Store House of all academic awards	Lack of technical knowledge and efficiency may prone to errors in records	Job Aspirants can seize the opportunities without delay whereas the employers may verify the genuineness of the testimonials of their employees digitally and easily	Manipulation of data and concealment of factual information may lead to wrong placements. It may adversely affect the outcome of the human endeavours.
4.	NATIONAL DIGITAL LIBRARY OF INDIA (NDL INDIA)	Store house of educational and research materials. It ensures easy access to the users.	Accessibility depends largely on the availability of technology and knowledge of the aspirants	Promotion of quality in academic and research activities becomes feasible with less time	Very often, the library is misused by the researchers. It results in plagiarism instead of innovation and solutions for problem solving
5.	E-SHOADH SINDHU (eSS)	Easy access to research journals and data bases	Sometimes, it may be very time consuming for definition of a problem for investigation due to its abundance	Review of literature for identifying research gap becomes easier. It justifies the need for a research	Quality of education and research may adversely be affected in the absence of originality and usefulness
6.	VIRTUAL LABS	Designed for remote-operation and viewing	Difficult to ensure coordinated efforts from the participating institutes for attaining the common goal	ICT-based education results in remote-experimentation	Lack of coordination amongst the participating institutes may not yield desired results
7.	e-YANTRA	Aims at spreading education in embedded systems and robotics	Lack of infrastructure and knowledge on technology become a hindrance for growth	Dissemination of an advanced knowledge in education and research will boost the socio-economic development at a faster rate	It involves huge monetary outlay in creating infrastructure and imparting training to the aspirants
8.	TALK TO A TEACHER PROGRAM	Interaction between the teachers and taught makes the teaching-learning process more effective	Lack of coordination and financial constraints may act as obstacles for the interactive sessions	It is a reward to pupils for gaining clarity on the subject matter of learning through personal interactions with the teachers. They are also expected to understand the close nexus between the theory and practice of their areas of learning in reality	Time consuming process. Lack of efficiency and knowledge of a teacher adversely affects the quality of learning amongst the students. In turn, the entire developmental process gets disturbed
9	E-ACHARYA	Provides a platform to the learners for searching and browsing all the hosted contents	Technical flaws and lack of knowledge on digitalization are the setbacks under this initiative	Huge learning materials at affordable costs will promote the quality of education and research	Lack of awareness and training may not entail the anticipated outcome
10	E-KALPA	Creates digital-learning environment for design	Infrastructural hurdles and lack of awareness and training make the process of learning sluggish	Access to more learning materials with less time and costs for the taughts	Creation of infrastructure and imparting knowledge for ensuring conducive digital learning environment can be a herculean task in any developing country like India
11	FOSSEE(Free/ Libre and Open Source Software in Education	Reduces the dependency on proprietary software in educational institutions	Upgradation of existing tools to meet the requirements also involves additional expenditure	Free software and its easy accessibility to open source helps the quality enhancement process in education	Freely accessible software may not yield better results if not updated regularly
12	VIDWAN	Information on profile and panel of experts can be accessed easily	Technological defects and high reliance on the data available online may sometimes affect the outcome	Accessibility to expertise paves a way for improvement in quality of education and research	Manipulation of data on the panel of experts may defeat the objective of its accessibility
13	SPOKEN TUTORIAL	One can learn various free and open source software all by oneself	Lacks the teacher's/ expert's guidance	Anybody can learn from anywhere at any time conveniently. It improves the quality of human resource in terms of their knowledge and skills	The process of self-paced study may not perpetuate for want of experts' advice

continued on following page

Table 1. Continued

Sl.No.	Initiative	Strength	Weakness	Opportunity	Threats
14	BAADAL	Results in optimum utilization of the infrastructure and acceleration of development	Involves huge investment on infrastructure.	Dynamic resource utilization monitoring helps the government to accommodate their infrastructural needs. Eventually, it leads to increase in productivity in terms of goods and services	Optimum utilization of infrastructure needs efficiency of the human resources. Lack of efficiency in use of the infrastructure may not yield desired results
15	GLOBAL INITIATIVE OF ACADEMIC NETWORKS (GIAN)	Aims at tapping the talent pool of scientists and entrepreneurs	Lack of innovation may not sustain development longer	Elevation of India's scientific and technological capacity to global excellence is feasible	Absence of multi-lateral agreements amongst the nations can be the bottlenecks for mobility of entrepreneurs and scientists globally
16	NATIONAL INSTITUTIONAL RANKING FRAMEWORK (NIRF)	Outlines the methodology to rank institutions worldwide	Inappropriate criteria for assessment of the quality of education may deteriorate the educational outcome	Global competition for improving the quality of education will ensure socio-economic development throughout the world	Competition may sometimes turnout to be rivalry which may not generate the anticipated academic output
17	IMPRINT	It has a positive impact on research innovation and technology	It will have negative impact if the science and engineering challenges are not properly addressed to.	Development of new engineering policy will be socially relevant and applicable	Lack of vision on its initiatives may fail without positive outcomes
18	SAKSHAT	Ensures lifelong learning for aspirants at free of cost	Lack of awareness on such initiatives	The advice of Content Advisory Committee (CAC) facilitates the learning process	Lack of coordination amongst the participating institutes becomes a complex issue in developing a database profile of human resources
19	ARIIA	Ranking of major higher educational institutions	There may be inadequate weightages for different parameters.	Regular assessment of innovation and startup ecosystem in HEIs will accelerate the process of education quality enhancement	Any biased evaluation or criteria for assessment may distort the factual position of higher educational system in any nation
20	KNOW YOUR COLLEGE	Helps the aspirants to choose their institutions for their education conveniently	Too many choices may not lead to the best choice	The needs of both the institutions and the students can be met. Thus, the demand and supply of education are matched in terms of its quality.	Misleading advertisements may defeat the real objective of education
21	DIGILOCKER	Ensures issuance and verification of documents digitally	Problems in software may make the execution of the task more complex	Enables the institutions and students for getting quality inputs and quality education respectively	Regular updating the software and implementation of such practices can yield desired outcomes.
22	NPTEL	Developing various courses creates more platforms for dissemination of knowledge and education	Too many choices, without knowing their applications in reality, may not entail sound decisions and choices	Indexing of all video and web courses, along with key words search can be utilized in order to improve the quality of education	Pursuit of many courses may improve the knowledge and skills of students/human resources.
23	OSCAR	Provides a repository of web-based interactive animations and simulations/learning objects	Lack of infrastructure, awareness and knowledge may hinder the accessibility to learning objects	Teachers and students can take the advantage of easy viewing, running and downloading the learning objects. This will help the nation to achieve the broader goals of higher education in India	Expenditure on Infrastructure of creating such platforms is sizeable and huge in nature
24	SHODHGANGOTRI	Deposit of synopses and theses reveals the research gap and provides directions for future researches	Very often, the affects the originality of the research works undertaken worldwide	Access to the availability of research works form the basis for further researches. Ultimately, it leads to improvement in quality of researches in the field of education and research	The quality of researches in the field of education may deteriorate in due course of time. It may lead to plagiarism.
25	VIRTUAL LEARNING ENVIRONMENT	It is an online environment of e-resources for UG and PG level students	Unless the users are techno-savvy, creation of virtual learning environment will be next to impossible	Exposure to new technologies in pedagogy will certainly enhance the quality of education	It involves huge outlay for creation of and accessibility to the e-resources by the human resources
26	TEXT TRANSCRIPTION OF VIDEO CONTENT	Provides transcription of all videos published by the NPTEL	Delays are unavoidable under this initiative. It is error-prone.	Video contents can be used prudently to maximize the advantages to both the service providers and users	It is more expensive and time consuming
27	SOS TOOLS	Useful for analysing the systems and solving the problems of the students	Updating and maintenance are very costly	It is user-friendly and property documented	Many open source software and resources have no proper documentation
28	e-PG PATHSHALA	It is the key component of education system. It is curriculum-based and of high quality	It involves huge capital and revenue expenditure	It facilitates the interactive process between the experts and taughts	Availability and Accessibility of the resources involve more time and money

Source: Secondary Data

The outcome of each and every initiative has to be evaluated based on appropriate criteria for immediate remedial actions.

LIMITATIONS OF THE STUDY AND FUTURE RESEARCH DIRECTIONS

The present study relies only on secondary data. It uses only limited secondary data at micro level on higher education in India. Hence, a comprehensive study with primary data will yield better results. A comparative study may be undertaken by the researchers, taking more than one country, on this front. Managerial or operational issues could not be focused much as it involves only secondary data. Hence, the gap may be filled by further researches worldwide.

CONCLUSION

In India, the quantity in terms of number of educational institutions and the students is increasing. Likewise, the digital initiatives of the government also in the recent past are remarkable in the field of higher education. The managerial issues pertaining to such digitalization process in higher education are increasing at a faster rate every year. Evaluation of every initiative and its effectiveness, based on realistic criteria, have to be made and identified in time. Regular updating of the software, creation of awareness and infrastructure, imparting quality education and training, proper monitoring and technological assistance to the needy institutions and all the participating members of the Indian higher education system will definitely be a boon in the days to come.

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Chapter 11
Digital Transformation Approaches for Aircraft Maintenance Operations

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ABSTRACT

Digital transformation is one of the critical drivers of change in aviation as in many areas. Aviation operations are always aimed to be carried out with a high degree of safety and security standards. Efficient aircraft maintenance management makes a significant contribution to meeting these standards. The digital revolution offers excellent opportunities for safety, reliability, and efficiency advancement for aviation continuing airworthiness. This chapter provides a basic overview of aircraft maintenance processes and highlights some of the maintenance management issues. This chapter addresses some of the industry 4.0 technologies that have been tested for use or currently used in aircraft maintenance operations and discusses the impact of these technologies on current management problems. Consequently, this chapter is expected to present useful information and comments for the aircraft maintenance community, including managers and professionals, and encourage them to think about other possible innovations beneficial to their processes.

DOI: 10.4018/978-1-7998-2402-2.ch011

INTRODUCTION

The 4th industrial revolution is taking place that will allow people and enterprises to interconnect the real world with the digital world and bring a high level of automation to the daily routine. This transformation, called Industry 4.0, includes significant changes for many business areas. Technological concepts underlying this change are mainly digitizing production systems, and it is quite common to hear about smart manufacturing and factory of future terms. While all industrial revolutions have primarily focused on production systems, the last one is affecting many other areas (Ceruti et al., 2019).

This revolution inevitably affects the aviation industry in which safety and efficiency improvements are considered as the key factors of sustainability. Maintenance 4.0 (Industry 4.0 for maintenance) offers excellent opportunities for safety, reliability, and efficiency advancement in aviation continuing airworthiness. A base maintenance repair and overhaul (MRO) organization may adapt Maintenance 4.0 for resource management optimization, while a line maintenance organization may digitize its operations to achieve fleet operational availability goals. Much more progress can be made in subjects such as predictive maintenance, maintenance training, and maintenance error prevention through the correct and effective use of Industry 4.0 technologies. On the other hand, there are some infrastructural obstacles in front of improvement. Technologies for aircraft (sensors and data transmission) and legacy infrastructures are still in development, difficulties of regulatory framework changes, safety and quality compliances, the adaptation of employees, change of working culture, organizational resources, not knowing how to proceed, and economic issues can be listed as examples(Guyon et al., 2019; World Economic Forum, 2017).

Reducing costs and ensuring flight safety are essential issues in aircraft maintenance management, while aircraft maintenance is a highly complicated and challenging process. These two issues have many sub-factors. However, managers now have the opportunity to use a variety of methods to make progress for many different matters thanks to industry 4.0. Some of these innovative technologies are; robots and drones, virtual/augmented reality, additive manufacturing (AM), the internet of things (IoT), artificial intelligence (AI), machine learning (ML), blockchain, cybersecurity, and big data(Guyon et al., 2019; International Civil Aviation Organization, 2019).

Besides the complexity of the aircraft maintenance process, integrating these new technologies into the system is not easy. However, some of them are already in use, and some other initiatives have already been started by industry leaders(Meissner et al., 2019). For example, airlines use IoT technology to download or upload data to aircraft on the ground, and in this way, they are transforming their daily operations to paperless concepts. They integrate the collected data with their enterprise resource planning (ERP) systems (maintenance software) on a real-time basis. Thus digital thread technique is being used for fleet tracking with several parameters. When the data transmission technologies are further developed for either aircraft or infrastructures, air-ground data transmission will be cheaper and readily available, allowing predictive maintenance to be used more effectively.

Furthermore, flexibility and mobility for maintenance teams will be more obtainable. In this way, maintenance processes may be effectively organized to minimize operational interruptions, since a flight delay costs the airline $25,000 - $40,000 in addition to customer dissatisfaction(General Electric, n.d.) . These are only a few examples formed by IoT technology. Industry 4.0 is a great driver of change for aircraft maintenance operations, and exciting innovations may come true.

Performing a safe, reliable, and efficient maintenance operation at minimum cost is one of an aircraft maintenance organization's primary purposes. Meanwhile, a proper balance should be maintained between cost and operational availability without any compromise on safety. Maintenance activities can be performed by airlines' in-house maintenance department or can be outsourced to another maintenance organization which generally called MRO(Younus & Iqbal, 2011). Aerospace Industry spent $76 billion for aircraft maintenance in 2017, and $118 billion is expected by 2027(Ezhilarasu et al., 2019). This market share creates revenue for MRO organizations but means a cost for airlines. Nonetheless, airlines should consider aircraft maintenance as a function of creating value by protecting physical assets and increasing operational availability, rather than regarding the cost to bear(Bierer et al., 2016). Airlines seem to benefit from every opportunity offered by Industry 4.0 to reduce maintenance costs, and therefore, MRO organizations should increase efficiency with digitalization technologies to reduce their costs.

This chapter briefly describes aircraft maintenance philosophy, mentions some significant issues of aircraft maintenance management, and presents some inspiring instances of industry 4.0 technologies used or intended to be used in aircraft maintenance operations to evaluate the impact of digital transformation on traditional aircraft maintenance processes.

Background

The aviation community is going through difficult times because of the uncertainty about the pandemic's negative impact on commercial air transportation. Excluding pandemic uncertainty, according to the pre-pandemic reports prepared by international civil aviation authorities and global aircraft manufacturers, it is expected that the commercial air transport sector will continue to snowball on a worldwide scale in the coming years. Accordingly, the aircraft maintenance sector will inevitably grow. Authorities encourage companies by carrying out studies that will raise awareness about digital transformation. Researchers are also working to measure the feasibility of digital technologies in aircraft maintenance. Including aircraft and parts manufacturers, some companies those are eager to achieve digital transformation and have sufficient resources have begun to integrate digital technologies into their processes. Some are in the research or testing phase. Apart from the difficulty of successfully achieving digital transformation and the uncertainty of whether the expected improvements will eventually be achieved, the aircraft maintenance community has many reasons to use digital technologies in their operations and to become a digital or smart MRO that possesses maintenance activities supported by digital technologies(Roy et al., 2016).

First of all, the aircraft maintenance, repair, and overhaul process, detailed in the next section, has its challenges and specificities. Since it is a process that directly affects flight safety, it is subject to strict procedures and rules, which make its implementation complex and challenging. Digital technologies have been expected to improve the sub-processes and performance indicators of aircraft MRO operations such as maintenance effectiveness, reliability, and control, training, supply chain, quality, inventory management, labor productivity, planning and scheduling, resource management, technical dispatch reliability, and operational availability, error prevention, safety, and risk management, etc.

On the other hand, aircraft and components are valuable assets, and maintenance is gaining more value day by day to protect those assets. In an increasingly globalized world, maintenance organizations have to take advantage of the opportunities offered by industry 4.0 technologies to increase value creation and competitiveness.

In a study published in 2017, it is predicted that beginning from 2022, the supply of aircraft maintenance technicians in the United States and then in the Asian continent will not meet the demand. The supply-demand difference will gradually increase. It is stated that this situation would increase aircraft maintenance costs and adversely affect the operation(Costanza & Prentice, 2017).This finding further increases the importance of the improvement opportunities offered by the digital transformation for aircraft maintenance.

Another future expectation is a remarkable increase of new generation aircrafts existence in global fleets. This change will inevitably create new challenges for maintenance organizations. Performing high technology aircraft maintenance activities will require new technologies, new materials, new tools, new capabilities, and high skilled labor. Digitalization is a strong supporter of MRO adaptation to change (Cooper et al., 2019).

In the 1950s, aircraft accidents were thought to be caused by technical factors, and it was predicted that accidents could be prevented with the advancement of technology. With the advancement of technology, more advanced aircraft started to be used in the 1970s, but accidents were still happening. Later, the effect of human factors on aircraft accidents was determined, and studies were conducted to minimize this effect. In the 1980s, there was a decrease in the aircraft accident rate, but accidents were still happening. After that, organizational factors were evaluated to be a contributor to accidents in addition to technical factors and human factors. Studies on these issues are still ongoing. The aviation community nowadays has another agenda besides the digital transformation; Safety Management System (SMS). The risk management philosophy is required to be used actively in all aviation processes. Organizations that can implement digital transformation and SMS integration in a way that supports each other will be a step ahead.

Hincapié et al.(2011)presented an introduction of augmented reality applications in aeronautical maintenance, show examples of AR, and emphasize the possible benefits. De Crescenzio et al. (2011) developed an AR prototype system to be used for training or supporting aircraft maintenance staff in order to reduce maintenance errors. From a broad perspective, Roy et al. (2016) showed fundamentals of continuous maintenance with current and future challenges, technologies used in continuous maintenance, and future trends. Masoni et al. (2017) proposed an AR solution that enables effective information exchange between experts and operators to support remote maintenance operations. Cusano & Napoletano(2017) demonstrated a visual recognition module designed to be used in smart maintenance activities for aircraft. They proved its feasibility by testing it on real aircraft mechanical parts. Robertson et al. (2018) presented a pilot study that demonstrates the potential of wearable technology and smart tools in reducing maintenance errors. Bengtsson & Lundström (2018) argued the importance of developing essential maintenance and management skills, such as root-cause analysis and simple maintenance tasks, in addition to technological advances for increasing overall maintenance efficiency.

Aleshi (2018) explained the disadvantages of the physical maintenance logbook and proposed a solution to secure aircraft maintenance records in digital storage formed with blockchain technology. Koslosky et al. (2018) demonstrated the aircraft heavy maintenance process of a Brazilian Airline and compared it with the proposed new model enhanced with digital solutions. They concluded that reducing the makespan of the heavy maintenance process is achievable with cyber-physical systems improvements. Eschen et al. (2018) presented a concept for evaluating MR systems' potential that can be used for inspection and maintenance processes in the aviation industry. They focused on the time and effort of the interaction between the virtual tools and humans to measure the MR potential. Liu et al. (2018) described the digital twin technology for predictive aircraft maintenance, specified its system as the combination of modeling and simulation supported by the Internet of things and cloud computing, and emphasized the role of data fusion techniques. According to Fischini et al.(2018), augmented reality is a useful tool for aeronautical maintenance to decrease task completion time and cognitive load. Ceruti et al. (2019) analyzed the advantages of Industry 4.0 technologies which were evaluated as viable tools for aircraft maintenance, specifically additive manufacturing and augmented reality. They presented case studies to support their statements. The study by Baghdasarin(2019) addressed the importance of cybersecurity for aircraft maintenance organizations and examined the role of SMS for cyber risk mitigation.

An approach for measuring a digitalization tool's potential was presented in Meissner et al. (2019). They provided an implementation framework for transforming the scheduled manual tire pressure reading tasks to an automated condition monitoring system-based approach, and they simulated the system to measure the operational impact in terms of maintenance cost reduction. Utzig et al. (2019) presented a concept study that provides the collective benefit of digital twin and mixed reality technologies to increase the traditional maintenance process's efficiency and support remote maintenance collaboration. Esposito et al. (2019) analyzed the application of a digitalization technology that functions as a parts tracking system solution. Their approach was descriptive for digital transformation efforts of aviation MRO processes. Chang et al.(2019) discussed some digitalization technologies, their potential usages, and their impacts on commercial aviation maintenance. Additionally, to emphasize future trends, they demonstrated the efforts of industry players. Liao et al.(2020) reviewed the digital twin and digital thread concepts, performed the airframe digital twin framework feasibility assessment for specific fleet structural life management.

Analyzing the current state, revealing the needs, and determining the goals are essential for a healthy development process(Esposito et al., 2019).Companies that plan to develop their processes by using digital technologies have to make sure that the skills they intend to acquire match the nature of their operation. For example, consider an airline that has invested in predictive maintenance and has gained this capability. If the airline has too tight flight schedule that does not allow the outputs of predictive maintenance to be implemented, then the investment is wasted. To be a better MRO service provider for internal or external customers and to be a competitive global player, the digital transformation process should be purposefully planned and realized. This chapter is also expected to be an informative work on this subject for professionals and academicians.

AIRCRAFT MAINTENANCE, REPAIR AND OVERHAUL

Basics

This section aims to describe aircraft maintenance management in general and address some managerial problems that expect solutions from digital technologies in particular. Aircraft maintenance is defined as any one or combination of overhaul, repair, inspection, replacement, modification, or defect rectification of an aircraft or component (European Aviation Safety Agency, 2009). Aircraft maintenance aims to assure flight safety, reliability, and airworthiness. The aircraft maintenance department is responsible for performing all maintenance tasks under the aircraft manufacturers' requirements, aviation authorities' rules, and companies' procedures. The goal is to keep aircrafts safe, reliable, and airworthy(Kinnison & Siddiqui, 2012).

An airline's operations department's primary purpose can be defined as fully meeting operational requirements for planned flights. In other words, preparations such as flight crew planning, maintenance, ground handling, catering, etc., must be completed under the standards before each flight. In this flow, one of the factors that interrupt the operation the most is technical problems. Thus, the maintenance department's responsibility is high for providing technical dispatch reliability and operational availability of the fleet.

The number of commercial aircraft is expected to be 50,000 by 2035 (19,500 in 2016)(Altran, n.d.). In parallel, the aviation industry is estimated to need 1.3 million maintenance personnel(International Civil Aviation Organization, n.d.). In addition to the market share forecast of the MRO sector, which is highlighted in the introduction, these forecasts are giving a clear message that managing and operating the future aircraft maintenance system will be compelling. It will be advantageous to have a competitive structure by integrating technology innovations into traditional maintenance experiences.

Aircraft maintenance has three primary classes; line maintenance, base maintenance, and component shop maintenance. Line maintenance generally consists of preflight checks, daily and weekly checks, defect rectification, and servicing tasks. All these works are performed within turnaround times and night stops. Base maintenance includes more extensive works, which necessitates a hangar facility, various equipment, and personnel qualifications. Also, these comprehensive checks may last one week to several months. Component shop maintenance consists of performing maintenance works of individual components that are to be rectified or overhauled. Base, line, or shop maintenance activities are split into scheduled and unscheduled activities from the planning point of view. Moreover, scheduled and unscheduled activities have many sub-categories(Hinsch, 2018).All aircraft maintenance operations have to be accomplished per instructions of aircraft and part manufacturers, regulations of international and national aviation authorities, and company procedures. The reality which makes this process complicated is; working to maintain the airworthiness of big flying machines by performing numerous works with too many procedures, regulation, internal and external factors. A solid organizational structure is required to achieve this. Generally, this technical structure is formed by maintenance, engineering, production - planning and control, quality, supply, parts store and tool shop, training, reliability, maintenance control center subdivisions for a medium-size airline. The number of divisions may be more for an MRO or a bigger airline(Hinsch, 2018).

Aircraft is an expensive asset and designed to fly for a certain period. However, environmental impacts, aerodynamic loads, structural loads, incidents, etc., cause gradual wear and tear during operation. Aircraft maintenance aims to compensate for these deteriorations and keeping aircrafts safe and secure as their original state as much as possible(Sahay, 2012).

By way of example, the aircraft maintenance process of a mid-sized airline begins with the engineering department. This department creates the aircraft maintenance program developed according to a guideline document provided by international authorities and aircraft manufacturers. Besides the outputs of this program, additional works such as modifications or airworthiness directives implementations officially request by authorities or manufacturers constitute scheduled maintenance. The production planning department coordinates the preparation of resources such as workforce, equipment, materials, and documentation according to the maintenance's content and assigns the works to the maintenance departments. Supply, tool shop, and store units also make the preparations before maintenance operations with the planning department's directives. Line, base, or components maintenance units perform the assigned works. The maintenance control center (MCC) monitors the compliance of the tasks performed with the principles of airworthiness, coordinates the necessary departments for the inclusion of unscheduled works in the maintenance schedule, and arranges the flight program to provide sufficient ground time for maintenance. The aircraft maintenance department issues a certificate of release to service after the maintenance is completed under all rules and regulations. Some other departments in maintenance flow, including those mentioned here, are briefly introduced in the following sections.

Aircraft Maintenance Management

Aircraft maintenance operations require a highly qualified management team because many different departments must be coordinated and managed. A culture must be created in which many people working in these departments can work in harmony to achieve common goals. Besides general administration duties, there is another essential requirement that aircraft maintenance managers must ensure; airworthiness of aircraft.

Major business models in aircraft maintenance can be classified as airline in-house maintenance organizations or independent maintenance organizations. These organizations can provide services consisting of line maintenance, base maintenance, components maintenance, or any combination of these to internal and external customers. Depending on the business model and capacity, aircraft maintenance management should establish a suitable organizational structure. Duties and responsibilities are assigned to the sub-units created by the establishment of the organizational structure. The person at the highest level of the organization is the vice president of aircraft maintenance and engineering, constantly monitors reports and feedback from sub-units subordinate to him/her, and manages this critical operation with his/her knowledge and experience.

Aircraft maintenance is subject to strict rules and competitive environments that are dynamically developing and changing. Accordingly, the way the works are carried out must also keep up with this change. These changes can be regulatory changes, or innovations to increase the company's efficiency, competitiveness, or quality. In recent years, as in many other industries, managers in the aircraft maintenance industry see digital transformation as an opportunity and try to create value by implementing these innovations into company processes. In parallel with the advancement of technology, the number of companies producing technology is also increasing. Managers who want to realize digital transformation have the opportunity to work with many technology companies if they're going to get support from outside. Technology companies can offer many project proposals for the digital solutions requested by MROs. It is the management's responsibility to find the best option that is efficient and cost-effective that can contribute to the company's maintenance culture and practices. Choosing suitable projects and managing the processes requires time, money, and a qualified workforce.

On the other hand, 67% of the time spent maintaining a narrow-bodied aircraft during its life cycle is for scheduled maintenance. The vast majority of scheduled maintenance tasks are completed without any finding. The industry will evolve the current maintenance concept to a more condition-based manner, and maintenance programs will be supported by digital tools to increase maintenance efficiency. In other words, it may be possible to digitally monitor many maintenance items, which are routinely controlled by physical maintenance procedures, with the information received from aircraft sensors to the extent to which regulations and aircraft technology allow(Weiss, 2018).

It is the most important responsibility to keep aircraft ready and airworthy for its planned flights regarding an airline's aircraft maintenance management. However, unexpected problems that may interrupt the operation, such as aircraft malfunctions, damage from environmental factors, and planned maintenance not being completed on time, are frequently experienced. The costs of resources such as spare parts, labor, facilities, and equipment required for aircraft maintenance are pretty high. Besides, an airplane that doesn't fly is a waste of money. To solve such problems in cases where resources such as spare aircraft or aircraft parts, workforce, facilities, and equipment are insufficient, aircraft maintenance management or sub-unit managers who are assigned responsibility must have high organizational skills such as resource management and decision-making. It is not easy to reduce operational costs by never compromising flight safety, keeping the time and resources allocated for aircraft maintenance at an optimum level, and minimizing operational interruptions(Hinsch, 2018).

Engineering

The engineering department's main task is to prepare the fleet's maintenance program, monitor its efficiency, and improve it. Also, they follow and evaluate various publications such as airworthiness directives, service bulletins, service letters, maintenance tips, modifications, etc., made by aircraft and component manufacturers and aviation authorities. They forward all the works that need to be performed as per the maintenance program, other publications, and instructions to the planning department. They contact aircraft or part manufacturers for advice on structural damages not described in technical documents or repetitive aircraft system failures, etc., if necessary. The engineering department can be divided into different sub-sections such as powerplant, structural, system, and cabin interior. Each sub-unit is in communication and coordination with the other units of the company to solve problems related to their areas(Kinnison & Siddiqui, 2012).

The aircraft and components' counter values, such as flight hour or flight cycle, are tracked by the engineering department, and real-time data transmission is crucial for such assets management. Engineering departments need robust technologies for monitoring the conditions of major components such as engines, landing gears, structural parts, etc.

Production, Planning, and Control

The planning department's duty is scheduling and organizing all routine maintenance activities ordered by engineering. The planning engineer checks all resources such as materials, labor, facilities, tools, and equipment required for planned maintenance and confirms their availability for the right time and right place. Besides, the planning department arranges maintenance slots with the coordination and cooperation of the flight control center. Likewise, the planning department should be in contact with the maintenance control center all the time for unscheduled cases and deferred defects. To optimize resource requirements for subsequent maintenance operations, it is necessary to keep statistical data of resources consumed in maintenance operations. The planning phase of maintenance operations requires extensive expertise and discipline since an overdue maintenance requirement is never desired(Hinsch, 2018).

The planning processes should benefit from digital solutions for better resource management and maintenance scheduling, faster troubleshooting, and reduced downtimes.

Supply

One of the most active phases of aircraft maintenance operations is the supply and logistics of parts and equipment. It is possible to have the necessary parts and equipment ready for scheduled maintenance in advance, but keeping a stock of spare parts for unscheduled cases creates a dilemma. There are thousands of different parts in aircraft, and they are costly. On the other hand, aircraft cannot be operated if necessary parts and equipment are not supplied on time and for the right location. It is not possible to keep all parts in stock. For this reason, it is more reasonable to stock only those parts that cause the most operational disruptions and are most needed. It may be a good solution for other parts to make component pool agreements with different service providers and manufacturers and make supply channels as fast as possible. There are some other duties of the supply department: warranty claims, shipment of repairable parts to/from component shops or vendors, setting stock alerts, tracking part requests and orders, component exchange or loan, etc.

Reducing inventory costs and increasing the ability to take rapid reaction for spare parts needs are two of the major supply management issues. Reducing lead times of part deliveries and having traceable history for supplied major components are also highly desirable. Creating value by in-house part manufacturing will be a revolutionary transform for an MRO.

Store and Tool Shop

Practical management and operation of part stores are essential for aircraft maintenance operations. Material shortages are one of the most common bottlenecks in aircraft maintenance operations. Stock levels are decided by senior management; however, it is the store's responsibility to handle and preserve the parts. In general, the store department's functions include keeping spare parts under suitable conditions, preparing the parts requested by the aircraft maintenance unit on time, sending or retrieving parts to or from external stations, carrying out incoming inspections, receiving, packaging, and tagging for all materials entering or leaving the store. Besides, store staff must monitor consumable materials' expiration dates and periodically count all parts to verify that stock levels are correct. To avoid troubles, especially in the warranty claims of repairable parts and customer-induced damage claims, the repaired parts arriving at the store and the parts sent from the store to repair shops should be inspected in detail.

The tool shop unit is responsible for the storage, maintenance, cleaning, calibration follow-up of many tools and test equipment required for aircraft maintenance, the handover of the tools to the aircraft maintenance personnel, and the receiving of the tools from the aircraft maintenance personnel after work. After the aircraft maintenance operations, removing the used tools from the working environment and delivering them to the tool shop is a maintenance requirement. A proper asset management system is required for a rigorous tool shop operation.

Line Maintenance

As stated earlier, line maintenance operations consist of preflight and post flight checks, daily and weekly checks, defect rectification, servicing tasks, and unscheduled cases. Additionally, line maintenance organizations can perform various scheduled tasks, engineering orders, and modifications that do not require hangar necessities. All these works are completed within turnaround times and night stops. During an aircraft's flight operation, plenty of unscheduled maintenance needs happen, including aircraft system failures, service needs, etc. Line maintenance engineers run against the time to prevent any operational interruption while performing all the maintenance activities per related procedures without compromising safety. For a successful line maintenance operation, engineers should easily access the resources they need, such as documents, materials, equipment, tool, and workforce support. The line maintenance department collaborates with MCC and planning departments to manage fleet technical status and maintenance schedule(Kinnison & Siddiqui, 2012).

To keep flight delays to a minimum, running a line maintenance organization supported by the entire maintenance system is necessary. Additionally, more robust and capable tools should be integrated into conventional maintenance practices, and new inspection technologies should be acquired to improve decision-making processes(Tat & Kushan, 2017).

Base Maintenance

Works done in base maintenance are relatively more comprehensive and detailed than line maintenance. Base maintenance is carried out in the hangar, and many scheduled tasks are performed within the framework of the maintenance program. Corrective actions are taken for findings detected as a result of precise inspections and tests. Sometimes, the excess of these findings may delay the completion of the aircraft's maintenance due to parts and labor requirements. Also, implementing comprehensive modifications and replacing major components such as the landing gear or engine are performed in the hangars. Since the operations within the scope of base maintenance require many different skills, different sub-units such as mechanical, avionics, structural, cabin interior, ndt, painting, etc., are generally constituted. Depending on the organization's size, component shop maintenance units such as engine, landing gear, wheel/brake, electric-electronic, pneumatic, hydraulic, etc., can be integrated into the organization.

Since it is a process that can last from a week to several months, deviation from the maintenance calendar due to the excessive number of findings or insufficient resources may result in unexpected delays at the end of the maintenance. Moreover, such delays may result in extra costs due to the subsequent maintenance slot postponement and possible workforce overtime. For this reason, the MRO organization must have a system that can dynamically follow the maintenance process and present it to its customers transparently. Besides, the ability to be flexible in utilizing resources such as workforce and equipment is one way to avoid bottlenecks for the MRO organization.

Maintenance Control Center

MCC is like the watchtower of a line maintenance system. MCC monitors all operating aircraft and functions as a communication and coordination hub between internal and external units for all technical matters related to the fleet. MCC provides technical assistance by contacting and guiding a contracted MRO for any fleet member aircraft with some unscheduled technical issues at an outstation. MCC department informs other departments about the technical limitations, operational changes, and interruptions caused by maintenance-related matters. Besides, MCC observes and analyzes the fleet technical status and advice the maintenance, engineering, and reliability departments about the persistent and chronic issues. MCC department is the critical unit for sustainable operational availability. The sooner MCC engineers learn about aircraft problems, the better they can manage unexpected events. Depending on the organizational structure and size, the MCC perform many different tasks.

The development of an effective predictive maintenance and aircraft health management system infrastructure is essential for an airline's MCC department. Thus, MCC engineers can contribute to the improvement of technical dispatch reliability and operational availability. On the other hand, remote maintenance guidance, approval, and certification processes have significant potential to create value.

Reliability

The reliability department is responsible for measuring the airline's maintenance program's effectiveness. Reliability management should constitute and develop a reliability program to ensure the maintenance program maintains the aircraft's inherent reliability level. The reliability engineers monitor technical dispatch reliability parameters, failure reports, component removal rates, significant events, "no-fault found (NFF)" rates of repaired components, repetitive defects, etc. If any unacceptable condition is detected, the reliability department takes necessary corrective actions such as asking for advice from the manufacturers or changing the maintenance program. The reliability program not only improves airworthiness but also provides economic optimization by reducing maintenance and operating costs(Hinsch, 2018).

The reliability management activities depend on the clean data. The paperless cockpit and maintenance operation concept has a great potential to provide transparent and real-time data for all reliability parameters.

Quality

A maintenance organization should establish a quality assurance system to ensure that all activities are conducted following the international and national authorities' rules and company procedures. The system functions include auditing of internal operations and external third parties to monitor the compliance with standards. The quality management system is required not only for compliance with the law but also for customer satisfaction and sustainable commercial success.

Digital maintenance record system offered by paperless maintenance concept will prevent aircraft technical logbook typos and frauds, and provide transparent and easily accessible data for quality system. Moreover, the transformation of a paper-based documentation system to a real-time digital version will allow instant and automated auditing for maintenance release certification requirements.

Maintenance Safety Management

The maintenance safety team is responsible for implementing safety and risk management activities with a systematic approach. Risk management has four core activities; hazard identification, risk assessment, risk mitigation, and effectiveness verification of actions taken. To constitute a safety culture, the safety manager encourages the maintenance staff to report unsafe conditions since the purpose is proactively to identify and mitigate the risk. The maintenance safety department investigates safety-related issues such as maintenance errors and incidents and takes preventive measures. All staff should realize the risk-based approach and decision-making process. The aircraft maintenance process is a complex system that includes technological factors, organizational factors, and human factors. The organization's management must be willing to implement risk management activities.

Training

Training is a continuous and integral part of aviation maintenance from the beginning to the end. The licensing and authorization requirements of aircraft maintenance staff include very comprehensive training and evaluation processes. Additionally, there are recurrent training obligations that should be met to refresh some essential subjects. Also, many different training activities can be organized by the company for the acquisition of some new skills or learn new methods. Aviation authorities clearly state requirements for licensing and authorization processes, and these processes are subject to strict supervision. Nowadays, some training activities are offered online, and the scope of online training is expected to increase even more. To improve the quality and effectiveness of classroom, field, or online training activities, it is inevitable that industry 4.0 applications, especially mixed reality, become widespread.

SOLUTIONS AND RECOMMENDATIONS

The information given in the previous section about the aircraft maintenance process is not limited to what has been emphasized. The aircraft maintenance process's components and issues differ depending on the MRO's business model, structure, and capacity. Some scientific research on the solutions that digital transformation can offer for aircraft maintenance operations has been mentioned in the previous sections. In this section, some of the field applications of industry 4.0 technologies are included, and digital solution suggestions are expressed for some problems related to aircraft maintenance processes.

Aircraft maintenance management must be careful in choosing technologies and providers for digital transformation. If possible, it should be guaranteed that the relevant technology will benefit the company's maintenance practices by requesting a free test period. Managers should not waste the resources to obtain data that will not be useful. They should analyze maintenance processes properly, pinpoint the needs, and seek correct solutions.

Management is more likely to approve the fund if the potential benefit is proven to exceed the project cost. In some cases, developing a joint project with the technology firm can reduce costs. The technology firm's IT strength can be combined with the maintenance organization's professional experience and business analysis capability.

Internet of Things and Big Data

IoT is an essential part of the digitizing process that enables the connection between physical assets and the digital world. Providing this connection requires data acquisition, real-time data transmission, and analysis. A digital replica of the physical asset is called digital twin. Some airlines have been using the digital twin method for a while. It is possible to track the data for utilization and performance of assets like an aircraft or a major component.

Furthermore, a predictive maintenance system, also called aircraft health monitoring, requires a solid IoT infrastructure because real-time data transmission is essential. When aircraft's technologies and system infrastructure enable more real-time data transmission, big data will flow to the company database, and analysis will alert potential failures. A turnaround time between two flights sometimes is not enough to solve technical failures. The reaction time of maintenance teams in case of a breakdown is the critical factor for not interrupting the operation. With the availability of effective predictive maintenance thanks to IoT, it will be possible to foresee failures before landing. Since the maintenance operation can be organized in advance, operational interruptions will be reduced(European Commission, 2017). Boeing's Analytx, Airbus' Skywise, and Lufthansa's Aviatar are examples of comprehensive data platforms and airplane health management systems.

For instance, if an airline is experiencing repetitive, unexpected crew oxygen bottle replacement cases which cause flight delays, a predictive maintenance method can be established with the real-time acquisition of the crew oxygen bottle's pressure parameters. The same philosophy is applicable for repetitive works such as fluid replenishment or tire nitrogen servicing tasks.

A robust IoT connectivity will support the paperless aircraft maintenance operations by integrating documentation and reporting systems to the company database via mobile devices. In this way, the flight crew can report defects online, and maintenance engineers may enter necessary reports online. They can also quickly reach maintenance documents via mobile devices instead of hard copies. Considering a base maintenance MRO, connection of all equipment, inventory, staff, and resource management system with an IoT platform will accelerate the service process. Monitoring performance and utilization of all assets and also tracking them will be easier. Moreover, providing accurate work-in-progress information is essential for managing the maintenance schedule and customer relationship(Esposito et al., 2019).

Virtual, Augmented, and Mixed Reality

Augmented reality (AR) is defined as superimposing virtual objects into the real world using a device like a computer, tablet, or glasses, etc. In this way, virtual objects and real ones are geometrically aligned in real-time. The potential benefits of AR for aircraft maintenance are promising. It provides enhanced guidance to maintenance engineers in performing maintenance tasks and contributes to error prevention(Palmarini et al., 2018).

In addition to increasing human performance, AR can be effectively used for remote maintenance support and certification. Low-cost airlines generally make contracts with technical service providers at outstations for circumstances like unscheduled maintenance needs. If the aircraft type is not familiar to contracted service providers' engineers, AR-supported documentation will be beneficial(Masoni et al., 2017; Utzig et al., 2019).

Virtual and augmented reality concepts are expected to be useful for aviation maintenance training. It can accelerate the learning process and improve the quality of training with the opportunity of enhanced simulation(Brown, 2018). On the other hand, it can be efficient to use mixed reality applications in inspection processes that the parts store performs at the part receiving phase. Performing the receiving inspections with a database-platform synchronized with the mixed reality application can easily detect and record the negativities in the parts that came from the repair.

Robots, Drones, and Smart Tools

Inspections are critical tasks for aircraft maintenance, and sometimes it takes long hours to complete depending on the type of work. There are some significant efforts to use robots and drones for inspection tasks. Inspections may include either regular tasks like general visual inspection or unscheduled tasks like lightning strike damage inspections. In case of such an occurrence, all of the fuselage sections should be inspected to identify damages. Drones will be suitable for both base and line maintenance conditions. Moreover, these tools can be designed to keep a structural damage database for a specific aircraft and evaluate whether the damage is new or old.

Airbus' Hangar of the Future (HoF) and Rolls-royce's Intelligent Borescope projects are two inspiring digital revolution instances(International Civil Aviation Organization, 2019; Rolls-royce, n.d.). Civil Aviation Authority of Singapore authorized ST Engineering to carry out general visual inspection tasks on Singapore-registered aircraft with an in-house developed drone solution named DroScan. These steps show that all stakeholders of the industry share digital transformation intentions(Aviation Pros, 2020).

Additionally, Radio Frequency Identification (RFID) technology is a powerful candidate for managing some maintenance works. It is possible to use RFID technology for a simple but time-consuming process such as counting and tracking aircraft emergency equipment. Besides, RFID is a suitable technology for store stock counting and tool-equipment tracking(Sahay, 2012).

Additive Manufacturing

Additive manufacturing, also called 3D printing, is the method for creating parts direct from the digital data with 3D printers. AM allows users to manufacture complex geometrical components without sophisticated tools or substantial investment costs. There is a critical obstacle to using AM in aircraft maintenance: quality assessment and final product certification. After authorities implement regulations and allow AM production for MROs and airlines, on-demand local manufacturing opportunities will make significant lead time improvements and inventory cost reductions, even if for small volumes. Thousands of parts form aircraft, and keeping all of them in inventory is impossible. Therefore, additive manufacturing is a potential supporter of supply chain management.

Aerospace manufacturing companies are already using the additive manufacturing method for manufacturing non-critical aircraft parts for a while. Aerospace manufacturing companies are already using the additive manufacturing method for manufacturing non-critical aircraft parts for a while. While various workshops have been carried out with major players' participation to integrate AM technology into the aviation industry further, AM is an immature concept for end-users such as airlines and MROs(European Aviation Safety Agency, 2019).

Artificial Intelligence and Machine Learning

It is known that airlines are planning to invest in artificial intelligence in the near future(Satair, 2018). Al refers to computer science that tries to simulate human intelligence in machines to make them learn, think, and act like humans. When used together with IoT and big data technologies, it is likely to bring autonomous monitoring and action capabilities to predictive maintenance and maintenance planning processes(Rao, 2017). It is also expected from Al technologies to reduce maintenance errors(Field technologies online, 2019).

With the increasing usage of new technology aircraft, which generate an extreme amount of data and the more widespread use of Industry 4.0 applications such as IoT and digital twin, the need for AI applications to process the resulting large amount of data will increase(European Aviation Safety Agency, 2020).

Blockchain

Blockchain is a data recording system that provides encrypted transaction tracking. It is not a database because the saved data cannot be changed or deleted again. Blockchain may significantly impact aviation's future thanks to its ability to value exchanging without conflict, as International Air Transport Association stated(International Air Transport Association (IATA), 2018).

Some industry leaders have already started to use blockchain technology for tracking valuable assets such as aircraft spare parts(Wight, 2020). Supply chain management is one the most promising process is to be evolved by blockchain technology. Additionally, easily accessible maintenance records of repair parts are beneficial for aircraft maintenance operations, mainly to track NFF components and repetitive failures.

On the other hand, another purposeful use of blockchain technology is keeping aircraft maintenance records digitally(Aleshi, 2018). Paper maintenance logs may be lost or damaged, and they are exposed to improprieties such as cheating on records. Moreover, many mistakes can be made while transferring paper records into ERP maintenance software. Blockchain will provide a more reliable environment for aircraft maintenance records.

FUTURE RESEARCH DIRECTIONS

Thanks to the development of Industry 4.0 technologies and the aircraft maintenance industry's passion for innovation, digital transformation is taking place, and digital applications are being actively used in daily work routines. As an emerging trend, digital transformation is a promising opportunity for aircraft maintenance managers that believe in the power of innovation and seek ways of improvement. Digital transformation approaches are expected to improve aircraft maintenance professionals to cope with the current aircraft maintenance managerial issues like those described in this study. However, managers need to prepare for future drivers of change such as new modes of transportation, new business models, new aircraft designs, newly created or redundant jobs, etc.

Future research about the digital transformation of aircraft maintenance operations is expected to include studies that measure applied digital solutions for specific issues. Such studies can be carried out with the collaborative efforts of academic knowledge and industrial expertise.

CONCLUSION

In this chapter, the purposes of aircraft maintenance and the main reasons for the digital transformation necessity of aircraft maintenance operations are explained in general terms, and a literature review on the digital transformation of aircraft maintenance operations is presented. Moreover, aircraft maintenance management issues are described in detail with the principal aircraft maintenance processes, and potential solutions that industry 4.0 technologies can offer for aircraft maintenance operations and their effects on the improvement of aircraft maintenance processes were discussed.

It is not easy to always ensure flight safety and keep the aircraft ready and airworthy for its planned flights while reducing costs. Managers should ideally analyze the maintenance processes, identify the issues, and prioritize aims.

This chapter is expected to be a helpful study for not only professionals and academicians but also IT entrepreneurs who intend to get deeper insights into aircraft maintenance.

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KEY TERMS AND DEFINITIONS

Aircraft Maintenance Program: A systematic approach standard that should be obeyed by aircraft operators to fulfill the maintenance requirements of an aircraft.

Airworthiness: Competency of aircraft or aircraft parts to perform its intended functions in safe and acceptable conditions.

Industry 4.0: Refers to the 4th industrial revolution, the digital transformation integrates a high level of automation and connectivity to traditional practices of various industries and systems.

MCC: A department that is responsible for communication, coordination, and monitoring of maintenance-related issues of an aircraft line maintenance organization.

MRO: Maintenance, repair, and overhaul organization that services for aircraft and its components.

Operational Availability: A measure of aircraft serviceability for planned flights.

Technical Dispatch Reliability: A performance parameter of an airline's maintenance activities. Expressed as the ratio of the number of delayed flights by technical reasons to the number of revenue flights for the same period.

Chapter 12
Digital Transformation in Port Management:
Smart Ports

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ABSTRACT

Like many other industries, the maritime industry has started to work on digital transformation due to its many benefits. Port management, which is one of the building blocks of the maritime industry, has also accelerated digital transformation efforts under the leadership of developed ports in the world. Today, conventional port managements are faced with many problems. The complex and dynamic nature of the port environment does not allow these problems to be solved by conventional methods. This chapter introduces how the smart port environment that can be achieved through digitalization efforts of ports can find solutions to existing and potential problems.

INTRODUCTION

In the days we live in the information age, digital transformation has become an indispensable target for all institutions. The reason for this is that institutions that fail to achieve digital transformation lose their competitive ability. Because compared to the institutions that have achieved digital transformation, they can do the work in a longer time, they need more employees and a larger office building, so their costs increase and profits decrease. In other words, digital transformation is also one of the most important instruments to ensure efficiency in institutions. Digital transformation brings about a corporate transformation. Digital transformation can be defined as organizational transformation in the digital age, where people's purchasing preferences are shaped by developments in information technologies (Tanniru, Xi, & Sandhu, 2020). With the effective use of digital technology in the institution, the operation of the institution also changes, and the institution undergoes a complete change. It is understood from this that digital transformation is a difficult, time-consuming, and painful process. However, the advantages to

DOI: 10.4018/978-1-7998-2402-2.ch012

be gained when the transformation is achieved ensure the establishment of a sustainable system. With the awareness that organizations that cannot transform will be doomed to disappear, all organizations have started to take steps towards digitalization. With the encouragement of increasing competition in recent years, digital transformation efforts in the port sector have gained momentum.

Ports are complex structures where ships, cargoes and other transport modes meet at some point. At the same time, they integrate different actors and organizations that can be defined from various perspectives (Rajabi, Khodadad Saryazdi, Belfkih, & Duvallet, 2019). It is necessary to organize the works, actors and organizations in this complex structure very well. The operation inside the port can be compared to a mechanical machine consisting of many wheels. Just as the failure of one of these wheels prevents the operation of the machine, a disrupted job in the port prevents the work to be done after it and consequently disrupts the operation of the port. For this reason, all works in the port should be done in a very good planning and coordinated. Good planning increases the efficiency and profit of the port. It is also a necessity for the port operation that all operations in the port are coordinated with each other. For both planning and coordination, real-time data is needed at ports, with no doubt about its accuracy. In recent years, port managements have begun to use digital technologies to meet these needs and at the same time have started their digital transformation. With the COVID-19 epidemic, the need for digitalization has increased and the common use of digital technologies has brought maritime sector stakeholders closer (UNCTAD, 2020). With the use of many digital technologies such as the Internet of Things (IoT), blockchain, and digital twin, digital transformation has accelerated, and the foundations of smart ports have begun to be laid.

IoT technology enables all kinds of objects to be connected to the Internet, storing the information they produce, communicating objects with each other, and giving commands to objects remotely. Digital twin technology, on the other hand, is a technology that allows a device or system to be created in a virtual environment and constantly updated with information from its real twin. The transfer of information from the real twin is usually provided by IoT technology. Fed with up-to-date data, the digital twin reflects the life of the real twin. Thus, the virtual world of the real world is created on the computer. In this way, applications, changes, experiments planned to be made on real twin can be applied over the virtual twin, problems that may occur in the real twin can be detected and intervened in advance. Blockchain technology is a technology that prevents digital data from being damaged. It prevents accidental or intentional stealing, deletion, modification or corruption of digital data. In this technology, digital data is saved to all computers connected to each other in a decentralized structure through an encryption system that is very difficult to decipher. In this way, security concerns, one of the biggest threats of digital transformation, can be prevented. In smart ports that have achieved digital transformation, the uninterrupted and problem-free operation of digital technology depends on taking all measures related to cyber security. Blockchain technology is an assurance in terms of security for smart ports.

Today, many pilot projects are carried out in order to establish a sustainable, competitive and more profitable system, to benefit from digital transformation and ultimately to reach smart ports by finding the most suitable solutions within the complex structure of ports. With these projects, it is tried to find optimal sustainable solutions to the problems experienced in the ports. The research question in this study is, “How can smart port technology provide solutions to the problems faced by port management?” The study examines applications made with digital technology in port management. The aim of the section is to introduce the uses of digital technology in port management and to provide insight into how smart port technology can create opportunities to solve current and potential problems in ports.

BACKGROUND

Digital Transformation

The goal of business organizations is to make more profit. As it is known, costs should be reduced in order to increase profits without increasing available resources. Cost reduction dictates the production of goods and services with fewer resources. When considered specifically in the port sector, performing all services in the port in less time, with less staff, and with less cost will increase the profit of the port. Today, conventional systems are insufficient to make an optimization as mentioned. Especially in complex systems such as ports, such optimization goes beyond the limits of the human brain. For this reason, it becomes inevitable to benefit from digital systems, that is, to realize digital transformation. In addition, the global competition also supports this situation. Transformation is a fundamental change in the organization (Berghaus & Back, 2016), while digital transformation means taking advantage of digital capabilities to maximize business performance (Weill & Woerner, 2018). Information technology, on the other hand, is the technology that involves the development, use, and maintenance of computer hardware and software systems for all kinds of operations on data (Al Amoush & Sandhu, 2020). One of the most important advantages of digital transformation is that it is easy to collect, store, process, and access information. Since it is free from human errors, there is no doubt about the accuracy of the information collected through digital systems. Since the information is stored securely, it is not damaged by events such as corruption, loss, deletion, theft. Information is processed in a very short time and tailored to the need. Thus, it helps managers to make fast and correct decisions. Information can be easily accessed not only from within the enterprise but also remotely. Remote work eliminates the need for large office buildings. As a result, the profitability of the business increases.

When the literature is reviewed, it is seen that there are various studies on digital transformation. Li (2020) argued that digital transformation could provide a much broader business model for creative industries. Tanniru, Xi, and Sandhu (2020) worked on leadership in digital transformation in the healthcare industry and explained that the principles they set could be used as a guide for transformation. Al Amoush and Sandhu (2020) examined the interaction between digital transformation and higher education students' teaching techniques. Heilig et al. (2017) argued that digital transformation can be applied to all processes at ports in his study within the scope of maritime logistics. Fletcher and Griffiths (2020) suggested that businesses constantly improve their digital maturity in order to reduce their losses when world economies are in a difficult situation such as a pandemic. Mergel et al. (2019) made a definition of digital transformation based on expert opinions and determined a conceptual structure for digital transformation in the public sector. Studying a digital transformation strategy, Chanias et al. (2019) argued that the digital transformation strategy is a dynamic process involving repetition between learning and doing. Vial (2019) has attempted to determine the framework of digital transformation inductively. Singh and Hess (2017) determined the job descriptions, skills, competencies, and employment of Chief Digital Officers (CDOs), who manage the digital transformation efforts of companies. Hess et al. (2016) suggested a guide for creating a digital transformation strategy in his study, in which he introduced digital transformation opportunities and risks.

Port Management

Nowadays, the number of vessels of 100 gross tons and over used in world maritime trade is 98,140, the total carrying capacity is 2,061,941 dwt, the weight of the cargo carried is 11 billion tons and the number of containers transported is 811 million TEU in a year (UNCTAD, 2020). This huge cargo is handled in ports of the world. For this reason, ports play an important role in the world economy as the most important actors of international trade. While gigantic cargo is being handled at ports, port management tries to find the most effective solutions to get things done in the shortest time, easiest, and least costly.

Ports are also part of the logistics system. The basis of logistics is the integration and optimization of different processes and functions. The aim is to increase customer satisfaction and reduce costs. Logistics combines transportation with other components such as production, warehousing, inventory management, marketing and procurement. Within the scope of this understanding, ports are considered as logistics and distribution centers where all service and goods movements in the logistics chain are optimized and added value to the goods (Institute of Chartered Shipbrokers [ICS], 2007). Ports are places where both ship and cargo related services are provided. This causes a complex working environment. In this complex structure, a very good planning should be made in order to continue the works efficiently. Accurate and reliable data are needed for good planning. Collecting data manually in ports operating in a conventional structure can cause errors and loss of information. Incorrect and incomplete data can cause managers to make wrong decisions.

Today, the fierce competition between ports located in close geographical regions and serving the same hinterland is increasing. Ports are developing various methods to increase their number of customers. Some ports try to minimize the port fees while others try to shorten the duration of the ships' stay in the port. Of course, while doing this, they try not to compromise on service quality. It is inevitable to use optimization techniques to reduce port dues and turnaround times of ships in the complex harbor environment. To use these techniques effectively, accurate and reliable data are needed. Most of the ports have started to benefit from digitalization, although not all of them at the same rate. The world's leading ports such as Rotterdam benefit from many digital technologies and add new methods to their inventory every day, making progress towards becoming a smart port.

Smart Port Technology

The concept of smart port generally refers to the digital transformation in ports. In recent years, with the development of computer and electronic technology and the increase in internet speed, the usage areas of digital technology in every sector have started to increase. Ports, which are one of the most important building blocks of the maritime industry, have accelerated their efforts to digitize as quickly as any institution. Since the maritime sector is a global sector, a change happening anywhere in the world is beginning to affect the whole world in a very short time. For example, it was inevitable to establish container terminals in ports all over the world as a result of the fact that most of the transportation, which was previously carried out by general cargo transportation, was carried out by container transportation. Autonomous ships, which we will soon be seeing in the seas, will make it necessary to establish smart ports. Smart ports aim to execute port operations in a shorter time, to eliminate time losses caused by planning errors and incoordination, to require fewer port workers, to reduce costs, to use information and resources effectively, to establish a safe and secure system that reduces environmental pollution and energy consumption.

When the literature is reviewed, it is seen that various definitions are made regarding the concept of the smart port. Molavi, Lim, & Race (2020) defines a smart port as a port where better-educated individuals, a skilled workforce, smart infrastructure, and automation are brought together. The authors argue that this union will facilitate the development and sharing of information, optimize port operations, increase port flexibility, and achieve sustainable development and a safe and secure environment. Douaioui, Fri, Mabrouki, & Semma (2018) stated that the concept of smart ports can be achieved by automation of terminal operations and connecting all players involved in port operations with each other through real-time mobile data transfer. Philipp (2020) summarized the developments leading to the smart port in five stages. The initial stage is when there is no automation in the port. The first stage includes individual automation, the second stage includes the integration of the systems of all stakeholders related to the port, and the third stage includes the connection of port and hinterland players in a digital environment. The fourth stage is the stage of reaching the smart port and it foresees that all smart ports will be integrated with each other. Rajabi et al. (2019) define the smart port as a fully automated port where all infrastructures and devices are connected via IoT.

It is seen in the literature that there are studies covering various aspects of smart ports. In their study, Chen, Huang, Xie, Lee, & Hua (2019) argued that green and smart ports are complementary and provided a theoretical basis for governments to formulate green and smart port policies. In addition, it has proposed methods and technical tools for the port industry to take advantage of smart port development technologies. Douaioui et al. (2018) created a model of the smart port concept by defining its main components. Effah, Amankwah-Sarfo, & Boateng (2020) examined the use of smart systems within the scope of port security in Ghana and determined the strengths and weaknesses of the system. Jovic, Kavran, Aksentijevic, & Tijan (2019) examined the current situation of Croatian ports to be converted into smart ports, evaluated that all ports have the capacity to be smart ports and that the introduction of smart technology will contribute to the process as much as possible. In their study on the economic impact of the smart port industry on the Korean economy, Jun, Lee, & Choi (2018) argued that the smart port industry has a particularly large impact on productivity, value-added, and employment. Kamolov and Park (2015) designed an IoT-based smart mooring system that automates the docking process for smart ports where autonomous ships will be aboard. Molavi, Lim, & Race (2020) identified a framework of the smart port concept and Smart Port Index (SPI) that smart ports can use for their sustainability and resiliency. Philipp (2020) explored how to evaluate the digital performance of ports for sustainable development towards a smart port and what strategic proposals can be derived for ports and created a port maturity model. Rajabi et al. (2019) investigated the concept of smart ports within the scope of the latest generation traditional ports powered by technologies such as IoT, proposed an architectural structure for smart ports, and analyzed how Automatic Identification System (AIS) data can be used for smart ports. Rodrigo González, González-Cancelas, Molina Serrano, & Orive (2020) made an analysis of the Spanish Port System within the scope of the smart port concept and determined that the development of a port should be based on digitalization, use of information and communication technologies, and automation of port processes. Tan, Kan, Tan, & Schablinski (2018) proposed a framework based on an energy management system to analyze sustainability initiatives in terminal operations in smart ports. Yau, Peng, Qadir, Low, & Ling (2020) has examined the work done so far on smart ports in order to motivate new research areas in the field of smart ports and revealed the gaps that have not been studied for new researches.

RESEARCH METHODOLOGY

As the research question of the study, "How can smart port technology provide solutions to the problems faced by port management?" has been determined. A qualitative research method was used in the research. In this context, firstly the studies about smart port technology have been examined through literature review and data have been collected. This data has been categorized under the subgroups of port applications. The categorized information has been compared with the problems experienced in the port sector today. Then, smart port technology can provide a solution to what kind of problems in ports in the future, and thus how smart port technology can contribute to digital transformation has been evaluated.

PORT OPERATIONS AND MANAGEMENT

Ports are the junction areas of land and sea where ships are loaded and unloaded. Considering the port operations, the port area is usually divided into three main sections. These can be defined as the sea area of the port, the terminals where the sea and land meet, and the land area of the port. The sea area of the port is an area that includes the navigation aids, tugboats, and pilot services required for ships to safely enter the port and aboard the pier. Terminals, on the other hand, are the areas that contain both the piers that allow the ships to abord and the equipment that enables the loading and unloading of the cargo. Terminals of developed ports are designed according to the cargoes they handle and are rigged with equipment suitable for those loads. These terminals are referred to by the names of the cargo handled such as container terminal, bulk terminal, ro-ro terminal. The land area of the port is the area where the cargoes arriving at the port are temporarily stacked and transferred to other transport modes.

Although the traditional function of ports is the loading and unloading of ships (Kapkaeva, Gurzhiy, Maydanova, & Levina, 2021), many functions have been added to the ports with the development of the ports. Examples of these functions are logistics operations related to cargoes; services provided to meet the needs of ships; transactions regarding the transfer of cargoes sent to and from the port to other modes of transport; and operations related to the organization of other transport modes within the port. With the increase in functions, ports have become logistical and industrial nodes at the center of today's complex and interconnected global supply chains (Notteboom & Haralambides, 2020). The logistics system is a system built on integration and optimization of many processes and functions related to goods. When considered as a part of the whole integrated into the logistics system, ports have to optimize their processes within the port in order to survive in today's competitive environment like other organizations. The world's leading ports such as Rotterdam, Hamburg, and Antwerp are known to be good logistics centers. (ICS, 2007)

The complex working environment in the ports requires good planning and coordination of all activities in the port. Good planning and coordination ensure efficient operation of the port. This can be done with the correct data. If the data used is incomplete or incorrect, the work done will not be correct, and as a result, it leads to inefficiency. Data collection, which was previously done manually, has begun to be carried out with electronic sensors and computer systems with the digitalization of ports. Thus, with the correct planning made with reliable information obtained from the port, it has been possible to operate the ports more efficiently. Efficient operation of ports reduces the duration of ships' stay in the port. When making their port preferences, shipowners take into account the duration of their ships' stay at the port and prefer the ports where they can load or unload in the least amount of time. Because the ships earn money for the shipowner as long as they stay at sea. In addition, shipowners try to minimize the port fees they pay to the port, so they prefer that they pay less than the ports that provide the same quality service. Ports need to be able to reduce their costs in order to reduce the port fees they charge from ships. The ability to reduce costs also requires optimization of port operations. Today, port management has started to use digital technology to optimize all their operations in the port and to base their port management on digital technologies. Thus, smart ports started to emerge.

SMART PORT APPLICATIONS IN PORT MANAGEMENT

Ports are a complex system in which many transport vehicles, port equipment, port workers, and transported cargo move. Complex systems are structures that contain many heterogeneous components which have very tight interconnections, relationships, and dependencies with each other (Selin & Santos, 2018). Port management tries to ensure that all activities in the port are in an optimum relationship with each other by analyzing this complex structure. Thus, they try to reduce costs and increase the amount of work done per unit of time. At the same time, they want to solve the problems that may arise as soon as possible and prevent the system from being disrupted.

In the process of transforming ports into smart ports by ensuring their digital transformation, creating a digital twin of the port will be very useful for resolving this complex structure. In addition, using the digital twin of a port, the past, present, and future activities of the port can be blended and the information obtained will be used in the strategic planning process of the port and the port operations will be optimized (Lind et al., 2020). Port administrations, which started their work to realize the digital transformation of ports, have started to create a digital twin of their ports. The digital twin is a living copy of the port living in a virtual environment. The map of the port containing all the static information is transferred to the digital environment. In order to have a live copy, dynamic information such as meteorological and oceanographic conditions, port and ship traffic should be transferred to this map without delay. This transfer is provided by IoT technology.

Today, the leading ports of the port industry continue to work for smart port transformations. Rotterdam Port aims to create a digital twin of the port by displaying the information received from IoT sensors placed at various points of the port on a digital map with the project that started with IBM, Cisco, Esri and Axians (Port of Rotterdam, 2019a). In this context, in order to create a digital map of the port, it has been started to record images of the port with an autonomous boat called the Floating Lab, which has been rigged cameras (Port of Rotterdam, 2018). Many port administrations, such as the Rotterdam port, have started projects to create the port's digital twin. The Singapore port started to form the digital twin of the port with the Center of Excellence in Modeling and Simulation of Next Generation Ports (C4NGP). Through the project, it will be possible to test the operational efficiency of the port in case of possible interruptions in operations due to natural disasters and extreme weather conditions. (Port Technology, 2018) The Port of Barcelona continues to work on the three-dimensional representation of the port, 5G communication, artificial intelligence, video image analysis, and improving data flow in order to create the digital twin of the port. Thanks to the digital twin to be obtained at the end of the project, the data received from the port will be able to be monitored in real-time. This will enable managers to make more accurate decisions, create a more predictable environment in ship loading/unloading operations, and increase port efficiency, the safety of port employees, transparency for port customers. (Piernext, 2020) The Hamburg port, on the other hand, has digitalized 95 percent of its logistics processes with its automatic data collection and analysis system. These data are displayed on the digital twin of the port. In addition, Hamburg Port can provide intelligent control over all platforms in the port with 5G technology integrated into the digital twin model with the 5G MoNarch project. (Piernext, 2020)

Digital transformation of ports is also necessary for the integration of autonomous ships with ports. Soon, autonomous ships will be used in world seas. The Port of Rotterdam has started preparations to host autonomous ships by 2025 (Loftus, 2019). Autonomous ships can easily navigate with their own sensors without any support on the high sea. Because there are no restricted waters that can impair safety of navigation. When autonomous ships arrive at the port, they will be abord to the port by maneuvering in restricted areas. For ships operating in narrow channels such as the Port of Rotterdam, additional situational awareness information should be provided from the port (Horwitz, 2019). Therefore, the digital information obtained from the port must be able to be transferred to the ship and this information must be compatible to be used in the ship's systems. Because autonomous ships will navigate using this information and will safely aboard the port. This situation necessitates standardization in the digital transformation process of ports and ships. Because autonomous ships must be compatible with all ports they call to. In other words, the standards should be brought to ports in the digitalization process.

At the beginning of the digitalization process, it is not easy to achieve standardization. Because each institution creates and maintains a process according to its needs. When digitalization reaches a certain maturity, studies are being conducted on how the ideal process should be and the processes begin to become like each other. Then, standardization occurs in the processes. It may be beneficial for some organizations to lead and bring together the organizations that continue the work to speed up the standardization processes. For example, it is thought that the intervention of international organizations such as the International Maritime Organization (IMO) may be useful to ensure standardization in the digital transformation process of ports (Horwitz, 2019). Port managers are aware that their future depends on smarter approaches and a very good integration (Greenport, 2016). For example, in the I2PANEMA research project, Fraunhofer CML company evaluates that they can increase their competitiveness by using the standards that will be obtained as a result of the IoT applications developed in Hamburg Port, Gijon Port and Derince Port in European ports (Hellenic Shipping News, 2019).

Conventional systems contain many problems in information processing due to human errors. These problems arise as inaccurate or incomplete collection or storage of information, accidental deletion or alteration of information. In addition, since information cannot be collected and stored as fast as digital systems, delays occur, and this causes the information not to be used up-to-date and not to be able to make correct decisions in decision-making processes. With IoT technology in smart ports, errors during collection of data can be eliminated and sent wherever needed via the internet (Dong, Gang, Li, Guo, & Lv, 2013). In conventional systems, it is not possible to record all the information in the port and therefore there is a lot of information loss. A lot of information is stored in the experienced personnel who make up the corporate memory of the port. With digitalization, all the information produced by the port can be recorded, so the leaving the job of these personnel does not cause any information loss (Horwitz, 2019).

One of the benefits of smart ports is that all transactions made on paper are transferred to the digital environment. Thus, information can be processed more easily, information can be stored securely, and access to information can be very easy and fast. Today, blockchain technology is used to provide a paperless office environment in smart port applications. For example, Port of Antwerp, together with T-Mining company, initiated a blockchain-based project to reduce paper transactions in logistics processes (Tan, 2017). Similarly, Malaysian Supply Chain Innovation Institute (MISI) and Shanghai Jiaotong University use blockchain technology to provide solutions to the complexity and inefficiency of less than container load (LCL) operations in Chinese ports (A Tan, 2017).

One of the most important goals aimed at by smart port technology is the real-time tracking of cargoes. In this way, both the shipper gains trust against the shipping company, and the port management can manage the cargo better and easier by making the right decisions. In addition, real-time monitoring also helps to reduce costs. Thus, the customers of the most affordable and safest transportation companies and ports increase. Cargo tracking, which focuses on container tracking in smart ports, is targeted. With IoT sensors placed on containers and at various points of the port, real-time tracking of all containers in the port can be made. This information is sent to shippers over the internet, allowing them to track their cargo. In addition, it has become possible to obtain information about the physical condition of the container by means of different sensors placed on the containers. For example, Semtech Corporation has integrated smart containers into its IoT network in the Irish port of Cork, enabling sensors placed on containers to detect opening and closing of containers' doors, monitoring the temperature of the sensitive cargo, and monitoring the location of the container. (Internet of Business, n.d.a) Another example is the Container 42 project of the Rotterdam port, in collaboration with IBM, Cisco, and Esri companies. Within the scope of the project, a container that has been made smart with various sensors was left for circulation around the world for a period of two years. The container records and sends information such as temperature, humidity, air pollution, noise, slope, location, and vibration. The aim of the project is specially to achieve the goal of ensuring autonomous transportation, to identify the difficulties encountered during transportation and logistics, and to help create the digital twin of the port area by digitalizing the physical information of the port area. (Port of Rotterdam, 2019b; Weare42, n.d.) In another project carried out by Hyundai Merchant Marine Company and members of the consortium, it is aimed to monitor and manage the reefer containers on board in real time by using blockchain applications together with IoT (Kang, 2017). The data produced by smart containers are also needed by digital twin technology. A digital twin for supply chain optimization fed by this data will provide opportunities to all stakeholders in the chain to optimize the choice of shipping mode and container route. In addition, the system will create an infrastructure for the flow optimization of empty containers. (Lind et al., 2020)

Determining the correct weight of the containers loaded on the ships is important for the safety of the port equipment, the ship and the container. It has been observed that containers loaded more than their capacity caused accidents at ports and ships in the past. In accidents, breaking of MSC Napoli container ship's hull in the English Channel on 18 January 2007 (MAIB, 2008), the fall of a container from the crane in the Australian Port of Darwin in February 2011 (Middleton, 2011), heeling of a container ship named Demeb in the port of Algeciras on 11 June 2011 (CIAIM, 2012), it has been known that container weights differing from those declared have caused of accidents. In order to prevent such accidents, IMO's regulation on verification and reporting of the gross weight of containers to be loaded on ships entered into force as of 01 July 2016. According to this regulation, containers is weighed before arriving at the port and the weight of the container and other information of the container is transferred to the port. Studies on blockchain technology have begun to transfer this information to the port in a correct and safe manner and to become a part of the smart port technology. Marine Transport International (MTI) company has provided the integration of container information to the port with a blockchain-based application (Jabbar and Bjørn, 2018). Thanks to this technology, the entrance of over-loaded containers to ports will be prevented and the certification process will be accelerated (Splash, 2017).

Marine vessels (ships, pilot boats, tugboats, patrol boats, feeder ships), land vehicles (trucks carrying cargoes coming into the port and other vehicles that supply the port administration) and railway freight trains cause heavy traffic in the ports. In addition, port equipment such as mobile harbor cranes, straddle carriers, tractors and chassis, automatic guided vehicles, ship loaders, unloaders, reclaimers, stackers and port workers are also a part of this traffic. The harmonious regulation of heavy port traffic is very important for the efficiency of the operation in the port. The biggest contribution to the port operation at optimum efficiency is the continuous operation of the vehicles without waiting for each other. Thus, it is aimed to minimize the losses caused by waiting times. In addition, the port area is also used effectively with this harmony. Losses arising from the waiting times of the ships in the port are the main losses in terms of both shipowner and port management. For example, according to the calculation of Rotterdam Port, one-hour reduction in the duration of a ship's stay at the port saves 80,000 U.S. dollars to ship operators (Loftus, 2019). Regarding minimizing the waiting times of ships, the project that aims to digitalize the operational environment of the port by using IoT technologies in Rotterdam Port, together with IBM, has been carried out since 2018. With the project, more safe and efficient traffic management is aimed at the port. (World Maritime News, 2018) It was determined that the waiting time of the ships decreased by twenty percent (Port of Rotterdam, 2018). Tides, currents, salinity, temperature, wind speed and direction, water levels, and visibility conditions are collected from IoT sensors and this information is transformed into useful information that can be used in decision making. This information is used to reduce waiting times for ships, to find the best times for berthing, loading, and unloading of ships, and to bring more ships to the port using full capacity. With this technology, depending on the water level in the port, the maximum loading and entry and exit times of the ship can be accurately estimated. (World Maritime News, 2019) In Port of Hamburg, congestion in the port is prevented and complex problems related to port logistics can be solved easily with IoT technology used to coordinate ships and trucks (Internet of Business, n.d.b).

Today, communication between port workers in many ports is classic radio and radar communication. This communication can cause a loss of time due to the loss and errors and the interruption of the communication during the transmission of the information. In the smart ports, IoT can provide synchronization between ports, ships, and cargo owners to optimize port traffic and minimize congestion and uptime at the port (Belfkih, Duvallet, & Sadeg, 2017). In communication with IoT technology, since the objects communicate with each other and automatically transfer information to the system, it prevents both time loss and the incorrect transfer of information. Thus, complex operations within the port can be maintained in harmony.

Along with many types of equipment related to cargo handling such as mobile harbor crane, straddle carrier, tractor, and chassis, automatic guided vehicle, ship loader, unloader, reclaimer, stacker, many types of equipment are used for various purposes in ports. For this equipment to be used optimally in the port, maintenance periods should be planned very well. In addition, even if timely maintenance is carried out, the failure of these equipment may disrupt the port activities. Thanks to digitalization and smart port technology, optimum maintenance planning can be made, and equipment can be detected before failure. The project that the Port of Amsterdam started with a company called 30 Mhz can be given as a good example of this subject. In Ijmuiden, located at the entrance of the Amsterdam Port canal, mooring points were built in order to lighten the ships by unloading some of the cargo before entering the canal. These mooring points consist of piles driven into the seafloor. Since the ships moored to them are unloaded and lightened, they do not have any draft problem in the canal while navigating to the Port of Amsterdam. Within the scope of the project, the leaning of the piles over time with the mooring of the ships is controlled by the information received from the IoT sensors placed on the piles. Based on the information, maintenance periods are planned proactively, and it is ensured that the mooring activities are not interrupted. (Port of Amsterdam, 2016)

In addition, with the 5G technology, which is the infrastructure of IOT technology, it is possible to easily transfer three-dimensional information to augmented reality application. In this way, on-site maintenance teams can easily get help from a specialist while continuing their work. This will help those in the field during the breakdown and maintenance periods of the equipment in the ports. For example, the works for establishing the infrastructure of 5G technology have started in the port of Hamburg (Blackman, 2019). Once complete, it will easily support these applications.

In addition to the great advantages it provides, digital transformation also brings the risk of exposure to cyber-attacks. Since it is based on digital technology, smart ports are more likely to be exposed to cyberattacks compared to conventional systems. The deliberate attempts of unauthorized persons to access information and communication technology systems for the purpose of information theft, interruption/ damage or other illegal actions are defined as cyberattacks (Fischer, 2016). All port operations may be interrupted due to cyber-attacks in smart ports where all transactions are carried out on computers. For this reason, the port may suffer enormous financial losses. For example, the ransom attack, which also affected Maersk on June 27, 2017, rendered computer systems unusable for a while and caused disruptions in 17 container ports operated by Maersk's port operator APM (Gronholt-Pedersen, 2017). This attack, which caused 300 million U.S. dollars in damage, has made it clear that cybersecurity threats are a major threat to the maritime industry (Novet, 2017; Baker, 2017). The unbreakable encrypted nature of blockchain technology and the recording of information on all computers in a distributed structure can prevent such ransom attacks. It is very important to protect the IoT technology, which constitutes the communication infrastructure of all equipment in smart ports, against cyber-attacks. Because all the equipment in the port is in contact with each other and with the central management with IoT technology. The interruption of this information flow may cause the harmony of all activities in the port to be disrupted. IoT protection in smart ports can be provided by blockchain technology with a decentralized structure and an indestructible encryption system (Kshetri, 2017; Dickson, 2016). It has been proven that blockchain technology can be integrated with IoT technology with the pilot application of Blocklab jointly established by Port of Rotterdam and the city of Rotterdam (Port of Rotterdam, 2019c).

Besides the aforementioned issues, it is considered that smart port applications will make significant contributions to the performance measurements of port and to the measurement of port efficiency. Port administrations make some calculations with the information they collect from the port in order to evaluate the efficiency of the port. Port performance indicators form the basis of these calculations. As a result of the evaluation, the decisions taken for the more efficient operation of the port are included in short, medium, and long-term strategic plans.Port performance indicators can be grouped under three categories: Physical performance indicators measuring the output of the equipment and facilities in the port, quality performance indicators covering the reliability, flexibility, and implementation of the port, and financial performance indicators measuring profit and loss contributions (ICS, 2007). In smart port applications, collecting data from the port with electronic sensors and computer systems without human involvement will ensure that the data is reliable. In addition, by performing these processes automatically, time losses will be prevented and instant access to information obtained from port performance indicators will be provided. Thus, a delay in corrective actions regarding the port will be prevented.

SOLUTIONS AND RECOMMENDATIONS

Ports try to increase their profits as a commercial enterprise. In order to increase profits, the port must operate at maximum capacity and at minimum cost. In order to work at maximum capacity, the number of customers of the port must be at least as much as the port capacity and all the resources of the port must be used at full capacity to serve these customers. Cost reduction is achieved by using all available resources at optimum efficiency. The reason why ports are made smart is the desire to use digital technology to increase profits and reduce costs. Optimization aims, which are very difficult to achieve with today's conventional port management understanding, can be achieved very easily in smart ports that will emerge thanks to digital transformation. Although the digital transformation process is long and arduous, many advantages are provided as results of the transformation. Today, many ports continue their efforts to become smart ports in order to benefit from these advantages as soon as possible, within the scope of pilot projects, without interruption. It is explained below how smart port applications can provide solutions to the problems faced by port managements.

Creating the digital twin of the port, which is one of the most important steps of smart ports, can be a solution for optimum planning by providing the resolution of the complex working environment in ports. In addition, the digital twin of the port can direct the port's strategic planning with the information stored in it from the past to the present. Exercises of events that can be experienced in extreme weather conditions and natural disasters can be performed on the digital twin and be prepared for real situations. With the real-time data obtained from the port, port managers can be made more accurate decisions, a safer and transparent working environment can be provided, and port efficiency can be increased. Smart ports are also among the necessary steps for autonomous ships that are expected to enter service soon. The fact that autonomous ships can receive information to be sent from all ports they will visit requires a standardization in the digital transformation of ports. This will contribute to the globalization of smart port technology. Through digital technology, all information produced by the smart port is collected, stored and processed without human involvement. Thus, the data obtained are known to be reliable and it is accepted that the decisions made by making use of these data will also be correct. The digitalization of information brings along speed and enables instant decisions to be made. The data needed for the calculation of port performance indicators used to measure the efficiency of ports can be automatically collected within the scope of smart port applications. Thus, the collected data are both reliable and time losses can be prevented. This situation contributes to the immediate improvements to be made at the port and delays can be avoided. Transactions on paper are minimized. In addition, loss of information is reduced if experienced personnel leave their job at the port. Storing digital information with blockchain technology ensures maximum protection from the damages caused by cyber-attacks. Real-time tracking of cargoes, especially containers, at smart ports facilitates the port's cargo operations and enables shippers to know the location of their cargo in real time. In addition, thanks to smart containers, it is possible to control the values of the environment inside the container and to intervene when necessary. The use of smart systems in the process of reporting the weight of the containers to the port will also enable the transfer of information to the port systems both without error and automatically. This will lead to improvements in reducing container accidents at ports and port safety. Smart ports minimize waiting times for cargo operations by regulating and optimizing traffic within the port. In addition, this ensures the most efficient use of the port area. Regulating port traffic also contributes to increasing safety by reducing the accidents in the port. Communication through sensors in smart ports ensures that the communication is both fast and reliable. In addition, the maintenance of port equipment in smart ports is carried out when the equipment starts to signal a malfunction, thus ensuring that all equipment operates uninterruptedly.

FUTURE RESEARCH DIRECTIONS

In the study, it has been evaluated how smart port applications can provide solutions to many problems faced by port management. At the same time, it is explained how and for what purpose IoT, blockchain and digital twin technologies, which are mostly used within the scope of smart port applications, are used. However, this study is a general evaluation of these three technologies within the scope of the digital transformation of port management. The study showed that the smart port potential capabilities are already at a level that can solve many problems in port management. In the upcoming period, detailed and technical studies may be conducted on how to benefit from smart port applications in each area under port management.

CONCLUSION

Like many other sectors, the maritime industry has started to work on digital transformation due to its many benefits. Port management, which is one of the building blocks of the maritime industry, has also accelerated digital transformation efforts under the leadership of developed ports in the world. Today, conventional port managements are faced with many problems. The complex and dynamic nature of the port environment does not allow these problems to be solved by classical methods. In this context, it was evaluated that today's problematic issues can be easily solved with an environment that will be obtained as a result of the combined use of IoT, blockchain and digital twin technologies used within the scope of digital transformation in ports.

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KEY TERMS AND DEFINITIONS

Blockchain Technology: A new generation recording system where data is encrypted and recorded in a system of computers connected to each other in a decentralized structure, and each encrypted data is recorded in a chain, making it impossible to change and delete data.

Digital Transformation: Transformation from classical systems to digital systems in a way that all functions of a business can be carried out on digital media.

Digital Twin Technology: Technology used to make transactions on complex systems more easily by creating digital twins of them.

Internet of Things (IoT): Internet network of smart objects connected to the internet.

Smart Port: A safe and secure port environment, where all equipment is made up of smart objects and operates on a smart platform, where port operations are carried out with automation, all activities in the port are optimized, and that has achieved a sustainable structure.

Chapter 13
The Siemens Digitalization Strategy in a Value-Based Management Framework

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ABSTRACT

The digital economy is growing at unprecedented speed and scale. Digital technologies generate the digital transformation of everything – organizations, industries, society. Digital technologies and digital business models disrupt industries in a digital vortex to a different degree by industry. In the new business context, value creation changes from the classical net present value of discounted cash flow or economic value added. Changes are given mostly by uncertainty. Reconciling classical value with digitalization becomes a research topic – the topic of this chapter. The chapter is a case study on Siemens, a Harvard Business Review case in digitalization, and one of the most important value-based management practitioners in the world, in the view of the economic value added model and in the view of journals indexed in Web of Science. The Siemens case is used to explore how economic value added and digitalization can work together and finds that they do in different stages that follow the logic of the innovation lifecycle.

INTRODUCTION

The Industrial Economy is transforming in the Knowledge Economy in several progressive stages. Digital technology has inflicted several waves of fast and high-scale change to the Industrial Economy (IBM Institute for Value Analysis, 2011; IDC, 2017a). These changes may be represented as the decades of the Knowledge Economy (IBM Institute for Business Value Analysis, 2011): in the 1990s, the emergence of the Knowledge Economy, with digital products and infrastructure; in the 2000s, digital distribution and web strategy; since 2010, digital transformation of business models.

DOI: 10.4018/978-1-7998-2402-2.ch013

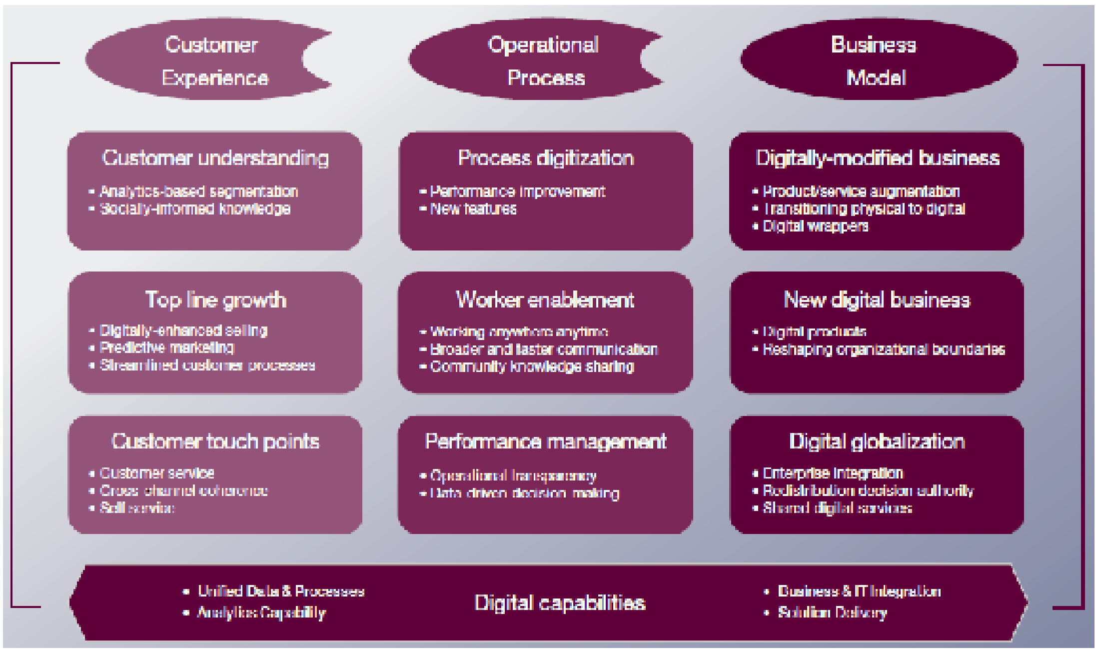
Digital technology, created by digitization, may be defined as the IDC's third platform. The third platform comprises cloud, big data analytics, social business, mobility and technology accelerators which consist of robotics, natural interfaces, 3D printing, Internet of Things, cognitive systems, next generation security (IDC, 2017b). Digital technology may bear different names and classifications. For exemple, digitalization technology in manufacturing is called Industrie 4.0 or the Industrial Internet and comprises big data and analytics, autonomous robots, simulation, vertical and horizontal integration, Industrial Internet of Things, cyber security, cloud, additive manufacturing, augmented reality (Boston Consulting Group, 2015). Digitalization technology transforms individual industries (World Economic Forum, 2019).

Digitalization is defined (CapGemeni, 2013; Gartner, 2019; The Global Center for Business Transformation, 2019; IBM Institute for Business Value Analysis, 2011; IDC, 2017a) as the use of digital technologies to change a business model and provide value-creating opportunities or improve performance quantifiably.

According to IBM (2011), digital transformation is the pervasive degree of economic impact digital technology has on functions, industries, society. IDC (2017a) describes digital transformation as the use of digital technologies in ways that were never anticipated. Innovations driven by digital technologies are expected to bring about unprecedented business transformation, representing the biggest industry shake-out since the Industrial Revolution. According to Accenture (2019), digital transformation turns every business into a digital business. Companies face the digital imperative to harness the power of digital technologies to become more effective, innovative and disruptive. Cisco (2019) defines digital transformation as the application of technology to build new business models, processes, software, and systems that results in more profitable revenue, greater competitive advantage, and higher efficiency. According to IScoop (2019), digital transformation is the profound transformation of business and organizational activities, processes, competencies and models to fully leverage the changes and opportunities of a mix of digital technologies and their accelerating impact across society in a strategic and prioritized way, with present and future shifts in mind. The Global Center for Digital Business Transformation (2019) identifies and defines digital business transformation as a journey to adopt and deploy digital technologies and business models to improve performance quantifiably. Digital transformation (CapGemeni, 2013) is the use of technology to radically improve performance or reach of enterprises – via change customer relationships, internal processes, and value propositions, the blocks of digital transformation. These blocks of digital transformation may be used to assess digital maturity. The emergence of the New Economy at all stages has brought volatility, uncertainty, complexity and ambiguity (Berinto, 2014a, 2014b; Bennet & Lemoine, 2014).

Digital disruption (Capgemeni, 2015, 2016; Casadesus-Masanell & Ricart, 2011; Girotra & Netessine, 2014; Grossman, 2016; Kavadias, Ladas, & Loch, 2016; The Global Center for Digital Business Transformation, 2015; Ovans, 2015; Westerman, Bonnet & McAfee, 2014) occurs when digital technology (IDC, 2017b) replace incumbents' business models in industries with new business models. Digital disruption, especially the shift from pipelines to platforms, impacts all industries in a digital vortex (Blank, 2013; Bonchek & Choudary, 2013; Girotra & Netessine, 2014; Grossman, 2016; The Global Center for Digital Business Transformation, 2015; Van Alstyne, Parker, & Choudary, 2016; Westerman, Bonnet, & McAfee, 2014). According to the Global Center for Digital Business Transformation DBT (2019) digital disruption is the effect of digital technologies and business models on a company's current value proposition, and its resulting market position. According to DBT, the digital transformation will impact all industries in a digital vortex. Whereas, in the Industrial Economy, product lifecycles are long and stable, in the Knowledge Economy, product lifecycles are short and given by cycles of innovation and re-innovation (Powell & Snellman, 2004).

Figure 1. Blocks of the digital transformation (source: CapGemeni, 2013)



METHODOLOGY

This paper illustrates how Siemens reconciles Economic Value Added with digitalization in a simple coherent approach that is tied to several other chapters from the same author. The purpose of this chapter is to explore, analyze and then synthesize the key value drivers and related decisions in Siemens' digitalization strategy, in the context of a world reference case (Siemens) in Economic Value Added centered management and the business context of digital transformation and disruption. The chapter is a descriptive case study. The literature review shows mainstream literature in digital transformation and managing value. The referenced sources in digital transformation refer to the works of consultants in digitalization. A second literature review is performed about value based management and comprises mainstream literature. The topic – strategy is extensive and an exhaustive literature review is too lengthy. The empirical data analysis is an extensive study from sources such as annual reports, presentation, chapters in Siemens magazines, other Siemens website sources. Alhough the paper resides on an incomparably broader reference list, only main sources are cited therein. The paper shows how Siemens reconciles New Economy tools such as digitalization, business eco-systems, open innovation, intangible assets, business models, venture capital with mainframe value indicator Economic Value Added. Siemens' digitalization strategy is a framework for both New Economy and classical tools in strategic management. This paper is conducted on one of the most proeminent value based management practitioners worldwide, Siemens and may serve as example to other companies, academics. The paper finds that Siemens' key value drivers are core technology, business technology, customer industry know-how and the customer value they create, measured as key performance indicators or return on customer investment. This value driver tree shows how Siemens' digital offerings are created across all organizational systems and decisions.

VALUE DRIVER DEFINITION AND RELATIONSHIP TO VALUE DECISIONS AND VALUE INDICATORS

In value based management, value drivers are the factors which create shareholder or stakeholder value in the generic formulas of value indicators. In the 1990s, several consultancy firms engaged in the war of metrics and proposed several value indicators: Shareholder Value Added for LEK Consulting (Rappaport, 1986), Economic Value Added for Stern and Stewart (Stewart, 1991), CFROI for Holt Associates (Madden, 1999, 2010), Cash Value Added for Holt Associates (Madden, 1999, 2010) or Boston Consulting Group (Boston Consulting Group, 2008), Total Shareholder Return for Boston Consulting Group (Boston Consulting Group, 2008). In value based management, value drivers may also be defined as the objectives of company decisions in creating long-term and short term shareholder value. In Rappaport's approach in 1986, value drivers are the objectives of competitive advantage, operational, investment and financing decisions that create Shareholder Value Added on the long-run (Rappport, 1986). Value drivers are the duration of competitive advantage; sales growth, operating profit margin, income tax rate for operational decisions; fixed capital investment and working capital investment for investment decisions; equite and debt in the cost of capital (Rappport, 1986). In this view, strategic decisions refer to the long-term and involve capital allocation (investment and financing decisions and related value drivers) for future operations. According to Mc Kinsey's approach since 1994 (Copeland et al, 2000; Copeland et al, 1994; Koller et al, 2005; Koller et al, 2010; Koller et al, 2010; Koller et al, 2015), value drivers are decisions' objectives to create value to be measured when strategy is executed. Value drivers are performance indicators, and managing value drivers is performance management. Value drivers also form the link between strategy and a company's intrinsic value on capital markets. Valuation bridges strategic management and financial management. In this view, strategy is the long-term value driver and as strategy is progressively implemented, value drivers become shorter term oriented and achieve value. In the Balanced Scorecard (Kaplan & Norton, 1992), value drivers are learning and growth, internal perspective, customer perspective key performance indicators that create future value represented by financial key performance indicators. In strategic management, value drivers are driven from strategy, refer to the future and are used to value and implement strategy (Arnold, 1998; Black et al, 1998; Kaplan & Norton, 1992, 2004; KPMG, 1999; Leahy, 2000; Martin & Petty, 2000; Mc Taggart et al, 1994). In valuation (Wendee, 2011), value drivers are defined as any variable that impacts a company's value to potential buyers and may constitute a large list in an extensive literature review. Across value based management 1990s literature and as in the Balanced Scorecard approach, value drivers are used to allign the organization to strategy and thereby implement it.

The transition to the Knowledge Economy shows the emergence of a new resource, intangible assets (Daum, 2003; Edvinsson & Malone, 1997; Stewart, 1991). Studies show that, by 2000, intangible assets dramatically shift to the greater part of company value and form the main source of value creation (Daum, 2003; Edvinsson, 2002; Lev, 2001; Lev & Daum, 2004; Lev & Gu, 2016; Stegmann, 2009). Strategy maps (Kaplan & Norton, 2004) are an overview about the firm grounded on intangible assets. There are several definitions of intangible assets. In financial accounting, IAS 38, intangible assets may be classified as customer lists, customer relations, supplier relations, marketing rights, research, development, patents, computer software, databases and trade secrets, trademarks, trade dress, newspaper mastheads, internet domains, video and audiovisual material, mortgage servicing rights, licensing, royalty and standstill agreements, import quotas, franchise agreements. In financial accounting, intangible assets need to be controlled by the entity, whereas in management a broader definition is accepted (Petrisor & Cozmiuc, 2015). Intangible assets may be understood as capitals: intellectual capital (Lev, 2001, 2004; Lev & Gu, 2016), which comprises the intangible value of a business, covering its people (human capital), the value relating to its relationships (relational capital), and everything that is left when the employees go home (structural capital), of which intellectual property is but one component. Another type of intangible assets are the activities that preceed operations (Damodaran, 2007): research and development, marketing, supply chain management. This type of intangible asset may be a project or series of projects, programs (International Organization for Standardization, 2017; Project Management Institute, 2013). Projects are allocated capital based on a mixture of strategic and financial criteria and in practicing organizations by a project management board which reviews all these criteria (International Organization for Standardization, 2017; Project Management Institute, 2013). In this view, projects are temporary endevours to create a unique product, service or result. Projects are capital expenditures, allocation or investment. Operation are repetitive efforts to deliver services or results. Their costs are operational expenditure. Intangible assets may explain companies' value (Stegmann, 2009).

The New Economy is shaped as networks (Chesbrough, 2001; Gossain & Kandiah, 1998; Kothandaraman and Wilson, 2001; Kelly, 1997; Moore, 2006; Prahalad & Krishnan, 2008) or eco-systems (Ben Letaifa, 2014; Gossain & Kandiah, 1998; Moore, 2006), where value creation and capture are different from the logic of the Industrial Economy. Business models may be products in traditional value chains or platforms in networks; in this view, business models are a synthesis which highlights traditional value chains, supply side economics, or products when compared to networks, demand side economics, or platforms (Van Alstyne, Parker, & Choudary, 2016).

The new VUCA environment also impacts financing decisions via real options (Luehrman, 1998). In a certain environment, strategy is a detailed plan for action valued via the net present value of discounted cash flow. In a VUCA world, strategy is a decision tree with several options (Koller et al, 2005; Koller et al, 2010; Koller et al, 2010; Koller et al, 2015). These options are modeled using call options or put options (Damodaran, 2010, 2011, 2012).

With Kaplan and Norton (2004), value drivers are the hypotheses that shape strategy. Strategy maps comprise customer value proposition, internal activities, capital resources are non-financial value drivers, while revenue, cost and assets financial value drivers (Kaplan & Norton, 1992, 2004). Business models work at the very early discovery stage in strategy as hypotheses (Blank, 2013; McGrath & MacMillan, 1995; Girotra & Netessine, 2013). Already in 1995, McGrath and MacMillan theorized discovery driven planning: in an uncertain world, stages of discovery and testing hypotheses preceed the business plan, suitable for a certain environment. One way to represent business models is the business model canvas (Osterwalder & Pigneur, 2010). With the business model canvas, a new tool in strategic management comprises the value drivers in strategy maps plus customer related drivers – customer segments, customer relationships and customer channels and external resources such as partners Moreover, business models canvas is intended to illustrate and explain value creation, proposition and capture (Osterwalder & Pigneur, 2010). The elements of the business model canvas are consistent with the value driver definition as any factor that impacts value creation. A series of chapters in Harvard Business Review (Blank, 2013; Bonchek & Choudary, 2013; Casadesus-Masanell & Ricart, 2011; Eyring et al, 2011; Ferry, 2017; Girotra & Netessine, 2013; Grossman, 2016; Kavadias et al, 2016; Johnson et al, 2008; Ladd, 2016; Ovans, 2015; Pisano, 2015; Satell, 2017a, 2017b; Van Alstyne et al, 2016) argue in favor of business models as the new tool to conceptualize competitive advantage, a major form of innovation, one of the drivers of digital disruption and digital transformation, the goal start-ups should produce, a means to fund start-ups later on. Business models, the new tool in strategic management, are managed in internal or external start-ups (Blank, 2013). Start-ups may be defined as (Blank, 2013) a temporary organization designed to search for a repeatable and scalable business model. An alternative definition for a start-up (Ries, 2011) is a human institution designed to deliver a product or a service under conditions of extreme uncertainty (Ries, 2011). At this stage, the product is a pivot (Ries, 2010, pp. 6). The subsequent stage is the execution of the business model, which involves a plan about the how cash flow will be generated. As the cost of developing a digital startup has fallen from approximately $5 million in 2000 to $5,000 as of 2013 (Capgemeni, 2016), the lean start-up movement is taking the world by storm (Blank, 2013; Girotra & Netessine, 2013; The Global Center for Digital Business Transformation, 2015; Grossman, 2016). Traditionally, venture capital has been used to finance start-ups or business development efforts (Kaplan Financial Limited, 2012a, 2012b). Venture capital is a type of private equity, a form of financing that is provided by firms or funds to small, early-stage, emerging firms that are deemed to have high growth potential, or which have demonstrated high growth (in terms of number of employees, annual revenue, or both). The lean start-up movement is closely tied to venture capital (Blank, 2013). Already since the proposal of open innovation (Chesbrough, 2002), one network business model, venture capital is recommended.

The Internet of Things is said to usher as a service business models (Böhm et al, 2016; Kowalkowski et al, 2018; Liinamaa et al, 2016; Ng et al, 2013; Porter and Heppelmann, 2014, 2015; Visnjic et al, 2018; Zheng et al, 2018; Zheng et al, 2019). Product-service systems mark a trend called servitization (Kamal et al, 2020; Li and Mischra, 2020; Pezzotta et al, 2018). Customer offering shifts from selling products to marketing solutions. The product-service system taxonomy may comprise: products; smart products; smart connected products, which are product service systems; product systems of cyber-physical systems; product systems of systems of cyber-physical systems (Porter and Heppelmann, 2014, 2015). As of service business models are deemed the most important contribution of the Internet of Things by Porter and Heppelmann (2014, 2015), and the most important management innovation of years 2019 at EY according to Forrester and of 2020 according to BCG. In another understanding of as a service business models (Raddats et al, 2019). In this view, there are three types of solutions, in progressive sophistication: product-oriented product service solutions; use oriented product service solutions; result oriented product level solutions. The first level of servitization, product-service models focus on products and are regarded as a simple solution. The second level of servitization is use oriented product service solutions, which provide output as value via key performance indicators. The most complex form of product service solutions are outcome based solutions, where suppliers pay for achieved performance outcomes and value in use. Integrated solutions (Storbacka, 2011) and outcome based services (Visnjic et al, 2017) are deemed to represent the most advanced form of servitization (Visnjic et al, 2017).

EMPIRICAL EVIDENCE: KEY VALUE DRIVERS IN SIEMENS' DIGITALIZATION STRATEGY

About Siemens

Siemens is a large industrial global European based engineering company founded in 1847. Since then, Siemens has acted as a large conglomerate with a portfolio of products that has changed throughout time. In 1998, Siemens has wide variety of businesses and business types. In 1998, Siemens' portfolio comprises groups in energy, industry, information and communications, transportation, healthcare, lighting, household appliances. Since 2010, Siemens has focused its portfolio on key sectors industry, energy, infrastructure and cities (Siemens, 2014d, pp. 4; Siemens, 2016, pp. 4). In the future, 2020 onwards, Siemens scale up and will tap adjacent markets. Siemens has large or medium business customers, with whom it engages in contracts that report sales per contract or won orders. Siemens supplies products, services, solutions, capital assets, constructions in customer specific contracts. Siemens is organized in Managing Board and Supervisory Board. Siemens' Management Board comprises members from Siemens' businesses, regions, corporate functions. Siemens' research and development activities are organized in a Central Technology Department and in business specific departments. Siemens manages customers via key account managers and Siemens Management Consulting. Key account managers are organized on customer markets as third organizational dimension. A Corporate Supply Chain Management organization is responsible for global supply networks, supplier involvement across the product lifecycle, global direct and indirect purchasing contracts, supplier related innovation. Siemens has 298 factories worldwide. Siemens' financial management is centered on Economic Value Added. Performance management bridges strategy, financial management, human resource management. Siemens is a global company, present in 190 countries, with targets to locate business unit management outside Germany, to be active in emerging countries, in innovation hubs, in large business centers.

With reference to the topic of this chapter, Siemens' value based management practice is cited by the proponents of the Economic Value Added model (Stern, Shiely and Ross, 2003) as one of the most proeminent cases worlwide. Siemens' Economic Value Added approach has been the topic of a past chapter at Emerald (Zhao, 2004). Digitalizaton at Siemens is a Harvard Business Review case study in 2018 (Collins & Junker, 2018). As follows, secondary data about Siemens is explored, analyzed, induced and grouped close to the Siemens original and following key value drivers as criterium to select statements. Whereas the statements belong to Siemens, their selection is based to the relevance of the key value driver approach.

Value Based Management – A Holistic Management Program 1998-2020

Since 1998 to date, Siemens implements value based management as a framework that overarches strategic management and financial management. In 1998, Siemens begins to implement value based management (Siemens, 1998, pp. 6) in several stages which show progressive scope of the management systems deliberately subordinated to value creation. To begin with, value based management is one of several management programs named top+ (Siemens, 1998, pp. 6), a ten-point program which comprises portfolio measures and financial and capital measures (Siemens, 1998, pp. 7; Siemens, 1999, pp. 8). In the following years, the EVA centered value based management is renamed Operation 2003 (2002), Siemens Management System (2003, 2004), Fit4More (2004-2007), Fit42010 (2008, 2009), Siemens One

(2010 onwards). These programs are all centered on value, involve financial value drivers or performance metrics as goals or targets, and non-financial value drivers as strategic directions.

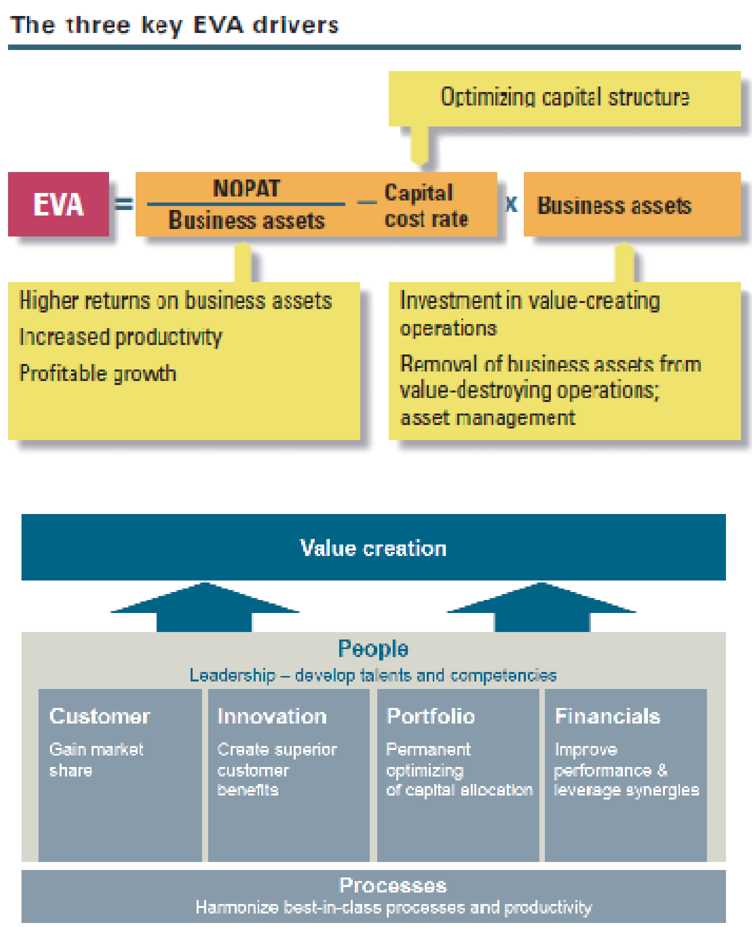
Corporate Governance is the basis for all decision making and control processes and comprises responsible, value-based management and monitoring focused on long-term success, goal-oriented and efficient cooperation between the Managing and Supervisory Boards, respect

for the interests of our shareholders and employees, transparency and responsibility in all entrepreneurial decisions and an appropriate risk management system (Siemens, 2010, pp. 88).

Sustainable value is measured via Economic Value Added, the ultimate corporate governance objective for Siemens 1998 – 2018. Economic Value Added is computed by a formula which summarizes the Profit and Loss statement, the Balance Sheet, the weighted average cost of capital. A business creates value when it recovers its cost of capital and furthermore delivers EVA in line with capital market requirements (Siemens, 2001, pp. 51). The elements of that formula are financial value drivers and performance metrics. Performance is driven by non-financial measures.

Since 2005, Siemens' non-financial value drivers comprise the strategic directions of Fit4More, Fit42010, Siemens One. Amonst these non-financial value drives have been innovation and customer

Figure 2. Overview about financial and non-financial value drivers
(source: Siemens, 1998; Dr Thomas, 2013)



proxmity, included in operational excellence in the Fit4More and Fit42010 programs and later as strategic directions in Siemens One. Siemens calls goal setting about value drivers performance management (DrThomas, 2013). Since its beginning, value based management involves clear goals about performance, concrete measures and rigurous consequences (Siemens, 1998, pp. 6). Siemens calls this approach business excellence (Siemens, 2002b, pp. 20 – 30). In the One Siemens strategic management framework, strategy, organization, performance management direct personnel behavior and transform environmental input into output (Dr Thomas, 2013, pp. 13). In performance management, the most important value driver is investment in tangible assets, intangible assets and portfolio activities (Dr Thomas, 2013, pp. 22). Value at Siemens is created in investment cycles, that begin with capital allocation, continue with growth, profitability and generate cash flow that allows self-financing new investment (Dr Thomas, 2013, pp. 21). Performance metrics are the basics of Siemens' global performance management process (Siemens, 2006, pp. 25), which involve the appraisal of all employees based on performance and the compensation of management based on the same criterium. Siemens has practiced competitor benchmarking since 1998, and incorporated benchmarking as hurdle rates for its performance metrics progressively in Fit4More, Fit42010 and eventually reaching all strategic performance indicators in Siemens One, the current group strategy since 2010 overarching 2020+. One Siemens is centered on value, and comprises three strategic directions: focus on innovation driven markets; get closer to customers; use the power of Siemens.

The Siemens One Group Strategy and the Role Digitalization Plays

The first strategic direction is focusing on innovation-driven markets, comprising three focus areas: be a pioneer in technology-driven markets; strengthen portfolio; provide a leading environmental portfolio. In 2013, Siemens defines its activities alongside key technologies electrification, automation and digitalization (Siemens, 2013a, pp. 98). In 2014, Vision 2020, and in Vision 2020+, Siemens defines its portfolio alongside key technologies electrification, automation and digitalization (Siemens, 2014e, pp. 14, 15). The three technologies define what all Siemens' businesses have in common, long-term trends that define Siemens' markets, the territory for competition, the requirements of customers, partners and society (Siemens, 2014d, pp. 15). Siemens is a leader in electrification, automation, and exploits the opportunities offered by digitalization (Siemens, 2017i, pp. 14). On structural level, innovation is achieved by the research and development department, which at Siemens comprises the Corporate Technology department for core technology and business specific departments. Research and development is organized in two directions: customer focus, divisions' responsibility; core technology leadership, the responsibility of the Corporate Technology department. While businesses spend research and development on future versions of existing products and solutions, the Corporate Technology department works with businesses to develop group technology and innovation strategy (Siemens, 2014d, pp. 218). Beginning 2014, according to Siemens, technology leadership stems from key competences in electrification, automation and digitalization across all Siemens customer industries or domains (Siemens, 2014d, pp. 12, 13). In 2015, the Corporate Technology department is focused on key activities in an electrification, automation and digitalization (Siemens, 2015b, pp. 140). The goal of Corporate Technology is to secure the technological base and future of Siemens (Siemens, 2014d, pp. 5).

Focusing on innovation-driven markets is Siemens' primary strategic direction out of three more. This strategy is complemented by the second strategic direction in Siemens One, getting closer to Siemens' customers and entails intensifying Siemens' customer focus, expanding service business, growing in emerging markets (Siemens, 2010, pp. 43). Customer focus involves customer loyalty from one project to another and even recommending Siemens to other prospective customers; this is measured via the net promoter score. This strategic direction also brings value drivers such as sales growth in emerging markets; empowering regional companies to make decisions on their own; enduring brand loyalty in emerging markets, via the net promoter score; establishing local service networks that bring higher return on investment via low capital employed; intangible assets such as customer knowledge (gaining a detailed understanding of customers' processes and of their customers' processes), customer relationships; high customer tailoring of Siemens' products (Siemens, 2010, pp. 43 – 46). Customer proximity is the responsibility of key account managers, which report to Vertical Market Management Boards, for vertical markets or individual industries, and Market Development Boards, for cross-industry solutions (Siemens, 2012, pp. 18). Key account managers have targets for won orders, that is the sales brought by new customer contracts, and for customer loyalty and relationship, measured via the net promoter score (Siemens, 2011, pp. 166). In the Siemens One strategy, innovation and customer focus are key non-financial value drivers.

The two main strategic directions in Siemens One show that innovation and customer focus complement each other in creating customer solutions. In Vision 2020 (Siemens, 2017i, pp. 3), Siemens' strategy for 2020 onwards is to scale up, based on innovation, customer and market focus, and digitalization. Beyond 2020, in Vision 2020+ (Siemens, 2018b, pp. 24), the two strategic priorities in Siemens One, focus on electrification, automation and digitalization and customer focus, remain and receive targets for measurable growth (in sales and in the net promoter score).

Stages in Siemens' Digitalization Strategy

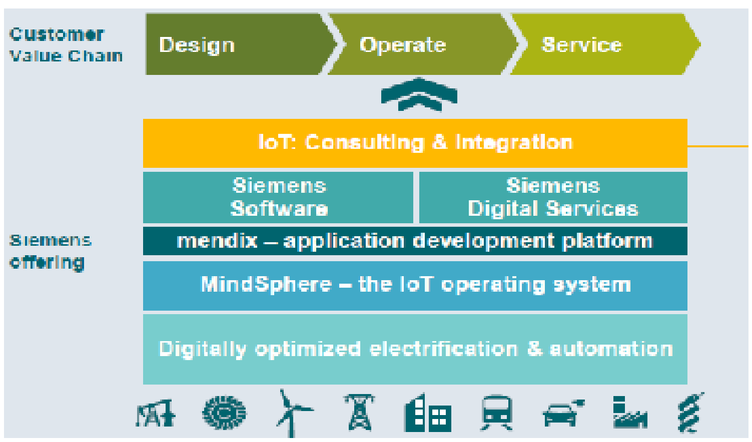
At Siemens, core technologies electrification, automation and digitalization are types of products, services or solutions Siemens' businesses provide (Siemens, 2018b, pp. 11). In Siemens' digitalization strategy and in a series of other statements, digitalization refers to digital services, vertical software, Internet of Things integration and Webs of Systems. Today, digital platforms all businesses share are Synalitics for digital services, Product Lifecycle Management software for vertical software, Internet of Things consulting and integration (Cozmiuc & Petrisor, 2018c; Siemens, 2015a, pp. 2-4; Siemens, 2018, pp. 13). Core technologies electrification, automation and digitalization are shared by Siemens' businesses and may be an alternative classification to their offerings – products, services, solutions, constructions.

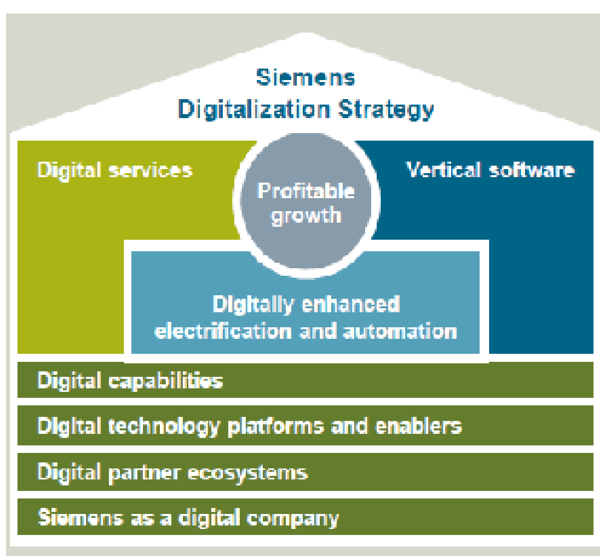
At Siemens, digital services connect Siemens' customers' devices to the digital platform Synalitics and generate data via sensors (Siemens, 2016d, pp. 8). This data is converted into smart data using the smart data principle, a combination of domain, context and device know-how (Siemens, 2016c, pp. 16 – 18). Data from Siemens' devices is processed using data analytics, business intelligence and business innovation to generate concrete customer value via key performance indicators. Customer benefits include performance increase, energy saving, cost reduction and risk avoidance and security. Data analytics may refer to the past, and be descriptive and informs; analyzes, via diagnostic and predictive analytics; prescriptive, describing future decisions and actions (Siemens, 2016c, pp. 9, 10). Vertical software Product Lifecycle Management is another customer offering Siemens classifies as digitalization. This is especially true in the Industry businesses, where Product Lifecycle Management software is a key technology component in Industry 4.0 (Cozmiuc and Petrisor, 2018c; Siemens, 2017h). Product Lifecycle Management software is a generic technology adapted to industry, energy and buildings.

Internet of Things integration is a management consulting service to Siemens' customers, conducted by strategy consulting Siemens Management Consulting (Siemens, 2018b, pp. 13). It is intended to achieve Internet of Things integration across Siemens' businesses. Cyber-physical systems and Webs of Systems are another digital offering at Siemens, not yet reported but possible to exist again or in the future (Cozmiuc and Petrisor, 2018b).

Siemens' digitalization strategy (Siemens, 2015a, pp. 2-3) consists of the digital foundation, the digital business opportunities thereby created, and tailoring core digitalization technology to businesses and customer industries. Siemens' digital foundation shows the open innovation strategy that comprises busines eco-ecosystems, internal capabilities and results in the platforms and enablers that underpin digital

Figure 3. Siemens' digitalization strategy (source: Siemens, 2015) and Siemens' customer offerings in digitalization





offerings. Several Siemens other presentations converge to show digitaliation offerings are created by blending core technology, business technology and customer industry know-how to achieve a concrete customer proposition, quantified as performance indicator or return on investment. Siemens' achievements in digitalization: digital services, vertical software, cyber-physical systems and Webs of Systems (Siemens, 2016e, pp. 6; Siemens, 2017i, pp. 19) reflect the core technology plus business technology plus customer industry know-how equals customer value (performance indicators or return on investment) strategy. The platform for digital services, Synalitics, blends analytics know-how, context know-how and domain know-how to deliver customers performance in the form of improved performance, energy savings, cost reductions, risk minimization, quality improvement (Siemens, 2016d, pp. 16). Siemens calls this combination the smart data to business principle (Siemens, 2016c, pp. 5-9). Vertical software, Smart Innovation including Product Lifecycle Management software, is a core technology adapted to Siemens' businesses and furthermore customer processes and customer industry know-how (Cozmiuc & Petrisor, 2018c). Contracts stipulate concrete return on the investment the customer makes. The formula for cyber-physical systems accross Webs of Systems combines the same: technology with domain context for return on customer investment (Cozmiuc and Petrisor, 2018b; Siemens, 2015c, pp. 4-11; Siemens, 2016e, pp. 22, 23). Technology comprises smart networked devices (Siemens, 2016d, pp. 10). Domain and context comprise domain-specific requirements, cross-domain integration and semantics (Siemens, 2016e, pp. 10). Web of Systems therefore become smart networked systems for industries and critical infrastructures (Siemens, 2016g, pp. 4-11).

According to Siemens' Digitrain (Siemens, 2017d) internal digital readine model, following autonomous systems are several stages of digital maturity: further artificial intelligence; additive manufacturing; disruption, new business models and outcome economy; co-creation and open innovation; next 47; blockchain.

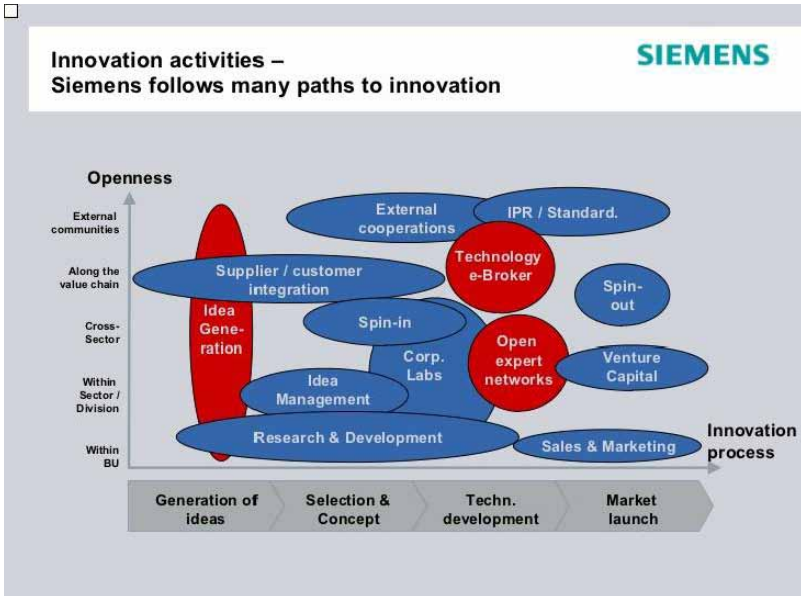
The foundation in Siemens' digitalization strategy is open innovation in core technology, that involves external networks and internal capabilities and creates digital technology platforms and enablers (Siemens, 2015c). Innovation in core technology electrification, automation and digitalization and in business technology is supported by the open innovation strategy. Open innovation is the core group strategy since 2008. Open Innovation is the task of the Corporate Technology Department (Siemens, 2013a, pp. 218). At Siemens, open innovation comprises crowd development, development of user stories and customer insights; validation of existing data-driven service business ideas; development of new data-driven business opportunities (high level); common description of ideas based on proven BizMo™ methodology; community idea generation, evaluation, discussion and maturation, Siemens' knowledge management system, Corporate Memory, division boards that compile knowledge about past projects as part of Corporate Memory, market information compiled by market boards, project Technoweb, blogs, microblogs, wikis, customer relationshp management, corporate memory, the Internet, Internet, publications, TechnoForum, a Web of Knowledge with world-class partners, crowdsourcing of ideas, the Siemens Innovation Fund, eco-systems of partners, innovation producing suppliers (Cozmiuc and Petrisor, 2018a). Open innovation at Siemens is a large topic that may constitute the topic of an individual much lager chapter (Cozmiuc and Petrisor, 2018a). Siemens' innovation partners form business eco-systems, another pillar of Siemens' digital foundation in its digitalization strategy (Siemens, 2015a pp. 11). Innovation occurs in several stages: ideation, concept and selection, technology development, market launch (Siemens, 2011, pp. 36). In a technology Siemens uses internally as well, ideation, realization, utilization are stages of product lifecycle (Siemens, 2018a, pp. 14). In 2013, Siemens works in an Enterprise 2.0 mode, that blends network structures with centralized project and portfolio offices

(Siemens, 2013b, pp. 7, 8). In 2017, Siemens places its key technology innovation in start-up organization next 47, also called Innovation AG and previously called Siemens Venture Capital. The innovations in 2017 cover: distributed electrification; autonomous machines; connected e-mobility; artificial intelligence; blockchain applications (Siemens, 2017d, p. 5). Siemens Venture Capital identifies (Siemens, 2019f) and finances young companies worldwide during their start-up phase, and provides established companies with additional capital for their growth plans during the expansion phase. Venture capital is important because it assumes the high risk involved by innovations. Siemens is rated among the top ten venture capital providers in the world. Siemens next 47 supports start-ups along the entire venture lifecycle: incubation, acceleration, growth, transfer and exit (Siemens, 2016c, pp. 8). Next47 will be established as an independent entity which offers freedom to experiment, to innovate and to grow in an early stage of the market development (Siemens, 2016c, pp. 8). To that end, Siemens uses all available options: builds, buys and partners to enable tomorrow's successful and profitable companies (Siemens, 2016b, pp. 4). Siemens' dedicated team of experts forms a bridge between the start-up world and the Siemens ecosystem (Siemens, 2016a, pp. 16). Within next 47, there are three organizations that manage start-ups: Technology to Business, Novel Businesses, Technology Accelerator (Siemens, 2016c, pp. 15). Siemens Technology to Business brings externally developed technologies and turns them into innovative Siemens products and technologies. Siemens Novel Businesses takes disruptive business opportunities and transforms them into innovative Siemens businesses. Siemens Technology Accelerator turns innovative Siemens technologies and exists them into innovative businesses outside Siemens. Siemens places future core technology in start-ups, such as artificial intelligence, autonomous machines, connected e-mobility, distributed electrification, blockchain applications. In Siemens' digitalization strategy, internal effort spent for innovation is called digital capabilities (Siemens, 2015a, pp. 7). From a performance management perspective, in Siemens' annual reports, innovation has been measured deliberately in the One Siemens strategy by the annual research and development expenditure; number of research and development staff, in all and by categories; number of patents or similar achievements. In the past decade, Siemens has been ranked by Boston Consulting Group as one of the most innovative companies in the world.

Siemens achieves technology invention in open networks. Siemens complements technology invention with business models. Siemens asserts innovation in the 21st century is created not just by new technologies. Business models also have what it takes to turn the rules of entire industries on their head (Siemens, 2017c). Technology invention and business models are the criteria used by Siemens to select innovation ideas in internal and external idea contests. At the concept and selection stage of the innovation lifecycle, the Open Co-Ideation guideline shapes innovation processes (Siemens, 2014b). According to Siemens, the method has been used since 2009 (Siemens, 2014b). Open Co-Ideation involves several steps to choose ideas (Siemens, 2014b, pp. 17). The first step new ideas by community (guided within predefined framework). The next steps are idea discussion and maturation (supported by expert moderators) and idea pre-selection (through community and expert rating). The fourth step is validation (supported by expert moderators). The next steps are final selection of winner ideas (by high level management jury) and implementation. The Open Co-Ideation concept comprises three parts: the technology view, the business view and the customer value proposition view they create (Siemens, 2014b, pp. 20). The technology view refers to core technology electrification, automation, digitalization.

The business view comprises business intelligence and business innovation (Siemens, 2014b). The customer value proposition view includes business intelligence and business innovation. Customer value proposition may comprise key performance indicators or return on investment. Ideas may also be selected

Figure 4. Siemens' innovation lifecycle (source: Siemens, 2011)



that create value for Siemens. Open Co-Ideation is used by Siemens to approve and finance new ideas (Siemens, 2014b). The universal idea language is BizMo, the Siemens framework for business models (Siemens, 2014b). BizMo is the Siemens framework to innovate business models (Siemens, 2014b, pp. 20), and comprises the revenue module (how to generate business volume), the customer module (who are customers), the value proposition module (what is customer value), the investment and finance module (how to obtain capital), the cost module (what are expenses), the delivery module (how to be achieved). Siemens defines competitive advantage as value based innovation, a blend of innovation and business models (Siemens, 2017a). Innovation comprises: technology, know-how, patents, copyrights (Siemens, 2017a). Innovation comprises business models: value proposition, customers, prototype testing, business plan (Siemens, 2017a). At Siemens (2019g), customer value orients the portfolio and may be described by individual key performance indicators. At the Hannover Fair in 2020, Siemens reiterates customer demands in the form of key performance indicators drive their business (Siemens, 2020b, p. 9).

The innovation stages: innovation in core technology; innovation in business specific technology; business intelligence, business models and ecosystems are used to generate concrete key performane indicators. In 2016, this combination dsecribes not only the stages in the digitalization strategy, but the smart data business model (Siemens, 2016d, p. 13). This is used for Mindsphere. Since 2013, the same strategy is used for Product Lifecycle Management software industry catalysts, which combine core technology in Product Lifecycle Management software, business specific technology and process know-how, and an industry catalyst individual for each vertical industry (Siemens, 2013). The combination is ascertained by Siemens (2013) and CIMdata (2013) to create and deliver customers superior customer value compared to simple not customized Product Lifecycle Management software solutions. The overall strategy for Product Lifecycle Management software, Smart Innovation (Siemens, 2015), is to generate smart connected products across several vertical markets: autonomouc vehicles, autonomous energy systems, other smart connected products. They move innovation from incremental innovation to transformational innovation, based on smart connected products and new business models. Initiaing or responding to disruptive innovation is the key performance indicator for smart connected products (Siemens, 2015). Digitalization transforms the what and how customers innovate (Siemens, 2015). The next digital product is smart networked devices: distributed interacting autonomous devices that negotiate and coordinate processes (Siemens, 2016d). Smart networked devices are autonomous, interacting, local analytics and application enabled (Siemens, 2016d). Ubiquitous communication (Siemens, 2016d) in the form of Internet and Web 2.0 technologies and domain specific requirements, cross domain integration, semantics are added to form Webs of Systems. Since 2016, the key data performance indicators are enclosed in customer contracts (Siemens, 2016d, p. 12), which according to Siemens go by the following taxonomy: classical time and material maintenance; performance and outcome based contracting; network platforms. Performance contracts include key performance indicators. Outcome based contracts include flexible return on sales in any service condition. At Siemens, innovation is a combination of new technologies (core and business specific) and new ecosystem business models (Siemens, 2017e, p. 3). For instance, Siemens' Mindsphere functions in an open eco-system of: consulting or stratey partners; application developer; system integrator; technology provider; IaaS provider; connectivity developer (Siemens, 2017e, p. 9).

The concept and selection stage is the stage when Siemens decide show to use ideas from its internal or external network. For example, venture capital may be used to spin in start-ups, to scale start-ups into full companies or to sell them to venture funds (Cozmiuc & Petrisor, 2018a).

In the past, Siemens used venture capital for special external partnerships but currently only uses it to finance start-ups at all their lifecycle stages (Siemens, 2019f).

As ideas digitalization ideas mature, they become technology platforms and enablers al businesses used. Other sources show Siemens' digitalization strategy as a two-stepped approach (Siemens, 2016c, pp. 19). In Siemens, digitalization strategy, Siemens builds on common technology platforms, that provide the latest technology for all Siemens businesses; reduce technical complexity in the company; leverage synergies through scaling; ensure faster development (Siemens, 2016c, pp. 19). In order to bring this technology to business, Siemens uses customer proximity of operating units to develop applications; this brings know-how about the large installed bases of products and systems; deep know-how of customer processes and challenges; many existing applications that already generate value for customers (Siemens, 2016c, pp. 19). The digitalization strategy enables Siemens to create the initial achievements in digitalization, digital platforms all businesses share, like digital services and vertical software. Siemens' digitalization strategy furthermore includes Siemens' customer focus to tailor customer offerings, using Siemens' large installed base and customer access, Siemens' being the trusted partner for critical processes, Siemens' deep vertical know-how (Siemens, 2015a, pp. 3). Taken together, technology innovation and customer focus enable Siemens to propose customer concrete value, via performance indicators such as increased productivity and flexibility, shorter time-to-market, improved uptimes and lifetimes (Siemens, 2015a, pp. 2). Customer outcomes are included in customer contracts and comprise performance indicators with defined levels, such as higher availability, lower costs, increased performance, more security or return on investment for the whole solution (Siemens, 2016c, pp. 10). Siemens calls this technology go to market. An even more advanced type of customer contract is network platforms (Siemens, 2016c, pp. 14). Siemens leverages digital technology trends for concrete customer benefits (Siemens, 2016c, pp. 5). Siemens' digital platform, Synalitics, provides tailored digital services to all Siemens businesses (Siemens, 2016d, pp. 11). Product Lifecycle software (Cozmiuc and Petrisor, 2018c) is essential to Industry 4.0 in manufacturing. The technology may also be used in energy, buildings. Cyber-physical systems and Webs of Systems are key technology in manufacturing, Industry 4.0, and also in energy, as energy grids, and in smart cities.

As products, services or solutions are tailored to customers, projects are used. In the Enterprise 2.0 organization (Siemens, 2013b, pp. 7, 8) and in the Siemens innovation lifecycle (Siemens, 2011, pp. 36), as ideas mature, projects are used in a Project and Portfolio Management organization structure (Siemens, 2014c, pp. 9-11). Projects are contracts with Siemens' customers (Siemens, 2019b) to supply existing products, services and solutions in large or medium-sized orders. Projects have phases, workpackages, milestones, plans that show how customer offerings are tailored to individual customers and marketed (Siemens, 2014c, pp. 11). Projects are approved by Portfolio Management Offices (Siemens, 2013b, pp. 7, 8; Siemens, 2014c, pp. 9-11) and financed by Siemens Financial Services using debt and equity capital (Siemens, 2019e). Siemens (Siemens, 2014a, pp. 7-15) shows concrete examples of how smart data was used in projects in various Siemens businesses with individual customers: energy, healthcare, mobility, smart cities.

It is also at this stage Siemens provides Internet of Things integration services. More recently, Siemens Management Consulting has given customer tailoring a new strategic edge (Siemens, 2018b, pp. 13). Siemens Management Consulting Services are customer market specific. They provide a holistic customer offering: consulting, design and prototyping, implementation (Siemens, 2018b, pp. 13). It is a dedicated unit for customer's digital transformation and Internet. Siemens Management Consulting relies on Siemens' global access to customer assets, on its installed base and vertical domain know-how (Siemens, 2018b, pp. 13).

Siemens Management Consulting has become Siemens Advanta, where the business to society concept (Siemens, 2020) involves employees in charge for customer statisfaction via the value hacker program (Siemens, 2017g). Where concrete key performance indicators are measured for customer, they are used to measure employees' performance and reward customer value creation on employee level (Siemens, 2017g; Siemens, 2020). Digitalization key performance indicators become objectives for employees, depending on the attiment of which employees get rewarded.

This is to work as incentive and performance appraisal for employees (Siemens, 2017g; Siemens, 2020b). Employee also receive ownership culture targets (Siemens, 2017g).

One of Siemens' business models is pay-per-use (Siemens, 2017b, 2019c). Designed to enable the acquisition of a system or an item of technology or equipment, this will usually be some form of finance lease, operating lease, rental or hire purchase arrangement. When use cases exist to shape solution architecture and make value predictable, pay-per-use business models tend to be employed (Siemens, 2017f). Customer business value will take the form of customer benefit, which is market specific (Siemens, 2017f). Examples are in manufacturing (Siemens, 2017f), where customer benefits are: reduced costs, via reduced energy consumption, compressed R&D and product development; increased productivity, via automated processes, preemptive service, higher production capacity; international competitiveness, via reduced time-to-market, enhanced quality and reduced faults; customer choice, via more rapid setup agility, mass consumption. The payment for the technology and its benefits is pay-per-use (Siemens, 2017f, 2019c, 2019d). This allows the benefits of the equipment's use to be broadly matched to payments over time (Siemens, 2017f, 2019c, 2019d). In 2016, Siemens (2016b) identifies three types of customer contracts: traditional contracts, performance based contracts, network platforms. One form of value-based contracts are performance contracts (Siemens, 2016b, 2017f). These performance contracts enclose performance increase stipulations for identifiable solutions, the listed benefits in the business case. Performance increase is predicted and guaranteed to the customer in this contract (Siemens, 2016b, 2016c, 2017f, 2019c).

Siemens moves business models from managed service to software as a service, availability as a service, insights as a service, outcome as a service (Siemens, 2018d, p. 16). Business models are changed from transactional to outcome based partnerships (Siemens, 2017f). Siemens also writes about two service models: pay-per-use a mature business model already described here, and pay-per-outcome business models (Siemens, 2017b, 2017f, 2019a). In all, paying for outcomes is suitable in several situations (Siemens, 2017f): digital enablement of customers' processes; the fast pace of digitalization and the rise of software-driven technology development; digitalized equipment and tech platforms allow outcomes such as shifts in productivity (cost per unit), product/service customization that contribute to competitiveness; the shifting of non-core competencies to suppliers, such as digital technology suppliers. Pay-per-outcomes (Siemens, 2017b, p. 8; Siemens, 2019a) is about the expected outcomes the technology makes available. Savings or gains from access to the technology are used to, in effect, meet monthly payments, making the technology cost neutral for the manufacturer over time. In pay-per-outcome business models, payment is based on return on investment (Siemens, 2017f, 2019a, 2019c). This means that investment the customer makes will be matched with the target return on investment which Siemens commits to. Siemens defines customer outcome on a market specific basis (Siemens, 2017f). Since 2015, Siemens has made public the use of value-based contracts, which include performance based contracts and outcome based contracts (Siemens, 2015b, p. 11; Siemens, 2016b). In 2016, an example of an outcome based contract was given by flexible service in any market condition. In 2017, Siemens explains pay-per-outcome business models to integrate technology and finance to deliver outcome-based solutions (Siemens, 2017f).

CONCLUSION

These key value drivers are a Siemens mantra and reflect financial value drivers such as investment in the EVA formula, key non-financial value drivers innovation and customer focus, the key strategic directions in Siemens One (the group strategy), the organizational structure, Siemens' digitalization strategy, statements about the way digital services are created, the guideline to approve innovation ideas, the key value drivers on the long-run in performance management, the key value driver in Siemens' philosophy, the value creation cycle in performance management. In the 1990s approach to value drivers, alligning the organization to strategy implements it effectively. Using 2010s tools, Siemens' digitalization strategy is a business model, and it is using business models that the strategy is approved at Siemens. Customer value proposition is performance or return on investment. Internal resources – core technology, business technology, customer industry know-how and an eco-system of business partners are main costs. Customers are large or medium sized businesses, the administration, and customer relationships are close. Siemens strategy highlights New Economy trends: digitalization is created using networks or business eco-systems in open innovation. Financing reflects decisions under uncertainty, using venture capital in an open network structure. In the Enterprise 2.0 Siemens management model, it is only later on, as ideas mature, that innovation is realized in projects, which are approved using a Portfolio Management Office and equity and debt capital. Both in theory and in the practice of Siemens, networks, business models and venture capital work at early stages of the product lifecycle: ideation, business development, discovery. As ideas mature, planning becomes possible. As in the discovery driven planning model of

McGrath and MacMillan in 1995, in an uncertain world, stages of discovery and hypotheses validation are necessary before a business plan can be drawn up. Management theory has posed pre-operations projects are to be treated as investment in intangible assets. With the lean start-up movement (Blank, 2013; Riess, 2010), business model discovery, in open innovation start-up networks, financed by venture capital preceed project management structures. Business models are as a service models, where the customer value proposition is enclosed in customer contracts with pay per use or pay per outcome terms. The business models match theoretical descriptions. As in the literature review, selling products and services shifts to selling solutions with concrete value stipulations or just the value enhancements without solution definition. Value becomes the condition from business to business relationships. As employees receive targets for shareholder value and customer value both, they become motivated to implement digitalization related targets. Where digital transformation is radical, value based management becomes an important competency internally and externally.

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Chapter 14
Artificial Intelligence:
The Missing Link Between Leadership and Knowledge Management

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ABSTRACT

Machines have emerged as intelligent players and are set to replace skilled practitioners in various fields. So, what would be a leader's contribution be if machines do the decision making? The chapter addresses this question by proposing that artificial intelligence will act as a catalyst enabling managers and leaders in the process of knowledge management. Further, the chapter aims to bring together the three constructs of leadership, artificial intelligence, and knowledge management and try to theoretically establish a relationship among them. The work is immensely relevant to the Indian context given the fact that at its current stage of development, artificial intelligence has the potential to add $957 billion to the country's economy by 2035. Thus, the chapter will emphasize the relationship between leadership and artificial intelligence and how it supports knowledge management in organizations and influences its everyday decision making.

INTRODUCTION

Times are tough for organizations in today's business scenario. The decrease in funding from traditional revenue streams coupled with intensely competitive markets have taken their toll on them (Santora *et al.,* 1999). This has forced organizations to search for the competitive edge within and the answer lies in leadership. Leader is a person who influences the behavior, attitude, and values of the employees towards the long-term goals of an organization. King (1990) tried to bring together the previously proposed theories on leadership under one roof and developed an evolutionary tree of leadership theory. Nine

DOI: 10.4018/978-1-7998-2402-2.ch014

phases of evolution of leadership were identified starting from the first era of personality and traits to the ninth era of transformational leadership. Authors have also indicated that leadership is a significant determinant in the performance of organizations thriving on research and development (Keller, 1992). The study found that leadership predicted higher project quality, especially for research and development related projects. Findings suggested that effective leadership inspires a sense of mission and objective, stimulates out of the box thinking and encourages people to do something more from what they are normally required to do. Talking of leadership, research suggests that one of the key attributes of effective leadership is managing knowledge in a way that leads to creating and sharing knowledge within an organization and this type of leadership style is defined as transformational leadership (Chi *et al.,* 2012). Effective management of knowledge is being considered as a critical success factor for contemporary organizations. Previous works have recognized the immense importance of knowledge management in organizational performance, whether contingent or universal (Alavi & Leidner, 2001; Becerra- Fernandez & Sabherwal, 2001; Kalling,2003). An indispensable part of a leader's responsibility is to take decisions. There was once a time when machine was considered a 'moron' and the decision maker was supposed to be bright to take informed decisions. But today machines have emerged as key players and are all set to replace skilled practitioners in various fields. So what would be a leader's contribution if machines do the decision making? The present work of research addresses this question by bringing together the two critical success factors of leadership and knowledge management and a contemporary concept of artificial intelligence and tries to understand how leaders in contemporary organizations can better manage knowledge with the help of artificial intelligence.

BACKGROUND

Over the years, there has been extensive research on leadership in different contexts and various theoretical foundations (Hogan & Kaiser, 2005; Horner, 1997; Yukl, 1989). These studies have brought out the phenomenal importance of leadership in organizations terming it as the single most important issue in human sciences. The studies clearly bring out the difference between good and bad leadership by suggesting that good leadership promotes effective team performance while bad leadership degrades the quality of life of everybody associated. Hence it can be concluded from these studies that leadership is hugely consequential for the success of not just organizations but also its employees. Not just well-being and success of employees, leadership has a direct bearing on the creativity and innovation capabilities of employees. This has been substantiated by previous studies where leadership has been studied as an umbrella terms and various mediating and moderating variables have been studied under the holistic term of leadership viz., transformational, transactional, empowering, authentic, ethical and servant leadership (Chen & Hou, 2015; Chiniara & Bentein, 2016; Hughes *et al.,* 2018). All the above studies examine the consequential importance of leadership whether ethical or servant, for creativity and innovation in organizations, for employees and overall achievement of organizational outcomes. Further mediating variables like attentive focus on employees and climate for innovation have been identified as catalysts which enable leadership in organizations to influence positive outcomes.

All these studies mentioned above, focus on leadership and its effects on organizational outcomes, performance, creativity, and innovation with the help of mediating and moderating factors. These are more or less generic factors which are applicable in all times. But if we look at the changing times and the changing ways in which organizations function, especially with the rising popularity of knowledge economy, the nuances of leadership will be very different as compared to what it was a couple of decades earlier. This work of research brings out the critical role of artificial intelligence as the new age factor which acts as a catalyst in enabling leadership to effectively influence knowledge management which is yet another important facet of knowledge economy.In a knowledge economy, machines are increasingly going on to become substitutes for human capabilities in many fields. As a result, there are machine -based intelligent technologies available for making informed decisions. Hence this chapter tries to bring together the three constructs of leadership, artificial intelligence and knowledge management and postulate a relationship among the three, thus proposing a conceptual model relevant to leadership in the changing times.

LEADERSHIP AND KNOWLEDGE MANAGEMENT (KM)

Organizational knowledge includes all the tacit and explicit knowledge that individuals possess about products, systems and processes and the explicit knowledge codified in manuals, databases and information systems. It also includes the tacit knowledge that is shared collectively in the firm in the form of routines, cultures and know-how embedded in social processes.

Outsmarting rivals in an immensely competitive market requires creating and managing knowledge effectively through organizational mechanisms. One of the most important organizational mechanisms is leadership practices. Hence performance of a firm depends of effectively managing knowledge through suitable styles of leadership. Many studies have brought out the importance of leadership and knowledge management in different forms. Some talk of mediating effects of knowledge management practices in the relationship of leadership and innovation while others speak of the significant relationship between leadership and knowledge management. Knowledge management (knowledge transfer, knowledge application and knowledge acquisition) has been studied as a mediating variable between leadership and innovation in organizations. Innovation was categorized into product and process and different dimensions of knowledge management were related to different categories of innovation. Some authors also specifically focused on particular styles of leadership and their relationship with knowledge management. They suggest that that the success of knowledge management systems depends a great deal how well leaders can balance between transactional and transformational behaviors. While transactional behaviors work within the current culture of the organization following the rule book, transformational behavior allows to adapt the current culture and align with the new vision but both have a positive relationship with knowledge management practices in organizations(Analoui *et al.,* 2013;Birasnav *et al.,* 2013; Crawford, 2005; Donate & Sanchez de Pablo, 2015; Nguyen & Mohamed, 2011; Noruzy *et al.,* 2013; Singh, 2008). It was suggested that people who are responsible for managing knowledge in organizations should assume particular leadership styles. But this work of research suggests quite the opposite. It suggests that all leaders, whether transactional or transformational, need to manage knowledge effectively in organizations. Leaders play a crucial role in creating a learning culture in organizations which has a direct bearing on knowledge management. They must attach high value to knowledge management, encourage questioning through empowerment, build trust and enable experiential learning of tacit knowledge. This is also supported by previous literature (Crawford, 2005; Noruzy *et al.,* 2013; Stonehouse & Pemberton, 1999). Study by Donate and Pablo (2015) brought out the role of a specific type of leadership- knowledge oriented leadership in knowledge management initiatives that seek to achieve innovation. Knowledge oriented leadership refers to the process of leading through the knowledge lens. This implies attaching knowledge management a prominent role in the firm in order to seize opportunities to innovate. Knowledge oriented leaders should champion the development of knowledge management initiatives and promote the best knowledge management practices in organizations. The study suggests that these knowledge management best practices like KM transfer, KM storage, KM application and KM creation act as mediators between knowledge-oriented leadership and performance. The role of knowledge management has not been sufficiently explored in context to the Indian literature except for a few studies here and there (Lakshman, 2009; Singh, 2008). Using the structured content analysis method Lakshman (2009) tested the relationship between the knowledge management capabilities of the CEOs and organizational effectiveness. Knowledge management. A new aspect of knowledge management was introduced in the study viz., customer focused knowledge management and it was established that the extent to which leaders indulge in knowledge management vis-à-vis customers determines organizational effectiveness to a great extent.

As mentioned earlier, decision making is an integral part of a leader's job. Knowledge management has also been studied as a moderator between leadership and rational decision making. These decisions could range from minor issues of day to day operations to strategic decisions involving major changes. Leaders have to do it all. And the outcome of these decisions determine the success or failure of the organization in the long run. It has been suggested that knowledge management acts as a catalyst which enables leaders in takingrational and informed decisions (Riaz & Khalili, 2014). Managing knowledge can provide organizations with sustainable competitive advantages.

Leaders have a crucial role to play on knowledge managementbecause they provide the necessary vision and motivation and facilitate the systems and structures at all levels of organization that enable the conversion of knowledge into competitive advantages.They create the conducive conditions that allow people to exercise and cultivate their and skills and contribute their individual knowledge resources to the pool of the organization's knowledge Moreover, there are three key processes of managing knowledge: creating, sharing and exploiting and leaders are central to each of these processes. It has been suggested in literature that transactional leaders are better at exploiting knowledge while transformational leadership style is better as far as creating and sharing knowledge is concerned. But all in all, it can be said that leaders and leadership have a significant influence on knowledge management in organizations. Also, maximum studies conducted so far talk of particular styles of leadership viz., transactional and transformational and establish the relationship between these specific styles of leadership and knowledge management. A few other studies talk of participative style and directive styles of leadership. But very few studies have established the relationship between leadership as a generic construct and knowledge management. Moreover, as mentioned earlier, there are negligible studies that establish relationship between leadership and knowledge management in context to India. The current work of research will contribute to that body of work.

LEADERSHIP AND ARTIFICIAL INTELLIGENCE

Technological advancements have brought a massive change in the way business organization functions. Be it development of e-commerce, advancements in data analysis, utilization of social media for product promotion and what not, the applications of information technology in various business areas are countless. Another such application area of IT in business organizations is the deployment of Artificial

Intelligence (AI) in business decision making and data analysis. AI is the buzz word which is making its presence felt in modern day organizations.

The AI concept can be defined as systems that are intelligent and which have the capability of learning and thinking. It encompasses an array of tools and techniques that perform some specific function that eases the manager's tasks somehow and provide them with deep insights about data they are operating upon which further assists them in decision making. The techniques are designed using various associated concepts like neural networks, natural language processing, genetic algorithms, and deep learning to name a few. The business organizations of today have realized the potential AI has and the impact it can have on streamlining the organizational processes. Hence, efforts are being made to align and streamline the business processes using AI with an objective to save human time and effort. Unlike the previous waves of new technology, which have largely replaced blue-collar and service jobs, AI will be all pervasive in organizations right from the C-suite to the front-line managers. Every manager, right from CEOs to front line managers will have to assume the role of a leader. This supports the objective of this paper of taking leadership as a generic concept and not only transactional and transformational leadership which are mostly associated with the C-suite executives. Same thoughts are reverberated by Smith and Farquhar (2000) who proposed that everybody is a contributor when it comes to knowledge management systems in organizations. The study also said that to be successfully applied for knowledge management, the AI technology must work for a broad population of people. Hence we can say that AI is to be mastered by all knowledge workers and all those who do it are leaders in their own way, not just C-suite executives, who are mostly associated with transformational and transactional qualities.

A study by (Plastino & Purdy, 2018) concluded that the three industries- information and communication, manufacturing and financial services sectors – will likely realize the biggest gains from AI. Also, the three industries- manufacturing, professional services and wholesale & retail will see the maximum AI impact on industry output. Also, it suggests that in order to realize the full potential of AI, top executives of organizations will have to become the primary AI champions. Leaders in any business organization are the people of top management, members in board of directors, and policy makers. They are responsible for taking decisions in the organization and creating a set of well-defined business processes. The business leaders have to ensure that every task in the organization is carried out by following those steps of business processes. Now here, the role of business leaders become significant because it is them who are the policy and decision makers in the organization and it's not easy to bring a sudden change in the way an organization functions. The business leaders have to be very open minded to feel and realize the potential AI has and what it can bring to the table for them. The leaders' first need to get themselves convinced on AI deployment and then they need to influence departmental heads and make them prepare for this massive change in the organizational functioning/operations.Business leadersneed to create an AI roadmap for their organizations. Essentially, this map should be a plan to grow the business, incorporating AI as a critical enabler. To do this, leaders and strategic planners from across the business will need a sufficient grasp of AI to effectively transform existing business plans, define key decision points and guide appropriate investment decisions.

Literature review suggests that companies can explore enterprise systems to comply with corporate governance reforms which can lead to enhanced performance (Lazarides *et al.,* 2009).This statement can be taken forward in the context of leadership and artificial intelligence by proposing that leaders of an organization can rely on the power of artificial intelligence in terms of the decisions taken in order to enhance performance. Corporate governance is closely related to leadership while artificial intelligence allows ERP vendors to improve ERP systems using machine learning and natural language interfaces

(Chen *et al.,* 2007). This comes in the wake of financial scandals and information system breakdowns like Enron and WorldCom which have rocked the corporate world previously. Hence it was proposed how proper designing of enterprise resource systems can benefit corporate governance.

Previous studies have tried to assess the benefits and limitations of AI when it replaces human leadership in decision making. While the studies brought out certain advantages that emerge out of automated decision making, they also threw light on the negatives and their implications that come along with the scenario. Authors brought together leadership and machine learning theory and proposed that it is advisable to delegate decision making to an AI based decision making system, it needs to be subjected to important safeguarding conditions (Parry *et al.,* 2016).

It can be said that a big advantage of AI based decision making system is that these systems do-not suffer from exogenously imposed constraints like religious, cultural etc. It enables better visualization of latent patterns in the available information without any cognitive bias. On the other hand human decision making always has a constraint in terms of perception, attitude, values and ethics which can sometimes come in the way of rational decision making. All in all it can be said that decision making in case of AI based system will be much more objective as compared to decisions taken by human leaders. While the disadvantage of AI based decision making systems is also its objectivity because sometimes it can lead to balancing quantitative targets against qualitative values. Therefore they tend to overweigh objective computable criteria and under weigh the subjective, non computable criteria. Also establishing accountability is a drawback in AI based decision making systems. But the major advantage of an AI based decision making system that cannot be overlooked is that it is able to look through several layers of complexity and identify latent patterns in data originating from disparate and often contradicting sources.

Dewhurst and Willmott (2014) support the importance of AI but conditional. The argument put forward was the advances of brilliant machines will transform the lives of senior executives for sure but only if proper groundwork is done to create datasets worthy of the most intelligent machines. The same thoughts were reiterated by Jarrahi (2018) who put forward a similar argument and proposed that leaders as humans can come together with AI based systems on the table and the intelligent systems should be designed in a way so as to complement human expertise and leadership.

ARTIFICIAL INTELLIGENCE AND KNOWLEDGE MANAGEMENT

Artificial Intelligence (AI) is concerned with understanding the nature of human intelligence and designing intelligent artifacts which can perform the tasks which, when performed by humans, are said to require intelligence (Srivastava, 2018).`

AI and its impact are all pervasive throughout the economies of the world. Like any other major technological development, AI will also come with own set of merits and challenges. While on one hand there are applications being developed or in process of development to improve quality of decision making in fields like healthcare, e-commerce, education, law and finance, on the other hand there is also skepticism that adoption of AI based decision making systems may lead to loss of jobs. Similar thoughts are reiterated by Srivastava (2018) who brought out in his study that while several countries have already chalked out their strategies pertaining to AI and how to churn out maximum benefits from it keeping the disadvantages at bay, India is yet to formulate its strategy. We can say that India has a huge opportunity with AI based decision systems since the strong political will of the government will act as an emphatic push in this area. AI can be crucial to certain major programs of Government viz. Digital India, Make in India and Skill India. This further makes the current study relevant in the given scenario.

Study by Leary (1998) analyzes the relation between artificial intelligence and knowledge management and looks at the use of AI in knowledge management but from a slightly different perspective. It focused on AI related technologies as knowledge bases and ontologies. The study brought out that there are similarities between AI and knowledge management because knowledge management systems make use of knowledge bases, but for both human and machine consumption. Hence this study can be said to be a reverse engineering of the previous study which says that AI assists in knowledge management while Leary(1998) brought out that for AI based decision making system also we require knowledge bases and ontologies.

Previous studies tried to develop a roadmap for knowledge management and along the way also highlighted how AI technology can be applied in knowledge management. Artificial intelligence was envisaged as one of the key building blocks for developing and advancing this field of knowledge management. AI was proposed as a critical factor in pushing the basic tenets of knowledge management which are knowledge sharing, transforming individual knowledge into collective organizational knowledge and reincarnating organizations into knowledge organizations. These studies clearly bring out that the technology developed by the AI community is required for successful knowledge management. In this process, the study brought out certain existing practices in knowledge management and certain future scenarios of knowledge management enabled by artificial intelligence. Also, using a knowledge value chain concept framework within the context of a knowledge company, the potential application of AI was investigated (Fowler, 2000; Liebowitz, 2001; Smith & Farquhar, 2000). Similar thoughts were carried forward in a study by Hoeschl and Barcellos (2006) where they tried to analyze how artificial intelligence aids in the process of effective knowledge management. They suggest that AI provides a better form to represent all the knowledge that is contained in our minds. We live in times of information paradox in a way that on one hand as we have access to enormous information, on the other, the capacity and forms of processing that information is very limited. AI aids the process of knowledge management to enable informed decision making. Hence we can conclude that to produce strategic information (knowledge) from crude information (data) we need an organizing element. And that catalytic element is artificial intelligence. Huang and Hu (2003) worked on the same lines and applied artificial intelligence techniques within traditional knowledge frameworks to support organizational knowledge management and decision making.

Plastino and Purdy (2018) suggested strategies for efficient AI adoption. They identified five practices that successful leaders will need to master in order to manage knowledge in organizations effectively

Practice 1: Leave Administration to AI
Practice 2: Focus on Judgment Work
Practice 3: Treat Intelligent Machines as "Colleagues"
Practice 4: Work Like a Designer
Practice 5: Develop Social Skills and Networks

To prepare themselves and their organizations for the kinds of human-led work that will gain prominence as technology takes on more routine tasks, leaders must explore early. To navigate in an uncertain future, managers must experiment with AI and apply their insights to the next cycle of experiments.

AI will bring new criteria for success: collaboration capabilities, information sharing, experimentation, learning and decision-making effectiveness, and the ability to reach beyond the organization for insights.

AI has also been conceptualized as a constituent of what has been termed as knowledge warehouse. Knowledge warehouse was proposed as a conceptual extension of data warehouse. Knowledge warehouse was proposed not only to capture and retrieve data but also share knowledge throughout the organization. Essentially knowledge warehouse will provide the same service for knowledge that data warehouse provides for data. Artificial intelligence was proposed as the enabling factor or constituent in the process (Nemati *et al,* 2002).

CONCEPTUAL GAP

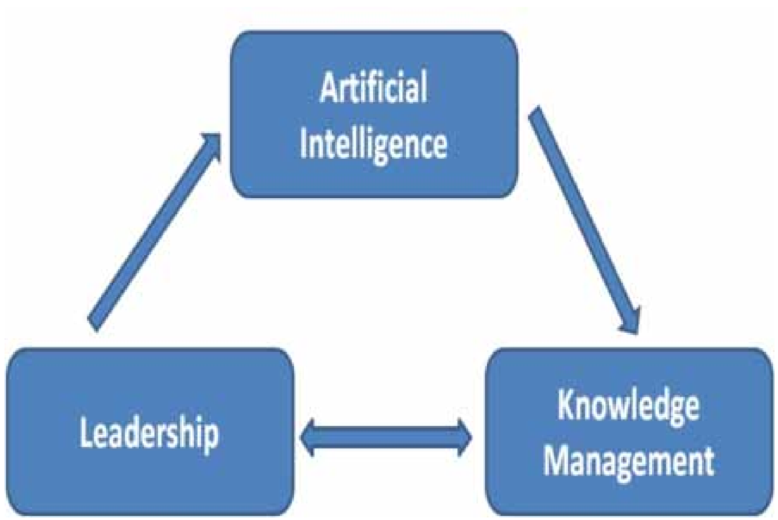
Maximum studies done on leadership and knowledge management talk of particular styles of leadership and their influence on knowledge management capabilities of organization. Relationship between the knowledge management capabilities of the CEOs and organizational effectiveness was tested in these studies. More specifically, these studies aim to examine the influence of transformational and transactional leadership behaviors on knowledge management. Studies have also dealt with charismatic leadership and contingent reward leadership behavior and their influence on knowledge management practices. Studies also suggested that when primary knowledge managers adopt transactional and transformational leadership styles, there is a noticeable increase in the knowledge management activities in the organizations. Studies have also examined the relationship between transformational leadership and product and process innovation. While knowledge transfer and application were tested as the mediator between transformational leadership and product innovation and knowledge acquisition and application were shown to act as a mediator between transformational leadership and process innovation. While empirical investigations have been conducted to test the relationship between transformational leadership, organizational learning, knowledge management and innovation, other studies established relationship among transformational leadership, transactional leadership, rational decision making while analyzing knowledge management processes as the moderating factor (Analoui *et al.,* 2013;Birasnav *et al.,* 2013; Bryant, 2003; Crawford, 2005; Dewhurst & Willmott, 2014; Lakshman, 2009; Nguyen & Mohamed, 2011; Noruzy *et al.,* 2013; Riaz & Khalili, 2014). All these studies majorly focus on two particular styles of leadership viz. transformational and transactional and their relationship with knowledge management practices in organizations. The current work of research focusses on leadership as a generic construct which includes not only C-suite executives but every employee in the organization in the capacity of a knowledge worker. Right from those people who are at the top of the organization’s hierarchy to the front-line managers, every employee has to embrace AI and every employee has to assume the role of a leader when indulging in knowledge management practices. In this sense, the current research tries to theoretically broaden the scope of the role of leaders in managing knowledge in organizations.

Most studies examined have brought out the consequential importance of leadership whether ethical or servant, for creativity and innovation in organizations, for employees and overall achievement of organizational outcomes. Further mediating variables like attentive focus on employees and climate for innovation have been identified as catalysts which enable leadership in organizations to influence positive outcomes. These studies have focused on leadership and its effects on organizational outcomes, performance, creativity, and innovation with the help of mediating and moderating factors. These are more or less generic factors which are applicable in all times. But if we look at the changing times and the changing ways in which organizations function, especially with the rising popularity of knowledge economy, the nuances of leadership will be very different as compared to what it was a couple of decades earlier. This work of research brings out the critical role of artificial intelligence as the new age factor which acts as a catalyst in enabling leadership to effectively influence knowledge management (Chen & Hou, 2015; Chiniara & Bentein, 2016; Hughes *et al.,* 2018). This study brings out AI as the missing link between leadership and knowledge management.

Lastly there are no studies which establish a conceptual relationship between leadership and knowledge management with AI as the catalyst in context to India. All these conceptual gaps are the major drivers behind the current study.

PROPOSED MODEL

Figure 1. The proposed model



On the basis of the conceptual gap identified, the present research paper proposes a model depicted in Figure 1 where artificial intelligence acts as a catalyst enabling organizational leaders in the process of knowledge management. This also paves the way for an empirical analysis for further building on the theoretical contribution made by the present work of research. The paper aims to bring together the three constructs of leadership, artificial intelligence and knowledge management and try to theoretically establish a relationship among them.

The evolution of the concept of leadership from being a process, person and behavior to transformational leadership creates a plausible link between leadership machines, since automation, artificial intelligence and computer-based simulations represent a paradigm change in a digital economy. Also, leadership and artificial intelligence will come together and support knowledge management in organizations and influence every day decision making. Literature also suggests that synergies between artificial intelligence and corporate governance can lead to a very stable corporate environment and improved organizational performance. This provides a fertile research ground to link machines and leaders and their major role in the corporate governance aspect of any organization. Also, there is literature available in context to a leader's role in knowledge management in the Indian scenario, but hardly any literature that links leadership with artificial intelligence.

CONCLUSION

This paper has tried to consolidate previous works done on leadership, artificial intelligence and knowledge management and tries to establish a relationship among the three, where artificial intelligence has been conceptualized as the missing link between leadership and knowledge management. Artificial intelligence is a new trend making the rounds in organizational circles, especially India. The work is immensely relevant to the Indian context given the fact that at its current stage of development, artificial intelligence has the potential to add $957 billion to the country's economy by 2035. Also given the rising popularity of digital economy and knowledge economy, India has the capability to emerge as a major player in the future of artificial intelligence. The paper also paves the way for an empirically tested research model that can be proposed for organizations where leaders can utilize artificial intelligence as a catalyst to up their game in knowledge management and organizational decision making. Lastly the paper conceptually answers the question that the authors started with "what would be a leader's contribution if machines do the decision making? Leaders will leverage the power of intelligent systems to effectively manage knowledge.

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Chapter 15
Mind the Gap:
It's About Digital Maturity, Not Technology

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ABSTRACT

The COVID-19 pandemic has amplified the influence of digital transformation on business entities. Although it is becoming more feasible to invest in digital technologies due to their swift progression in terms of reaching higher technical capabilities and better pricing levels, some companies could not achieve expected improvements in their business results. On the contrary, a remarkable number of companies had the opportunity to develop their businesses by leaps and bounds. Academic research on the subject revealed that a company's digital maturity level is directly related to the company's success and progress in sustainability issues. In this chapter, the concepts of cross-functional collaboration and corporate digital cultures, which are the basic components of achieving digital maturity, which must be coordinated together, are elaborated, and an applicable roadmap proposal is created.

"When the digital transformation is done right, it's like a caterpillar turning into a butterfly, but when done wrong, all you have is a really fast caterpillar." - George F. Westerman, Principal Research Scientist with the MIT Sloan Initiative on the Digital Economy

INTRODUCTION

During the last few years, with the incoming support from swift progression of digital technologies, and their applications, technology has elevated the pace of digitalization or digital transformation to another level in daily business activities; therewithal, the Covid-19 pandemic has amplified the influence of the digital transformation on business entities. The challenge for a business or a company is not only to

DOI: 10.4018/978-1-7998-2402-2.ch015

remain competitive, but also to facilitate means of growth by harmonizing the new and the traditional tools, and maybe melting them in the same crucible to generate even better modalities in the pandemic hit business environment.

Some companies take it for granted that, digitization is the sole requirement for success, however this is not enough for remaining competitive, growth or sustainability as obtaining digital technologies is not a difference making competitive edge. Advantages of digital technologies can be experienced with a limited amount of contribution; unless they are supported, and even preceded with a strategic mindset transformation. In other words, attainment of a mindset transformation in a working digital transformation process requires designing for digital maturity, which will be a part of a business strategy formulation, cultural development, and it will not be limited to technology deployment.

As of today, business world still does not have a fixed recipe neither to be nor to keep sustainable, especially during the turbulent times, and during discontinuity as lately being experienced due to Covid-19 pandemic (Miceli et al., 2021). Throughout the chapter, digital maturity will be defined, and its role in digital transformation on business entities will be explained, by trying to emphasize its importance, and analyse its effects aiming to create a roadmap that can be used in business strategy formulation to foster and facilitate sustainability of corporations.

Technological advancements and customers' enthusiast to use technology driven facilitators of interaction accompanied by products and services - or new customer expectations push digital transformation through. Subsequently, corporations head towards developing digital capabilities, not only to confront the competition and even forging ahead, but also to transform their entities (Kane et al., 2017b; Rossmann, 2018; Saliola, & Islam, 2020). Although, this propulsion of *"killing two birds with one stone"* might look like a spontaneous outcome of the requirement of agile organizational structures; but actually, it is a compulsory desire to achieve organizational flexibility (Westerman et al., 2014; Harvard Business Review [HBR], 2020b). At such a point in a company's history, this kind of an action actually ignites the journey to reach digital maturity in which organizational design is to be redefined simultaneously.

Positioning digital transformation with a higher priority and rushing for quick results is regarded as a remedy for achieving resiliency (HBR, 2020b). One of the most used methods for big companies is to acquire a company that has potential or has proven to be promising in e-commerce business (Kane et al., 2017b) as a practical method of becoming a digitized firm. However, being impelled by evolving digital technological capabilities offered in the market, this method usually becomes obsolete after a while, and organizations need to update their organizational structures and transform both themselves and the touch points and the interfaces with their stakeholders, in order to not to lag behind the accelerating competition and the speed of the consumerization of technology, and to in order to keep resilient and agile (White, 2012; Miceli, 2021).

The most sought-after technologies of a digitized business environment have not changed so much apart from newcomers such as Virtual Reality (VR), Augmented Reality (AR), Machine Learning (ML), Artificial Intelligence (AI), 5G, Internet of Things (IoT), blockchain, and automated decision support systems (Kane et al., 2017b; Neugebauer, 2019, HBR, 2020b; HBR, 2020c), since White (2012) has listed them as adapting to a mobile first focus, big data, cloud computing and search-based applications. Availability of these technological tools changes the way companies do their business which results in organizational productivity and gives room to deal with more value-added activities and finding new ways of determining value chains and inter organizational relationships (Cennamo et al., 2020).

The methodology of this chapter is to unclose the term digital maturity regarding digital transformation; first by highlighting prominent digital maturity models including the concepts and main dimensions of contemporary Industry 4.0 maturity models and indices. After these dimensions are exhibited, the chapter will define, what digital maturity is, explain its role in digital transformation, why we need it, and will offer a path to facilitate a nurturing atmosphere as a starting point in becoming a digitally mature company with a focused perspective on psychological asset (human)-related organizational dimensions of digital maturity. Digital maturity level/stage assessment is to be mentioned with a brief description to concentrate on the main purpose of this chapter. The core discussion will be mainly around, cross-functional collaboration; cross-communication, organizing cross-functional teams around the customer, reorganizing organizational boundaries, and collaboration dynamics, and corporate digital cultures; new working styles, new ways of engagement, organizational flexibility, risk-tolerant culture, and accepting failures.

Background

It is a good idea to start with one of the humankind's interactions with the digital technology; Neugebauer (2019) states that "the first programmable computer using binary code was the Zuse Z3" getting its name from the creator Kondrad Zuse and Helmut Schreyer which was introduced at 1941 in Berlin. In 1971 the first microprocessor was patented; it contained 8,000 transistors (Neugebauer, 2019), and today we are talking in about millions of transistors in a single microprocessor. Technological advancements result in transformation, and they can even be epoch-making by creating new markets and facilitating development of innovative products, services and ideas (Baldwin, 2019; Olszak, 2020). The critical point is that, organizations need to transform themselves as a whole in order to attain merits of these advancements; we name this state of alacrity as organizational digital maturity (Machado et al., 2020).

Forrester Research has determined culture, technology, organization and insights as the components which are required to be possessed at the topmost level of their digital maturity model (VanBoskirk, et al., 2016), which also corresponds with the need to change as whole. There are other maturity models which try to elucidate levels of maturity in different sectors and settings such as Neuhofer et al. (2013), De Carolis et al., (2017), Colli et al. (2018), and Ryan et al. (2020). Table 1 highlights some of the current prominent digital maturity and industry 4.0 models and indices that are used to assess the current maturity stage of an organization.

When Table 1 is studied human-related dimensions can be listed such as culture, human capital, organizational alignment, competences, customers & partners, strategy and leadership, strategic vision, culture of innovation, management, customer experience, and employee experience.

These attempts to create a variety of models as exemplified in Table 1 to manage digital transformation clearly put forward a classification of maturity levels which requires a progressive mindset not only at the individual, but also at the organizational level in order to leap forward and turn challenges en route to opportunities under volatile business environment (Kane et al., 2018). Assessing maturity levels of organizations is related with determining priorities, sketching the right roadmap, and optimizing a firm's journey to digital maturity in a controlled and organized manner to utilize opportunities (Şener et al., 2018) rather than rolling around (Pihir et al., 2018). This vigilant state of mind is a combination of both structural-organizational (policies, procedures, resources, technological infrastructure, etc.) and psychological (engagement level, commitment of leadership, culture, etc.) factors (Wiener, 2009; Machado et al., 2020).

It would also be remarkable to note that, human nature is prone to change, but the speed of change we feel within does not always correspond to the speed of change that is required in a specific organi-

Table 1. Outstanding digital maturity, and Industry 4.0 models, and indices

DT Dimensions / Model:	**The acatech Industrie 4.0 Maturity Index**	**The acatech Industrie 4.0 Maturity Index**	**Industry 4.0 Maturity Model**	**Digital Maturity Model 5.0. - Forrester**	**Industry 4.0 Maturity Model**
Source:	(Schuh et al., 2017)	(De Carolis et al., 2017)	(Colli et al., 2018)	(VanBoskirk, et al., 2017)	(Şener et al., 2018)
Dimensions / Indices	Resources	Process	Technology	Culture	Asset management
	Information Systems	Monitoring and control	Governance	Organization	Data governance
	Organizational Structure	Technology	Value Creation	Technology	Application management
	Culture	Organization	Competences	Insights	Process transformation
			Connectivity		Organizational alignment
DT Dimensions / Model:	**Industry 4.0 Maturity Model for Manufacturing**	**Dimensions of Digital Transformation**	**Digital Readiness Index Assessment**	**The New Elements of Digital Transformation**	
Source:	(Schumacher et al., 2019)	(Gurbaxani & Dunkle, 2019)	(Philipp, 2020)	(Bonnet, & Westerman, 2021)	
Dimensions / Indices	Technology	Strategic vision	Management	Business model	
	Products	Culture of innovation	Human capital	Customer experience	
	Customers & partners	Know-how and intellectual property	Functionality (IT)	Operations	
	Data & information	Digital capability	Technology	Employee experience	
	Corporate standards	Strategic alignment	Information	Digital platform	
	Employees	Technology assets			
	Strategy & Leadership				

Source: Please refer to second (source) rows of the table.

zational setting and environmental conditions such as the available technologies, development level of competition, requirements and desires of the consumers, and time. This correlational situation is asserted as "digital disruption" by Kane et al. (2018); which might become a challenge of organization-wide overall refitment - Neugebauer (2019) calls this as digital revolution- or an incremental process that can be handled with progressive improvements in some structures of the organization if previous positive progress has been achieved earlier.

Kretschmer & Khashabi (2020) also state maturity of the technologies which has to be considered in order to not have uncertainties and excessive costs; on the contrary they also assert choosing a group of crucial processes to avoid the concept of "missing the boat" and falling behind in competition. Timely implementation of maturing or mature digital technologies in such a manner also puts forward effective priority planning to enable effective utilization of resources and promotes fast outcomes and gains in strategically important business processes which requires an assessment of digital maturity stage of a company. Development of digital technologies and harmonization of those within business processes create digital systems, which have the potential of transforming the way of doing things not only at an individual but also in an organizational perspective, rendering higher productivity, better performance, increased value-add, and efficiency of resources resulting higher competitiveness levels (White, 2012; Neugebauer, 2019).

Another compelling factor is the level of overall disruption and the level of competition in the sector of activity; an intense pressure arising from your business area gives no other direction than to leap forward and make away with ambiguity. Such a background also catalyzes enthusiasm and facilitates the psychological perception of the need to act in an organizational setting. Therefore, Kane et al. (2018) suggests to assess a company's existing digital maturity first, as it would be unevenly distributed throughout the organization. After such as an assessment, which also corresponds to the traditional strategic management current status assessment "is", it will be more effective to plan which parts are to be cured or invigorated and also which parts can be overhauled faster to realize swift outcomes.

However, there are different approaches to attain transformation; Kane et al. (2018) suggest to handle organizational change in a manageable way instead of an overall holistic transformation of an organization; while Kretschmer & Khashabi (2020) advise a simultaneous handling and improvement of sets of processes and parts of an organization to not get trapped in the fallacy of incompleteness or to avoid getting adversely affected from other lagging dimensions within the extended organization which also covers the whole set of stakeholders which take part in the value delivery to the customer.

Digital transformation needs a progressive mindset to ignite the transformation journey after a thorough analysis of company's culture, archetype, infrastructure, internal & external factors, previous steps, lessons learned and resources. It is important to emphasize that, organizations and individuals can get better in using digital technologies and even learn to be more efficient by learning more and more each time from thematic practices; the key can start whether with baby steps or with greater scope (Deloitte, 2016; Kane et al., 2018; Neugebauer, 2019; Kretschmer, & Khashabi, 2020). It should also be kept in mind that, as you progress related technologies and your stakeholders do also have the potential to advance both in capabilities and experience, and embrace more work with the joy of achievement.

It should not be disregarded that one of the basic elements that will create a difference in making an organization successful in its digital maturity journey is leadership (Kane et al., 2015a; Kane et al., 2017; Alkhamery et al, 2020; Gorter et al, 2020; Bonnet, & Westerman, 2021).

This chapter is not focusing on a specific sector or a business area; so that, instead comparing and contrasting those models, and making an evaluation; it aims to create a general roadmap on the subject and reveal the important components of the digital maturity in order have a wider generalizability perspective. Human- related fundamental aspects of digital maturity in accordance with the objective of the chapter will be detailed using the following sub-sections.

MAIN FOCUS OF THE CHAPTER

Digital maturity is adapting the organization to compete effectively in an increasingly digital environment (Kane et. al., 2017b). The focused concepts of cross-functional collaboration and corporate digital cultures, which are the basic components of achieving digital maturity, which must be coordinated together will be elaborated in this section.

Cross-Functional Collaboration and Cross-Communication

Incorporation of digital technologies into corporate life while conducting routine business activities is named as digital transformation, thus a collaborative way of doing business and culture as facilitators has to be embedded/adjoined in business model building strategies of a company to enhance effects of utilized digital technologies (Warner & Wäger, 2019).

Transparency cultivates collaboration and cross-communication especially between groups of people which are not put together in a formal structure and generates a win-win situation by learning and even crowd-learning as used in co-creation practices Fletcher, & Griffiths, 2020).

An adequate amount of autonomy in a distributed decision-making atmosphere is a requirement to be embroidered in teamworking which will enable individuals to take on multiple roles such as managing teams, decision-making, participating in decision-making, being consulted, and influencing members. In a digital workspace any of those roles can be required in a sudden; being in need of crafting an immediate solution makes strict hierarchical structures and bureaupathology obsolete (Kane & Philipis, 2017; Birkinshaw, 2018; Kane et al., 2018). The organizational mindset and perspective change, which will be gained through cooperation between functions, which can be monitored with more sharing, openness and transparency by coming to life in autonomous teams while conducting daily work, is a crucial need for transformation in order to achieve digital maturity (Fletcher, & Griffiths, 2020). Kane et al. (2018) advise that, just checking existence of such autonomous teams will be a meaningful answer to understand how digitally mature a company is. Kane (2017) reports that digitally mature companies are more prone to employ cross-functional teamworking practices.

Digital teams would get themselves more develop on digital strategy comprehension and formulation, on controlling digital ways of doing business throughout the organization, and getting better at digital activities (VanBoskirk et al., 2016).

Organizing Cross-Functional Teams around the Customer

Companies create value for their customers, the nuance here is; both a traditional and a digitally transformed company also serves for future or potential customers (Correani et al., 2020), the power of digital technologies especially emerge at this point as they enable reach to potential customers in an extensive way. Big data or data analysis helps corporations to address new customer profiles and review value propositions of not only for external customers but also internal customers, and brings up the optimization of value chain processes, procedures and frameworks and for each customer segment.

Fernández-Rovira et al. (2021) pinpoint using big data obtained from the transactions with the customer would be best used to anticipate customer requirements and intentions for constructing loyalty by taking care of general personal data protection rights. On the other hand, as digital technologies speed up the traditional ways of doing business, another important task in corporate agendas would be planning orientation of customers about methods, procedures, digital aids and tools which they need to make use of during their ordinary interactions with your company. Furthermore, asking customer about their needs and expectations can result in a result in a leap in their loyalty which will also be considered as listening to the voice of the customer and an act of extending boundaries of organizational structures (Westerman et al., 2019).

The other side of the medallion is the task of creating internal upheaval about how customer data can be used not only for innovation but also for customer lock-in and desired value creation by customers

(Weritz et al., 2020). There is a requirement of data platforms which would serve as means of engagement and mutual learning platforms that are clearly announcing ethical guidelines to proactively avoid any exploitation (Kane et al., 2017b; Kane et al., 2018; Weritz, 2020).

Interaction with external customers can also bring in crowd knowledge and wisdom, so that companies would be forming their networks around them clearly promoting and sharing proofs declaring the importance of openness and (Deloitte, 2016; Fletcher, & Griffiths, 2020). Saarikko et al. (2020) highlight collaboration with an emphasis on the importance of getting your brand recognized which will be encouraging external stakeholders to participate in your transformation journey.

Reorganizing Organizational Boundaries

The customer is out here and a digital organization's capabilities to communicate with her customers have increased thanks to evolving technological advancements and its data collection tools. New methods to interact with the customers are evolving and also existing ones are also developing and companies are offered more or more talented instruments that can be used in their value creation processes (Organisation for Economic Co-operation and Development [OECD], 2019; Fletcher, & Griffiths, 2020; HBR, 2020b). Since companies are in favour of co-creating their products and services directly with the customers and partners, the organization needs to be getting more fluid; on top that cultural change, companies can benefit from digital technologies to enhance to involvement of their customers into their creation processes (Baldwin, 2019; Kindermann et al., 2020; Kretschmer & Khashabi, 2020). Actually, the information required for improving products and services or making revolutionary developments is coming from the outside of organizations; so that, by logic firms would be extending their boundaries in order to cherish innovative ideas. On the other hand, managerial expertise can also be seized from outside (Yan et al., 2020).

Digital transformation makes things easier for reaching open innovation stakeholders and extends the boundaries of ecosystems (Saarikko et al., 2020). On the other hand, White (2012) reminds that being already connected to customers, and other routinely connected partner companies have already extended their boundaries; today, with the help of technological developments (captured data and transaction capacities) more value generation can be obtained from external parties when compared with the past.

The dimensions of where value is created at a digital company goes far beyond the organization; taking the amount of data generated, considering where it is created and also the interaction density indicate wider span of organizational boundaries. Most of the data is generated wherever a stakeholder is and it can be retrieved in an economical way and can be utilized for value creation (Fernández-Rovira et al., 2021). Additionally, the main idea behind the progression of new product and services of information technology; such as cloud and data warehouse management, is to generate convenience, cost efficiency and extend boundaries (Li & Chan, 2019). A digital platform is the technical interface which serves as a backbone on which digital technologies are build. The boundaries of the organization automatically extend via externally facing platforms which becomes perceivable as ecosystems such as websites, applications and payment systems. These platforms are interconnected with data platforms handle tons of data and information mostly in an autonomous way in other words they keep boundaries of an organization at a very flexible level (Bonnet & Westerman, 2021). In today's connected world organizational boundaries intersect with those of customers', business partners' and stakeholders' (HBR, 2020b).

Collaboration Dynamics and Capabilities

Mintzberg's (1991) view on becoming an effective organization rely on co-aligning strategy, structure and context. The essence of inter-organizational tasks is a combination of collaboration, coordination, and cooperation; where cooperation chases coordination (Castañer & Oliveira, 2020). Kane et al. (2018) asserts that the more digitally mature the companies get, the more they delegate decision-making down to individuals which creates an atmosphere of collaboration and facilitates growing number of unhierarchic leaders. In order to make the most out of such a structure, *"absorptive capacity"* is advised be increased; not only by deploying more information to employees in order to foster learning, knowledge transfer and innovation payoff, but also utilization of digital technologies and teaching how to efficiently use them (Lane & Lubatkin, 1998; HBR, 2020a; Yang et al, 2020). The best way is to increase the interaction also with external stakeholders to increase the potential of knowledge assimilation and collaboration mindset development.

Warner & Wäger (2019, p. 335) have develop a process model that identifies four main capabilities which are consisting of nine variables; putting forward digital sensing (digital scouting, digital scenario planning and digital mindset crafting), digital seizing (rapid prototyping, balancing digital portfolios and strategic agility), digital transforming (navigating innovation ecosystems, redesigning internal structures, improving digital maturity), and contextual factors (external triggers, internal enablers, internal barriers) as main categories.

Companies usually have to take part in their stakeholders' digital transformation strategies who take part in their ecosystems, this spontaneous situation requires collaboration and coordination between internal and external bodies bringing in contingent role changing which ranges from being a contributor to being a decision-maker. Such dynamic roles/capabilities for acquiring and utilizing external knowledge are nurtured with more exposure to external bodies and promoting openness (Reck & Fliaster, 2019). Since organizations are becoming more flexible, people are undertaking different roles at a time (which foster leadership skills) that amplifies exposure to more ambiguity, which is resulting in increased pace in business life. The cure to overcome this need for speed is collaboration which is to be undertaken without worrying too much about organizational boundaries to not to block leveraging effects of business ecosystems, out of which we will possibly pull innovation opportunities as complimentary results of knowledge accumulation and having a better understanding of the environment (Kane et al., 2018; Yang et al, 2020).

Mastering digital transformation creates two capabilities which Bonnet & Westerman (2021) name as digital capability and leadership capability which render it possible to manage transformation in a planned way without creating inefficiencies (Westerman et al., 2014).

Dynamic capabilities such as *"balanced redundancy, requisite variety and cognitive discretion"* nourish business models and transform them into gear wheels of a more harmonious machine and they serve to create better version of a company that is designed for future. This harmony can be achieved through the presence of a set coherent capabilities; when such a situation can't be assured, transformation and firm objectives will not be achieved within schedule (Warner & Wäger, 2019).

The VUCA (Volatility, Uncertainty, Complexity and Ambiguity) concept can be recalled to be integrated with fluid organizational structures and boundaries to form a more profound state of sustainability, which are this time voluntarily extended on purpose by organizations that are running after agility and overall improvement on stakeholder basis. (Burchardt & Maisch 2019; Fletcher, & Griffiths, 2020).

As people are exposed to more digital technologies, adapting themselves to the conditions of tomorrow has in a way become a learnable element. As the cooperation between teams increases and people continue to work in more different teams which have dynamic member lists based on the contingency requirements of the assigned task, the continuous learning required by the organization can come to life in a more dynamic way thanks to the cooperation between teams (Kane, et al., 2018; Neugebauer, 2019).

Corporate Digital Cultures

One of the most precise and to the point definitions of culture is has been brought in by Waterman et al. (2019): "Culture is what happens when the boss leaves the room." Basic components of culture; shared norms, values, implicit traits and beliefs shape the way things are handled managed in an organization, as well as the support and the commitment of leadership are major determinants of a ðrm's management style, level of democracy, depth and extend of collaboration and innovation behavior, and performance (Westerman et al., 2019; Nakata, 2020).

Kane et al. (2015b) argue whether technology has the ability to change culture or not; and he concludes that, although; technology is a crucial driver for change, culture serves as a facilitator for the adoption of digital technologies, which he also names together with leadership as one of the essential elements of strategy execution that will sustain engagement both on employee and customer perspectives.

For sure, the scope of digital transformation has brought agility and transparency as default attributes into business life. This is a natural outcome of the need of heterarchical organizational structures; at this point not only the organization but also the psychological factor (employees, customers, suppliers, and even other stakeholders) of corporations would adopt to this cultural paradigm shift; moving from keeping the power and information on individuals to deploying (adequate amount of) these to whoever needs them accomplish tasks (Pfohl, Yahsi & Kurnaz, 2015; Burchardt & Maisch, 2019; Pulkkinen et al., 2019; ; HBR, 2020a).

The dark side of culture is its stickiness to tradition and tendency to be stagnant, which may cause blind adherence to business manners that are far from today's needs. However, the fortunate thing about culture is its power to unite humankind around common values and practices which directly ensures the longevity of the useful ways of doing and supports the sustainability of organizations (Westerman et al., 2019). Burchardt & Maisch (2019) assert that:

In order to support this ongoing transformation through learning, self-reflection, autonomy and competence development, a leadership understanding in self-control, self-reflection, empathy, intuition, creativity and attitude is needed. In this sense, through agility, a joint and step-by-step organization with changed acquired skills and the new developed team and leadership understanding as well as with a changed understanding of culture is developed. This agile new framework offers the opportunity to become an innovation in itself and mobilizes the entrepreneurial forces to exploit the opportunities of dynamic markets and new technologies in the company in the future (Burchardt & Maisch, 2019, p. 116).

Collaboration in cross-functional teams is the best practice of efficient learning as enables people to have wider perspective about the work to be accomplished and it also requires the acquisition of a new culture. In most of the cases unlearning can be a breakthrough to get results quickly without getting stuck in competency traps and embracing new ways of adding value continuously with and innovation perspective (Kane, et al., 2018).

Westerman et al. (2019, p.61) have specified four pivotal principles of digital culture: impact – never give up on changing your surroundings substantially; speed – instead of waiting for all answer act swiftly, make progress and innovate; openness: enlarge your span of your contact and share information / knowledge; autonomy: give room to people to decide, do not limit them to strict organizational structures and programmes.

New Working Styles

Digital organizations require bilateral feedback continuum to retrieve facts and desires both from the customer and the organization in order to realize timely improvements or innovations which will result in increased effectiveness and utilization. It is a combination of openness and dynamic organizational structure, and in order to control the course of the subordinate-superior relationship, instead of providing proximity in physical distance, it should be focused on innovation that eliminates the need or problem as experienced during Covid-19 pandemic (Kane et al., 2017b; Fletcher, & Griffiths, 2020).

Digitalization brings a growing amount and wealth of data. The interaction with the customer is shifting to information based-services instead of structures that are product-centric. Bonnet & Westerman (2021) present Michelin Global's transition from being a manufacturer to an additional value provider as a tire management service:

Michelin connected its products using embedded sensors that collect and transmit valuable data on usage, distance, and maintenance needs. Its Fleet Solutions business now provides its customers with comprehensive and convenient tire management services that deliver better cost control, fewer breakdowns, and less administrative work (Bonnet & Westerman, 2021, p. 87-88).

Not only information but also leadership roles are handled in a distributed way; this has a positive reflection also on psychological maturity level of the stakeholders and results in autonomous engagement, and it also helps to learn and disseminate digitalization tools quickly (Kane et al., 2015; Kane, et al., 2018; Zomer et al., 2018). As economies become digital, the role of leaders is evolving towards inspiring people as members of a community of leaders and their commitment to organizations. Today's leaders' main success criteria are to facilitate and create an atmosphere where every involved individual's or institution's ideas and feedback is articulated (Ready et al., 2020).

Today's digital transformation gives a greater meaning to daily operations of a company; operations are interconnected with business models serving as bridge to bring together customers and employees, and creates the infrastructure (with the help of the digital platforms) to uncover experiences. It can be thought that this is totally technical, but the aim here is to highlight that in order to think about workforce automation, first companies would be equipped with the culture to welcome such augmentation ideas, would have enough knowledge in order to consider dynamics in operations, and also to welcome decision-making by using data. This is more a conceptual transformation rather than a technical one (Kane et al., 2018; Bonnet & Westerman, 2021). Digitalization's core building block is delivering and deploying information that enable new knowledge management tools and creating value in an automated structure making processes and systems more efficient and effective (Jabłoński & Jabłoński, 2020; Yang et. al., 2020). Most of the information flow in a company is automated thanks to digitalization and employees and managers have reach to timely data (HBR, 2020b) which makes old style long meetings obsolete;

however, culture still remains the main decisive factor whether the earned time will be used for other means or for traditional long meetings.

There is another important point about working styles; Kane et al. (2017b) also argue that innovation should be seen as the main responsibility for any employee or someone who has a stake in the longevity of a company. Stakeholder point of view is strengthened by shared goals and incentives that are designed for the benefit of the whole. Digital maturity's objective is to transform individuals into innovators.

New Ways of Engagement

Organizations have to engage both their customers and employees this section will be detailing both of the perspectives. Warner and Wäger (2019) state that employee find it interesting to check what is new in their sector and carry this task which they call "digital scouting" with great engagement as it helps them to keep up with contemporary development and even to have an idea about with what other companies are busy. People are aware that they can gather valuable intelligence about the market so that they can reckon their role in strategy formulation. Customer engagement is a desired outcome of digital transformation from start; offering faster solutions and seamless data via digital platforms enable companies to personalize data flow and interactions for different personas or customers segments. As a result, the customer is treated in a more comprehensive way and has more access to more information (more than ever) with an option to engage in social platforms if the companies are offering such services (Ryan et al., 2020; Weritz et al., 2020). The more digitally mature a company is the more engaged customers she will have, which is one the goals of starting a digital transformation journey.

Digital leaders, learning platforms, social platforms, autonomous decision-making systems, chatbots, and big data analysis are the most common means used to generate engagement (Colli, 2018; Baldwin 2019; Ryan et al., 2020; Weritz et al., 2020). Zomer et al. (2018) state that digitalisation is also used for talent engagement. Main values of a digital culture which are impact, speed, openness, and autonomy empower employees and propagate the will to transform the company to an advanced version of herself (Westerman et al., 2019).

Westerman et al. (2019, p. 61) have specified four pivotal principles of digital culture: impact – never give up on changing your surroundings substantially; speed – instead of waiting for all answer act swiftly, make progress and innovate; openness: enlarge your span of your contact and share information / knowledge; autonomy: give room people to decide do not limit hem to strict organizational structures and programmes. Automation and low code systems for system users give room to focus on higher value adding activities and even generates time to think about future requirements of a company and facilitates strategic reviews (HBR, 2020b). Studies reveal a supporting evidence that employees are expecting reach to data about how they can improve the way they work and the outcomes of their work which can be considered as autonomous learning (Kane et al. 2018; Ryan et al., 2020).

The fundamental factors of contemporary customer experience are experience design, customer intelligence, and emotional engagement. Experience design firstly starts with understanding customer personas and quite related with consumer behavior practices in terms of inferring insights is the crucial part of the process. Making sense out insights also requires related digital technologies to be aligned to enable observation, listening and experimentation with customers. Customer intelligence is gathered by digital technologies but can be interpreted or predicted whether by humans or by human aids like artificial intelligence (AI), machine learning (ML), augmented reality (AR) and similar technologies which are generally more accurate, proactive and faster. Companies are getting help again from digital technologies create touch points with the customer which are designed carefully to enhance to create emotional engagement (Bonnet & Westerman, 2021).

Managing the related operations and crafting employee experience with the help of digital platform are the task to be undertaken to make it possible to interact with the customers and manage that interaction. In a digitally mature culture employees enrich value that is retrieved with customer communication so that both the customers and the employees should be taken good care of simultaneously. Augmentation technologies increase productivity and performance saving more time for dealing with customer requirements. In order to keep employees motivated and their contributions to the goals of the business at the maximum, their skills should be developed in line with competition and technological advancements. Such an effort will also result in multi-skilled employee development, will be creating potential leaders, and will generate rotation possibilities which facilitate agile and learning organizations (Bonnet & Westerman, 2021).

Getting inspired from Kane et al. (2018) and raising the meaning of their words to those of J. William Marriott and Sir Richard Branson; it will be in place to finalize this subsection using the following motto: “Develop digital leaders, so that they will take care of your company and customers.

Organizational Flexibility

The contingency approach requires organizations to be flexible enough to react instantly. Digital maturity is the way to increase the competence levels of leaders. As a company matures digitally, it becomes more flexible. For this reason, companies on the journey of digital maturity regard maturity as a strategic and cultural flexible element, especially considering that the external environment and instant business practices may change constantly (Reck, and Fliaster, 2019; Fletcher, & Griffiths, 2020).

Innovation can’t find ground under strict organizational boundaries and rules; creating a culture that is emphasizing the importance of value sharing and transparency is a good starting point to shift to a more flexible structure as Google does. Transparency in declaring objectives within organizations will generate momentum to achieve higher performance levels and sustain a more conscious belonging collaboration-teams’ responsibilities (Westerman et .al, 2019).

Having a flexible organizational design is a requirement of sustainability and strategic scenario planning; which also ensures faster response time to customer demands and business environment needs strategically. Since designing your organization for flexible situations will allow you to react with sudden updates and assign different roles to stakeholders, it will also prepare the necessary ground for the development of digital maturity and give the option to revise its direction if there is any defection (Fletcher & Griffiths, 2020; Weritz et al., 2020). Dynamically designed digital platforms which elevate effectiveness and utilization of information technology infrastructure form the hardware required for agile organizations (Li & Chan, 2019). However, Machado et al. (2020) remind a key parameter to be used is the digital maturity level of the organization as whole, while deciding about the implementation timing of new technologies. They name these maturity levels as organizational, digital, and smart maturity. Furthermore, they define these levels’ features and enucleate differences while examining them in two pillars as maturity level and roadmap for maturity. In the state of roadmap for digital maturity, concentration would be more on nurturing a digital culture and concentrate on strategy.

Baldwin (2019) has stated how important it is to have flexibility in remote-working practices which was a popular way of doing business even before the pandemic lockdown. There are many studies stating that, the biggest weapon of companies that can continue their activities without interruption is flexible organizational structures (Fletcher, & Griffiths, 2020; Saliola, & Islam, 2020; Miceli et al., 2021). Self-organization and autonomy are common traits of flexible organizations; in other words, agile teams and adaptable collaboration teams (Burchardt & Maisch, 2019).

Risk-Tolerant Culture and Accepting Failures

The biggest determinant whether a company has a development mindset or not is to employ a risk-tolerant culture. Learning is generally considered as risky issue because of unlearning and the risk to not to achieve a competency level in what is to be learned (Gupta & Bose, 2019); but also, risk-taking culture eliminates risk by learning; and especially when we consider the fact that a learning mind is must to generate innovation. On the other hand, employees are prone take more risk in digitally maturing companies as the culture of accepting failures have good ground and due to higher maturity level people are more open to experimentation (Kane et al., 2018; Zomer et al., 2018). Lately conducted studies advise companies to build a culture which promotes sharing of new ideas and giving those ideas company-wide testing opportunities, learning by iteration and experimentation, finding new ways of doing things, openness in sharing failures experimentation and protecting people who iterate and experiment (Kane et al., 2018; Alatovic et al., 2020).

Implementation of digital technologies have two contrasting facets: the first one is the risk elimination such as avoidance of human error by automation (Popović-Pantić et al., 2019), and the second one is confrontation of risk which comes into question when internet technologies are to be updated (Furr & Shipilov, 2019; McGrath & McManus, 2020). This chapter's approach is to eliminate the second type of risk by learning required skill sets and planning. Building up digital leadership as a talent competency with the support of company's leadership (Kane et al., 2017b; Zomer et al., 2018) is the best risk aversion strategy. Alkhamery et al. (2020) assert that the failure of many firms in the digital world is a result of poor leadership which lack creativeness, profound knowledge, loyalty, being visionary and robust collaboration and networking.

In a digitally transformed business world's main risk can be defined as losing your digital talent, so that in order to keep people within the ecosystem companies would think beyond traditional trainings; creating a learning atmosphere is an imperative which would have a wider span by being open to incoming collaboration from external bodies and would make the most out of social platforms (Kane et al., 2017b).

Alatovic et al. (2020) pinpoint to employ a Chief Digital Officer (CDO), which is named as Chief Transformation Officer (CTO) by Gorter et al. (2016). That officer's main task would be priming passion, accepting failures and deploying a risk-tolerant culture while enhancing the digital maturity of the corporation. In some cases, there might not be room for such a position due to the type of the firm or its structure (common for entrepreneurs); so that the tasks can be carried out by a digital leader who would provide vision and purpose (generating direction), create conditions for risk-taking, iteration and experimentation (facilitating innovation), empowering people for taking action (performing), exercising boundaryless collaboration and creating more inspirational leaders (make people lead) (Kane et al., 2018).

SOLUTIONS AND RECOMMENDATIONS

Incorporating digital technologies does not mean that they can be used effectively and efficiently. Companies should review the digital maturity level of their employees, systems and infrastructure before technology acquisition and deployment steps, and lay the groundwork for digital maturation in order to accelerate the return on investment and not to fall behind in the competition.

If the planned gains cannot be achieved by making large investments in digital technologies, the companies can reach an economic condition that threatens their sustainability. It should not be forgotten that a company that is ready for digital technologies can get ahead of its competitors in the short term and enlarge the gap with mediocre performers.

This chapter advises that, companies would start the starting point for the digital transformation journey of a company would be updating its culture and creating an agile system that is also bonded to external stakeholders welcoming cross-functional and cross-organizational collaborations. Cross-functional collaboration standalone is not adequate for today's connected world in which co-creation of services and products is replacing the traditional in-house development mentality; companies do also need to organize their cross-functional teams around their customers with the help of enabler digital technologies. The concept of agility is to be positioned with utmost priority as this cultural and collaboration capabilities' shift is dynamic and progressive in character. The digital maturity journey does not have a fixed destination at which ultimate success can be declared.

Today, it is already taken granted that distributed systems are more secure – thanks to blockchain technology. The same condition is also valid for an organization about leadership; distributed leadership should be conceded as an embedded trait of corporate digital cultures which help organizations to become more competitive, agile and sustainable. It is important to get trained about multiple capabilities and when it is done for leadership, an organization does not have to rely onto a few her resources.

Cross-functional collaboration gets aligned with contingency planning necessities; people can take on multiple or variety of duties and while more employees are getting in contact with are aligned around more customers, companies also get capable of responding to customers' needs and requirements in a more in-time and in-full mentality manner. Such an alignment around the customer will generate a reciprocal refinement customer and employee experiences. Changing culture and getting people used to collaboration is longitudinal process; so that, there is no perfect time to start a digital maturity journey. The competition does not stop and there can always be some obstacles or constraints, that is why it is important to plan and start the transformation phase.

A digitally mature culture can motivate people to try without bothering about making mistakes, accepting failures is a virtue in learning organizations and a digitally mature company has to keep learning in order to keep the pace with the ever-evolving digital technologies. Unlearning and welcoming better ideas not only failures will be another remedy for maturing companies since it is necessary to unlearn in order adapt to a new routine whether it requires a mental or procedural challenge.

FUTURE RESEARCH DIRECTIONS

The concept of digital maturity, which has already increased its popularity in recent years, has become a subject of more studies, especially during the pandemic period, since the institutions that have already started this journey got ahead of their competitors and provided a long-term competitive advantage. This popularity seems to increase as digital maturity is a continuous activity.

This chapter is running after a common recipe which can be utilized in various organizational settings and sectors. The topic is extensive enough to carry out research on specific sectors. It can be a good idea to deep dive into service industry sectors; even comparing manufacturing companies with the ones which require more soft skills such as service sectors.

Another concentration area can be focusing on learning and unlearning, and its correlation with the customer experience management, in order to search for practical advice. The relationship between employee and customer experience will be a good area to research too; a model which tries to evaluate conjunction points. Many research projects can be created based on generalization or comparison in different or the same sectors, which will reveal the differences and / or similarities of these mutual experience concepts.

Studies that reveal the relationship between employees' entrepreneurial behavior and digital maturity can be investigated with new models in different settings or countries. Such a study can lead to an intercultural comparison.

With comparative longitudinal research models, how the companies that have achieved digital maturity today and their sustainability metrics are changing overtime can be investigated.

How digitally mature companies determine their goals can be a research area which will possibly point out other potential areas to study. Digital maturity level assessment also remains as an extensive research area in order to sustain a complementary guide for organizations to their make progress in a more systematic way.

It can insightful to understand whether there is room or not for coopetition amongst employees in a digitally mature company; if yes, another study can be carried out to understand the effects are positive or not.

CONCLUSION

While closing the topic, recalling Drucker's (2003) famous quote "culture eats strategy for breakfast" and blending it with the emphasis on the way we do things today and the potential way of doing business tomorrow (Fuller et al., 2019), again puts forward the idea that a sustainability securing culture is first to be primarily embroidered into organizational structures, and then the brotherhood of blood between strategy and organizational culture are to be intertwined. In an atmosphere provided in this way, it will also be possible to benefit from the digitalization efforts at maximum efficiency.

Mintzberg's (1991) view on becoming an effective organization relies on co-aligning strategy, structure and context, which he names as "doing it all together". Similarly, establishing a cross-functional cooperation order can be achieved by realizing a cultural shift which promotes experimentation and trial & order as standard perspective.

A chief transformation/digital officer role can be used to accelerate maturity journey as advised by Gorter et al. (2016), and Alatovic et al., (2020), and can ensure that the organization is staying flexible; such a role can especially generate a plan to effectively utilize distributed leadership practices by an empowerment plan. Digital leaders also play an important role in the dissemination of acquired knowledge that will have role in updating strategies and vision of their company. Competition never sleeps; so that, companies need accelerating solutions as employing such an officer. Digital maturity speed can even be used a market entry barrier in some sectors.

Using various digital technologies in engaging with customers can also bring in new information and knowledge with the prerequisite of being open to external collaboration and being able to re-establishing organizational boundaries. In fact, it would be correct to admit that today's digitally mature companies do not have organizational boundaries; This acceptance will create the basis for organizing around the client for collaboration and learning, as well as for organizational flexibility and the non-biased creation and acceptance of new ways of doing business.

There is room for new research about the topic, as detailed in this chapter a multi-cultural setting might be more insightful and increase cross-cultural collaboration amongst researchers.

Calling Westerman's quote - right transformation is turning into a butterfly - to mind, that is given at the opening of the chapter, it is noteworthy to state that, when the aim is maturing there arise a dilemma due to the life span of a butterfly; transformation or in other words getting digitally mature according to contemporary criteria is the sole way to keep sustainable and requires both structural and cultural level flexibility.

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KEY TERMS AND DEFINITIONS

Collaboration: Mutual engagement of participants in a coordinated effort to solve a problem together.

Digital Maturity: Adapting the organization to compete effectively in an increasingly digital environment.

Engagement: Focused effort, involvement, commitment, and dedication.

Inter-Organizational Collaboration: A cooperative, inter-organizational relationship that is negotiated in an ongoing communicative process, relies on neither market nor hierarchical mechanisms of control.

Organizational Boundary Types: Competence, efficiency, identity, and power.

Organizational Flexibility: The degree to which an organization possesses a variety of actual and potential procedures to improve the controllability of the organization and environment.

Risk Tolerance: Composition of risk perception and risk preference.

Chapter 16
Towards an Artificial Intelligence (AI)–Driven Government in Sultanate of Oman:
Transforming and Augmenting Leadership Competencies

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ABSTRACT

Many tasks that require human intelligence to perform changed to being executed by artificial intelligence such as voice recognition, image recognition, and various predictions. This study investigates how adopting AI-based technologies could redefine leadership roles and identify the gap of critical leadership competencies of AI-based technologies in Oman's public sector. The study used secondary data sources of four Omani ministries. The results confirm that the work of the leaders in Oman's public sector focuses more on administrative coordination, control, developing strategies, and problem solving. On the other hand, there is little attention given to innovation and focusing on developing people. AI-based technologies enhance leader performance and productivity in many areas such as mindful tech-savvy humanist, fostering systemic intelligence, building trust and innovation, developing creative capabilities, fostering leadership skills, enhancing strategic thinking skills, managing uncertainty, and having creative foresight.

DOI: 10.4018/978-1-7998-2402-2.ch016

INTRODUCTION

Intelligence1. Examples for the tasks are voice recognition, image recognition, and various predictions. Machine learning, which is considered as a subset of Artificial Intelligence, has enabled different technologies to learn from experience by using different types of algorithms (Brynjolfsson & McAfee, 2012). Researchers emphasize that AI-based technologies will create new jobs which has no precedent to train, explain, and sustain AI-based technologies in organizations (Wilson, Daugherty, & Morini-Bianzino, 2017).

AI-based technologies in organizations can be divided into three categories: (1) process automation, (2) cognitive insight, and (3) cognitive engagement. Process automation refers to the use of AI-based systems to input and transfer big data by multiple information technologies system. Cognitive insight incorporates using AI-based technologies to recognize and interpret big data. It aims to enhance decision-making process. Cognitive engagement depends on a subset of AI which is Natural Language Processing (NLP). It provides technologies with the ability to interact with humans. (Almarzooqi, 2019).

Recent researches suggest that leadership roles can be altered in the presence of artificial intelligence –based systems. AI-based technologies can help leaders to evolve and expand their roles in a way that makes them more adaptable to new and complicated working environment (Infosys, 2018). According to (Schatsky, Muraskin, & Gurumurthy, 2015), such sophisticated technologies lead to redefining the skills, roles, performance objectives, and management practices and this would ultimately impact the way leaders spend their time on specific tasks. (Kirkland, 2014) argues that unlike traditional leadership, AI –based technologies offer wide range of solutions which result in leaders taking over more complex duties with an ultimate target of directing, motivating and developing their subordinates (Benny, de Waal, & Ravesteijn, 2018).

GCC countries including Sultanate of Oman work in adopting the digital transformation process as a part of a worldwide movement towards using the applications of the 4th industrial revolution (Industry 4.0) where AI is a major part of it. Digital transformation aims to improve and optimize work efficiency and processes. Innovation is considered a base for economic growth, diversification and job creation in digital economy in Oman Vision 2040. The IT market in Oman is expected to grow by 8% by 2021, which indicate that digital adoption is ripe among the main market sectors. (Oman Observer, 2019)

According to The World Economic Forum's Future of Government Report, government structures and processes need to be redesigned due to the complex and changing working environment. This is exhibited in the process of digital transformation carried out by the Sultanate of Oman to improve the quality of life and achieve economic growth. There are many AI applications that Oman works to demonstrate such as chatbots, traffic congestion and car accidents prediction, Predicting and identifying diseases and hazards, anticipating cyber-attacks and big data analysis. (E.Oman, 2019)

Oman's government established many institutions in order to keep pace with the fast changes during the last 20 years. Recently in 2019, the governments established the Ministry of Technology and communication, which is responsible for Oman's Digital Strategy and developing IT infrastructure. Oman's Digital Strategy looks for adopting the best practices in e-Governance and advanced technologies including AI-based technologies in order to improve the overall efficiency of government performance. (MTC, 2019)

This strategy will change the current structure of the government to be intelligent and relying on AI -based technologies. It will contribute in developing and improving the work quality in Oman's government (MTC, 2019). Hence, the adoption of AI based technologies will change the work process and structures by using technologies to automate and augment human capabilities (Daugherty, Morini-Bianzino, & Wilson, 2017). However, Human resource development is one of the important priorities of Oman's vision 2040. Since 1970, it is the main concern of Oman's government and it believes that investment in human resource is the main factor for societal and economic development (Oman Vision 2040, 2019).

In August 2020, HM, Sultan Haitham bin Tariq issued 28 royal decrees announcing the appointment of a new cabinet that comprises of both new and re-appointed ministers and governmental leaders. The decrees created new ministries and merged others while some ministries were completely abolished. In fact, the size of the government was remarkably reduced by appointing technocratic leaders with the right competencies and were granted unprecedented powers. The chief criterion used for the appointment of the government leaders was leadership competencies and capabilities (DeLozier, 2020).

The appointments represented a clear shift from the highly personal style of government that existed before and moved towards a more institutional model. Perhaps the most prominent change was the monarch's giving up on three ministries namely Ministry of Finance, Ministry of Defense and Ministry of Foreign Affairs. Instead, three independent leaders were appointed at the head of those ministries. This delegation of power is a proof for liberating the state from single leadership towards delegated shared leadership (Ona, 2021). Out of the recently appointed technocratic leaders, 13 ministers hold a doctorate degree, 14 have a Master's degree and 9 with Bachelor degrees. The new cabinet included 3 female leaders. In addition to that, the majority of the new or re-appointed leaders have respectable experiences as bureaucrats or qualified professionals. Four government leaders are dealt with in this paper in order to demonstrate their leadership competencies and roles through the adoption of AI-based technologies.

In fact, working towards country's vision and strategy depends on an effective leadership. Leadership effectiveness also depends on developing many competencies (Adams, Fleenor, Turregano, & Van Velsor, 2016). Hence, there is a constant change, the leadership competencies are continuously redefined to align with the technological development (Ali & Ryan, 2013). Thus, Oman's government has established the national CEO program designed specifically to develop skilled Omani leadership capabilities to drive cross-sector transformational growth and performance. The program utilizes various leadership tools and methods in order to develop competent leaders in the government in line with the country's vision (The National CEO Program, 2017). No doubt that the main challenges of AI is to redefine the leadership role and competency model. For example, AI is able to accomplish most of the administrative tasks which will help the leaders to have more time for innovation and development (Abbatiello, Knight, Philpot, & Roy, 2017).

Earlier studies on AI-based technologies focuses investigating the organization changes and tasks which might handle by AI-based technologies see e. g. (PWC, 2019; Brock & Wangenheim, 2019; Burgess, 2018; Moldenhauer & Londt, 2019). In the other hand, many researchers and authors attempted to address leadership competencies of AI-based technologies see e. g. (Amico, Kolbjørnsrud, & Thomas, 2016; Infosys, 2018; Rao & Verweij, 2017; Kirkland, 2014; Boyle, Heaton, Kerr, & Garvin, 2006; Bourton, Lavoie, & Vogel, 2018; Working Voices, 2018; Speth, 2008; Smith & Green, 2018; Harms & Han, 2019). These studies has tried to investigate the leadership competencies partially by examining the influence of AI-based technologies on leadership competencies. Furthermore, these studies targeted non-governmental organizations as well as there is lack of studies in Sultanate of Oman context. To the best of authors' knowledge, this is the first attempt to collect all other researchers and authors findings of leadership competencies of AI-based technologies in which this study will fill this gap. This needs to be investigated besides understanding the gap of critical leadership competencies of AI-based technologies in Sultanate of Oman. The aim of this research is to suggest a competency framework toward adoption of

AI-based technology, which may be valuable for improving the current new leaders in Oman's government. The study aims to explore how adopting AI-based technologies could redefine leadership roles. Also, to identify the gap of critical leadership competencies of AI-based technologies in Oman's public sector. A Deductive approach and descriptive analytical methodology is adopted. This study depends on secondary data source. The study selected randomly four Ministry leaders which are: (1) Minister of Housing and Urban Planning, (2) Minister of higher education and scientific research and innovation, (3) Minister of economy and (4) Minister of Finance. The study planned to gather findings of many researchers in one study to develop a competency framework toward adoption of AI-based technology. A critical evaluation of collected background of the selected Ministry leaders has been conducted in relation to the developed competency framework toward adoption of AI-based technology for the purpose of identify the competency gap. The study is structured to have the following respectively, literature review, research methodology, results and discussion and finally conclusion, summary and recommendation.

Background

AI is a computerized system that can feel the surrounding environment and has the ability to response to the changes after thinking and deciding the popper action that matches the given objectives (PWC, 2019). (Ertel, 2017) demonstrated that the purpose of AI is the development of machines that can act as if they are intelligent. Examples of AI systems include; predictive modeling, autonomous vehicles, cognitive computing, chatbots and smart robots and others. (PWC, 2019)

According to the survey conducted by (PWC, 2019), CEOs agreed that AI is going to drastically change the way they do their work within the next five years. It is going to be widely used in organization due to the availability of enormous amount of data and the ongoing developments in technology in terms of speed of data processing and the increasing capacity of data storage, which justifies the large investments in AI-based technologies. Another survey that was performed globally for leaders in different industries by (Brock & Wangenheim, 2019) shows that AI is going to change the way organizations offer their products, automate manufacturing and operations systems, and support decision making process. According to (PWC, 2019), AI can be used in four different ways: (1) Automated intelligence by automation of tasks, (2) Augmented intelligence by decision support, (3) Assisted intelligence by assisting in doing tasks in less time and improved quality and at least (4) Autonomous intelligence by taking decisions artificially without the need for human element.

(Burgess, 2018) pointed out the severe effect of AI on jobs. It not doubtful that AI is going to replace humans in a lot of areas. Chatbots replace normal call centers. Data processing can be done by AI systems in a faster and easier way compared to what accountants and lawyers usually do by themselves. (Moldenhauer & Londt, 2019) show that AI and automation shift the needed work functions away from routine tasks to creative participation as it can replace a lot of the those tasks in efficient and effective way. Such replacement can create disruption in the organization because some jobs may not be needed anymore. Good leadership should try to train employees to keep pace with new developments in order to avoid losing their jobs. AI can even assist in providing individualized training processes that can be more tailored to fit the needs of employees to be ready for AI usage.

The generic model of Leadership competencies is divided into four essential competencies which are critical thinking, people effectiveness, self-management and social awareness (Sanghi, 2016). Critical thinking refers to the leader's ability of visionary thinking, precognition and data analysis for identifying the strategic direction of the organization. The critical thinking competency of the leader includes visionary, strategic orientation and decisiveness2.

The second competency is people effectiveness, which identifies leader's ability to lead the organization employees, building relationship and developing them. Thirdly, Self-management drives toward achievement orientation, result orientation, high performance, self-confidence, accountability, integrity and trust. At least, social awareness refers to the ability of influence and Conflict Management (Sanghi, 2016).

According to a study conducted by (Amico, Kolbjørnsrud, & Thomas, 2016) which targeted 1,770 managers from 14 countries, organization Leaders spend 53 percent of the working time on administrative coordination and control, 30 percent on problem solving, 10 percent on strategy and innovation and 7 percent on developing people and engaging with stakeholders. The study also indicates that leaders spend 83 percent of their time on administration and problem solving tasks in which the AI-based technology is able to perform most of the required data analysis and predications to assist in decision making process.

For a number of scholars, the adoption of AI-based technologies can make leaders more efficient and productive. For example, when leading change, AI-based technologies will help leaders to efficiently lead effective change ventures (Infosys, 2018). Likewise, a study conducted by PWC with the aim of assessing if AI-based technologies can make leaders more productive and effective. The findings showed that thanks to the adoption of AI-based technologies, leaders show better performance and productivity at mainly three areas; mindful tech-savvy humanist, fostering systemic intelligence and building trust (Rao & Verweij, 2017). (Kirkland, 2014) indicates that the emergence of advanced AI machines help to make leaders more effective in terms of promoting innovation, developing creative capabilities, fostering leadership skills and enhancing strategic thinking skills. Artificial technology advancements also make leaders more proficient in managing uncertainty and having creative foresight (Bourton, Lavoie, & Vogel, 2018).

Basically, a successful technology-oriented government entails the availability of certain leadership competencies as suggested by several studies. One such a study is the one proposed by (Boyle, Heaton, Kerr, & Garvin, 2006) who saw emotional intelligence as a primary leadership competence in this regard. For these authors, emotional intelligence is particularly important as a chief skill for leaders to excel at their careers. It is even more important than technical hard skills this viewpoint is also emphasized by (Working Voices, 2018) which highlights that such an interpersonal skill is highly valuable for leaders to be outstanding at the time of intelligent machines. (Working Voices, 2018) points to five main leadership skills which are tightly related to emotional intelligence. They are empathy, critical thinking and planning, building rapport, judgment, and teamwork and collaboration. (Speth, 2008) identifies two key leadership competencies namely innovation and adaptability explaining that since technology is ever evolving and changing, leaders need to be highly innovative and adaptive so that they can cope up with the recurrent changes.

In addition to emotional intelligence, Digital Savvy is considered one of the important competencies that the leaders should have in the era of AI. Digital Savvy refers to the leader's ability to understand the role, methodology and potential outcomes of Artificial intelligence in the organization (Amico, Kolbjørnsrud, & Thomas, 2016). As long as the leaders are having this competency, they will be able to facilitate and introduce AI in the organization. Leaders with this competency can assume and adopt the suitable AI-based technologies applicable for their organization along with requirements of making these changes. Perez, 2017 indicates that leaders may augment their judgment competency which includes Creative thinking, Data analysis and interpretation and Strategy development. Furthermore, (Amico, Kolbjørnsrud, & Thomas, 2016) indicate that achieving successful implementation of AI-based technologies requires improvements in leader's digital competency.

(Smith & Green, 2018) contends that leaders can consider AI as an emerging type of followers to be added to the existing types. Robots and AI applications cannot work without the supervision of a leader. The results of those systems can't be trusted without a qualified leader who can make sure of their accuracy. The leader will take actions when there are mistakes which may result from incorrect programming. Mistakes of AI can badly affect organizations' operations as AI is used for decision making support. Decisions have to be taken based on trusted information to alleviate risks.

AI should not be supervised the same way leaders do with humans. As AI machines still don't have the emotional intelligence, they need to be managed and influenced differently. Team leadership style was being used since the emergence of AI in managing programmers. This style focuses on relationships among the team members while supervising the process. The evolution of robotic AI shifted the leadership style to focus more on the process while giving less attention to relationships. This is due to high cost of the process and the complex hardware and software being managed, which needs an authoritative robotic leadership (Smith & Green, 2018). (Brock D., 2006) came up with a Moore's law; which shows that the ability of technology is doubled every two years and at the same time, the cost is halved. If this is applied in the case of AI, team based leadership can be used in the future when the abilities and the costs of AI change as per Moore's law.

AI can make a better leaders. When AI is used, leaders usually don't have a predetermined idea about the outcomes of the system from a set of data. This means that by time they will be able to get genuine insights and ideas that were not expected. AI can help in providing more time for creativity as they perform the data filtering and processing on leaders' behalf and informing them with only the things that they need to know when needed. (Bourton, Lavoie, & Vogel, 2018). (Harms & Han, 2019) asserted that with the development of technology, the leadership role is moving towards "Algorithmic leadership" especially with the increasing spread of Gig economy. According to the definition given by (Investopedia, 2021), Gig Economy usually refers to new forms of business organizations that tend to use freelancers instead of hiring full time staff. Algorithmic leadership can be defined as using Artificial intelligence to perform functions that were previously done by leaders such as distributing work over staff, determining how workers should do the work, proper compensation and evaluation methods. The freelancers in Gig economy company models usually meet and communicate with superiors via digital tools, which clearly shows that management activities are no longer needed to be performed by people. (Harms & Han, 2019). Using the new technology will be essential not only to manage, but to predict the well-being of staff and automatically implement actions to heal and support them. This means that AI is able to take control of both functional and relational tasks that were previously done by leaders. It's debatable that only three functions of leaders can't be automated which are; networking, representing, and envisioning change (Harms & Han, 2019). People need to see machines and AI systems as partners who will positively affect their work performance and provide better results. AI systems can't work on its own as it will always need leaders to supervise them and to provide accurate information to able to perform their tasks effectively. (Harms & Han, 2019)

AI Leadership competencies

Public Sector Leaders' Competencies in Oman

Omani government leaders are well educated and most of them are technocrats as they pursued their post-graduate studies in their field of specialization. Housing and Urban Planning Minister has a Ph.D. in Architecture obtained from Glasgow University in Scotland, and Master's degree in Civil Engineering from Drexel University of Pennsylvania, USA (Al-Iktisadi, 2020). Minister of higher education and scientific research and innovation holds a Ph.D. in English language and communicative education and Master's degree in teaching (scholars, 2020). The Minister of economy is a holder of Ph.D. in Economics from Victoria University in Australia (Dhownet, 2021). The theory suggests that government leaders with post-graduate education in their domain specific areas are more likely to succeed in their positions rather than those appointed according to their political belonging (Besley & Marta, 2011). This theory is further reinforced by a study conducted on 146 countries which shows that leaders with good backgrounds in Economics are better at driving GDP growth (Paul, 2020).

On the other hand, other leaders may not have the same level of education, but they have an extended impressive record of leadership in governmental organization such as the ministry of finance who holds a bachelor's degree in Accounting from Ein Shams University in Egypt. His previous leadership capabilities as a senior executive in the ministry of finance drives his promotion. The current minister worked for the ministry of finance since 1988 along with other positions within the ministry such as Chairman of Omani Tax Authority, Deputy Chairman of Board of Governors of the Central Bank of Oman and Chairman of the Board of Directors. In 2008, he worked as Under-Secretary of previous Minster of Finance. The key leadership competencies identified for him are goal setting, motivating people, building teams, problem- solving and leading change (Al-Iktisadi, 2020) .

The leadership record of Minsters is not exclusive for the finance minister. Other Minsters also have outstanding experience in Oman's private and public sectors. For example, Housing and Urban Planning Minster worked as an architect in USA and UK before coming back to Oman to work for Diwan Royal Court till the time of promotion to be the Minister of manpower for five years between 2013 and 2018. The experience of the Minister raised for being responsible for mega infrastructure projects in Oman such as Muscat International Airport project, Salalah Airport, Duqm Airport and Sohar Airport in where he was responsible for the whole project from the first step of technical designs into the building process and finalization. Furthermore, He worked as CEO of Oman Aviation Services and Oman Airports Management Company. The minister of higher education and scientific research and innovation has a profound record in higher education sector. The Minster occupied many positions in Sultan Qaboos University such as deputy vice-chancellor for postgraduate studies and research as well as director of the human resource center (TRC Newsletter, 2013). The current appointed Minister of economy has an extensive experience in managing the country economy. He worked as an economic advisor for the GCC statistical center, President of Omani Economic Association and CEO of Omani Numbering Center (Dhownet, 2021).

Leadership Roles of Omani Public Sector

In public sector, each organization has specific objective which organizations'' leaders are accountable to achieve. The new leader of housing sector in Oman has to face and overcome several challenges. The top challenge is the fossilized issues in the quality of management in public housing. Furthermore, the main role of the Minster is a radical reform of the management by changing the work mechanisms through the integration of technology including AI toward the provision of e-housing services (Alban-Metcalfe & Alimo-Metcalfe, 2006).

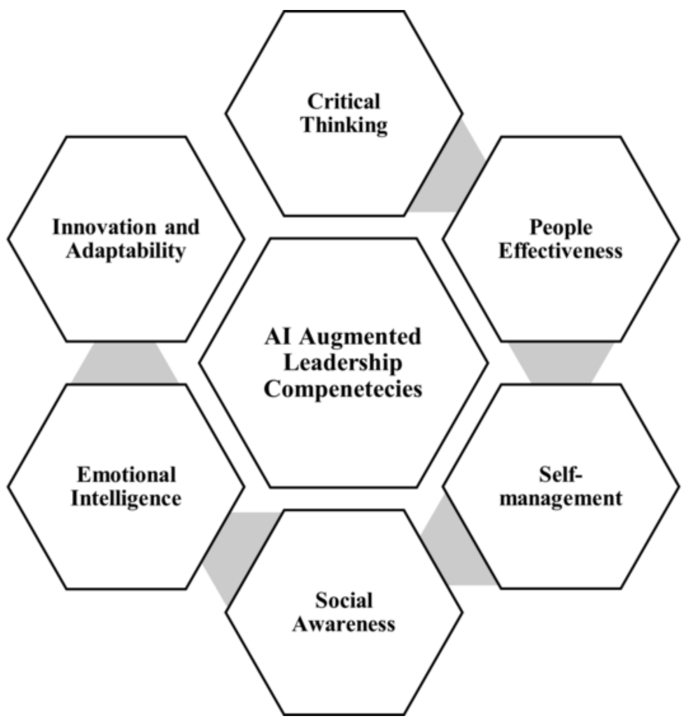
(Drugus & Landoy, 2014) stated that leadership's role of higher education ministry is concentrated in enhancing the quality of community partnership of Higher Education System. This government leader can have remarkable control over the knowledge-processing environment in the Sultanate. As argued by (Webber, 2016), the Minister of Higher education must ensure that role of Higher Education Institutions in Oman is not only limited to knowledge availability and ease of accessibility of information, but also in designing a curricula and developing a healthy knowledge environment that infuses learners with the right skills and competencies required for modern time education including the integration of artificial intelligence and e-learning. Furthermore, the Minister of Finance plays diverse roles that revolve around implementing the state's financial policies towards the preservation of public monetary, proposing financial development policies, financial plans and implementation procedures. The ministry of Economy, which was abolished in 2011, was recreated by virtue of the royal decree 94/2020 with the aim of reforming the economy and reconstructing the state administration in accordance with the requirement of Oman Vision 2040. Much of the work then lies on the edge of this government leader who was carefully selected and appointed to support this orientation. The Minister of Economy plays a fundamental role in developing the economy and the human capital needed for sustainable economic development through promoting alternative economic sectors including technology (Paul, 2020). Also, economic diversification by encouraging entrepreneurship in the technological sector which can lead to the adoption of AI-based technologies in the country (Eager, Smit, & Whittle, 2020). Economic leadership is also expected to bring about wide-ranging sustainable development of country and to play a significant role in planning and supervising the implementation of the economic plans in order to fulfill socioeconomic development (Allen, 2015).

AI-Augmented Leadership Competencies in Oman

As Oman is moving towards applying the best practices of digital transformation including incorporation of AI based technologies, changes must happen to the structure of the Omani government (MTC, 2019). One of the changes is the challenge of redefining the leadership role and Competency Model. (Abbatiello, Knight, Philpot, & Roy, 2017). According to deep research in Literature review of leadership role, leaders spend most of their working time (83 percent) on administrative coordination, control and problem solving. At the same time, they spend minimal time on strategy and innovation and developing people (17 percent) (Amico, Kolbjørnsrud, & Thomas, 2016). According to the above discussed ministries, the leaders working time focused more on administrative coordination and control and developing strategy and problem solving. Also, there is few attention toward innovation and participating on developing people.

AI-based technologies enhance leader's performance and productivity in many areas such as mindful tech-savvy humanist, fostering systemic intelligence, building trust, innovation, developing creative capabilities, fostering leadership skills, enhancing strategic thinking skills, managing uncertainty and having creative foresight; (Kirkland, 2014; Bourton, Lavoie, & Vogel, 2018; Rao & Verweij, 2017). The generic model of Leadership competencies is divided into four essential competencies which are critical thinking, people effectiveness, self-management and social awareness (Sanghi, 2016). In Addition to the above basic leadership competencies, many researchers found that other competencies should be with the leaders for the purpose of augmenting leadership competencies toward AI-based technologies. The main leader's competencies are emotional intelligence, innovation and adaptability, Digital Savvy, judgment competency, digital competency. Emotional intelligence includes skills like empathy, critical thinking and planning, building rapport, judgment, and teamwork and collaboration. Also, judgment competency includes Creative thinking, Data analysis and interpretation and Strategy development. Figure 1 shows the comprehensive framework for AI-Augmented leadership competencies. The Omani government leaders are well educated and most of them are technocrats as they pursued their post-graduate studies in their field of specialization. According to the recent changes in Oman, Ministries' leaders depended on competencies, experience and previous accomplishments rather that political situation. The current Ministers have the most above additional competencies required for AI-based technologies.

Figure 1. Framework for AI-augmented leadership competencies



SOLUTIONS AND RECOMMENDATIONS

Ministry Leaders should plan for the fact that using AI will create and remove other jobs with the organization. The leaders should focus more on developing and preparing them for this purpose. Leaders may fact up in adopting AI-based technologies to reduce the time spend on administrative coordination and control and developing strategy and problem solving. Hens, they will have more time for innovation and participating on developing people. Leaders should be aware that the process of transformation towards using AI-based systems is moving very fast globally and requires careful planning and administration to manage the negative consequences and gain the most benefits from the system.

FUTURE RESEARCH DIRECTIONS

The research could be conducted by using primary data to provide more reliable information about transformation of AI leaders in public sectors and their needed competencies. More similar studies are needed to cover other sectors, contexts and organizations with different sizes. Also, the framework developed in this study needs to be examined through primary data which can be collected by mixed approach studies.

CONCLUSION

The research investigates how adopting AI-based technologies could redefine leadership roles. Also, to identify the gap of critical leadership competencies of AI-based technologies in Oman's public sector. The study depended on secondary data source. The study selected randomly four leaders Ministry which are: (1) Minister of Housing and Urban Planning, Minister of higher education and scientific research and innovation, Minister of economy and Minister of Finance. The results confirm that leaders spend 84 percent of their time on administration and problem solving works in which the AI-based technology is able to perform and making the required data analysis and predications to make the decisions. In Oman's public sector, the leaders working time focused more on administrative coordination and control and developing strategy and problem solving. Also, there is few attention toward innovation and participating on developing people. Also, AI-based technologies enhance leader's performance and productivity in many areas such as mindful tech-savvy humanist, fostering systemic intelligence, building trust, innovation, developing creative capabilities, fostering leadership skills, enhancing strategic thinking skills, managing uncertainty and having creative foresight (Kirkland, 2014; Bourton, Lavoie, & Vogel, 2018; Rao & Verweij, 2017). AI-based technologies required further competencies which are emotional intelligence, innovation and adaptability, Digital Savvy, judgment competency, digital competency. The study found also that the current Oman's Ministries leader are having most the competencies required for augmenting AI-based technologies.

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ENDNOTES

[1] Artificial intelligence (AI) is part of a computer science that focus on developing self-aware and capable machine to perform several tasks which usually required human intervention.

[2] Decisiveness refers to the leader's ability to analyze the available information related to ambiguous or uncertain situations and make good decision at the right time.

Chapter 17
Moving Vehicle Detection in Traffic Video Using Modified SXCS-LBP Texture Descriptor

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ABSTRACT

In this chapter, the authors proposed background modeling and subtraction-based methods for moving vehicle detection in traffic video using a novel texture descriptor called Modified Spatially eXtended Center Symmetric Local Binary Pattern (Modified SXCS-LBP) descriptor. The XCS-LBP texture descriptor is sensitive to noise because in order to generate binary code, the value of center pixel value is used as the threshold directly, and it does not consider temporal motion information. In order to solve this problem, this chapter proposed a novel texture descriptor called Modified SXCS-LBP descriptor for moving vehicle detection based on background modeling and subtraction. The proposed descriptor is robust against noise, illumination variation, and able to detect slow moving vehicles because it considers both spatial and temporal moving information. The evaluation is carried out using precision and recall metric, which is obtained using experiments conducted on popular dataset such as BMC dataset. The experimental result shows that the method outperforms existing methods.

INTRODUCTION

Nowadays, there is an increasing demand for the computerized visual video surveillance system. The video surveillance cameras installed in highways and roads intersections helped to record different types of abnormal events, most common abnormal events like vehicle collisions, traffic jam, near pass, lane cross, and sudden vehicle stop. In demand to detect the abnormal events in traffic video, one of the significant preprocessing steps is moving vehicle's detection in a video sequence captured by a stationary camera. In the last two decades, the investigators have proposed many approaches for detection of moving vehicles in traffic video and not reached good accuracy due to many challenges such as illumination variation, dynamic background, and shadow. These challenges are usually noticed using background

DOI: 10.4018/978-1-7998-2402-2.ch017

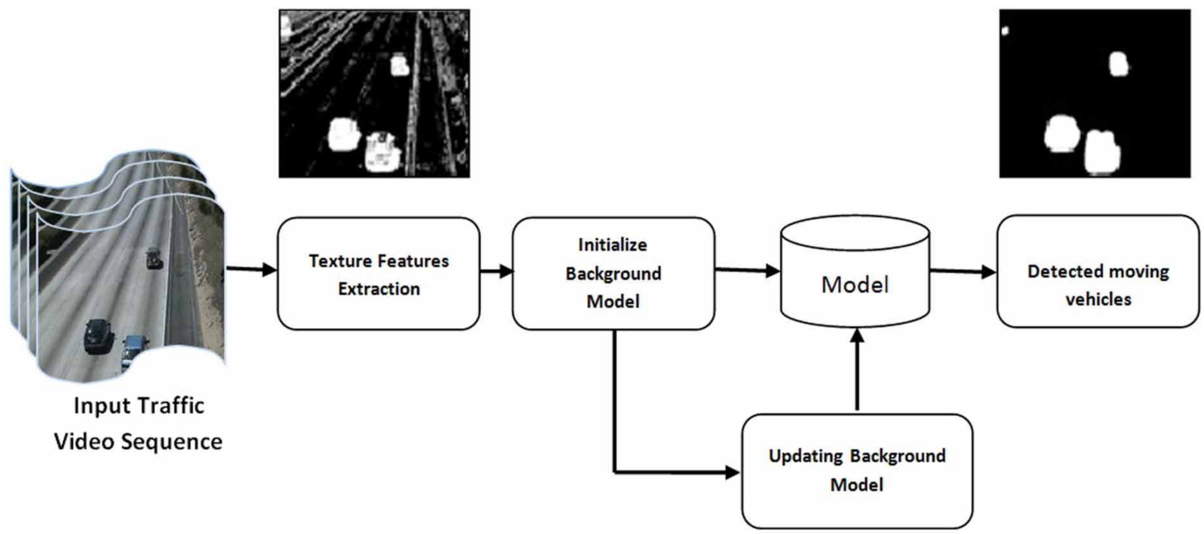
model-based approaches where the background model is constructed, and its parametric quantity can track changing illumination, and it can more accurately represent complex backgrounds. The process needed in the background model-based technique is that subtract the background modeled frame with the current video frames, which first constructs an adaptive dynamic background model, and then new pixel that is unlikely to be generated by this model is labelled as moving vehicles.

The state-of-art have proposed background model-based systems for detection of moving objects in video captured by a stationary camera. Among all these current background model systems, the Local Binary Patterns (LBP) (Ojala et al., 2002) texture descriptor based background modeling system show the outstanding result for moving object's detection. Perhaps the most significant properties of the LBP texture operator are its tolerance against illumination changes and its computational simplicity. Still, the original LBP descriptor is not efficient for constructing background system because of its sensitivity to noise where a small change of the central value significantly affects the resulting code (Caroline Silva et al., 2014). It produces the long histogram and does not study temporal moving information of objects (Gengjian Xue et al., 2010). Marko Heikkila et al. (2006) have proposed the moving object's detection in the video sequence using Center Symmetric Local Binary Pattern (CS-LBP) descriptor. The CS-LBP descriptor is an extension of LBP and has various advantages compared to LBP descriptor such as tolerance to illumination changes, robustness on flat image areas, computational efficiency and produced short histograms. The drawback of CS-LBP descriptor based background modeling system is that temporal moving information of the object is not considered. Hence, the CS-LBP descriptor failed to detect slow-moving objects in the video sequence. Gengjin Xue et al. (2010) have proposed Spatial Extended Center-Symmetric Local Binary Pattern (SCS-LBP) for moving the object's detection in video based on background modeling. It extracts both spatial and temporal moving information concurrently, but not considered central pixel value while calculating binary patterns, which leads to omitted of central pixel information. Caroline Silva et al. (2014) have proposed the method called as eXtended Center-Symmetric Local Binary Pattern (XCS-LBP) descriptor, which is the mixture of original LBP and CS-LBP descriptor. The XCS-LBP descriptor yields a small histogram as related to LBP and extracts more texture details in video frame compared to CS-LBP and SCS-LBP descriptor. However, the disadvantage of XCS-LBP descriptor is that it is delicate to noise because in order to produce binary code, the value of central pixel value is still used as the threshold directly and the second drawback is that it does not consider temporal video frame information, considers only spatial information. Some other disadvantage of XCS-LBP descriptor is that it produces same binary code for different local structures.

In order to overcome the drawbacks of XCS-LBP, in this chapter, we proposed a new texture descriptor called as Modified SXCS-LBP descriptor, which is an addition of XCS-LBP descriptor for moving objects detection in the video sequence. In order to make our approach most robust against background noise, the value of each central pixel in a 3x3 local area is changed by its average local gray level (Zhao et al., 2013). Related to gray value, an average local gray level is more robust to noise. In order to avoid the same binary code produced for two dissimilar structures, the neighbors of each neighbor pixel are also considered (Zhao et al., 2013). In our approach, with these modifications to original XCS-LBP, we also consider the temporal moving object information in addition to spatial information, which helps to detect slow-moving objects in the video sequence.

Our main contribution involved in this chapter is that we proposed a new descriptor called Modified SXCS-LBP texture descriptor, which extracts detailed spatial texture features with the temporal moving object information. For adaptive background modeling and subtraction, we adopted the method proposed by Marko Heikkila et al. (2006), which involves two major steps. In the first step, we extract the texture features using Modified SXCS-LBP texture descriptor; the extracted features are used to initialize and update the background model. In the second step, we subtract the current video frame and the constructed background frame, which helps to segmented or detected moving objects. The flow diagram of our approach is shown in Figure 1.

Figure 1. The pipe line of our approach



Literature Review

In the state of the art the last two decades, a number of methods have been proposed for detection of moving objects in the video sequence. Some of the most important and popular approaches are based on frame difference technique. Frame difference based techniques can be categorized into two types, adaptive and non-adaptive methods. In non-adaptive methods, moving objects are detected through subtraction of consecutive frames, and do not maintain any background model, whereas in adaptive methods, moving objects are detected through initialization and construction of the background model, which is subtracted with the current frame. Our proposed method belongs to adaptive method's category.

Changing the object's position detection purpose is to find moving objects in all video frames. In the case of detecting the moving objects in a video which is captured using still camera, background modeling is very important compared to foreground modeling. This is due to the fact that foreground information is continuously changing and background information is constant because of the fixed camera. Hence, background modeling is essential and these techniques yield good results. Background modeling is referring to the kind of model to denote the background. It controls mainly the capability of the model to deal with uni-modal or multi-modal backgrounds (B. Langmann et al., 2010). In the survey paper (Bouwmans, 2014), an overall review of traditional and recent approaches for moving object's detection using background modeling is presented and discussed them in terms of the critical situations that they claim to handle, and also presented the available resources, datasets, and libraries.

The literature survey reveals that, the simplest background modeling technique assumes that the intensity values of a pixel can be modeled by a single Gaussian distribution (W.E.L Grimson et al., 1999). In this approach, each pixel is modeled as a mixture of Gaussians. The Gaussian distributions of the adaptive mixture model are then evaluated to determine, which are most likely to result from a background process. Each pixel is classified based on whether the Gaussian distribution which represents it most effectively is considered part of the background model.

A large number of background modeling based methods for detecting moving objects have been proposed based on different features, which are utilized for modeling the background. The feature's selection is a very important step in features based background modeling construction techniques. The selection of the discriminative features leads to constructing the dynamic background model accurately (S. Zhang et al., 2008). Some of the popular features for constructing the background models are spectral features (color), spatial features (edge and texture features), and temporal (motion) features. The computational time, accuracy and consistency are some of the considerations that need to be taken into account when making features selection. Even if each type of features has its own strengths and weaknesses, there is no universal feature that can perform well for all problems.

Blauensteiner et al. (2007) have proposed a novel approach for background modeling based on IHLS (Improves Hue, Luminance, and Saturation space) color model and saturation weighted hue statistics. Each background pixel was modeled by its mean luminance and associated standard deviation. Lorena Guachi et al. (2014) have proposed to construct the background model using color descriptor combined with the gray color descriptor. The accuracy of background modeling using color features is very low because there is a situation that, both foreground and background may have a similar color. Munir shah et al. (2014) have proposed background modeling method using SURF features. The proposed method automatically learned dynamics of the scene and adapts its parameters, and a new spatio-temporal filter is employed to further refine the moving object's detection results. The SURF features are quite resilient to noise and thus are a better choice to deal with illumination changes.

Atsushi shimada et al. (2013) have proposed framework is called bidirectional background modeling, and performed background subtraction based on bidirectional analysis, i.e. analysis from past to present and future to present frames. This method is computationally expensive because the information is taken from a future period, and accuracy is about 30 percent if only 33 milliseconds of delay are considered. Chia Hung Yeh et al. (2013) have proposed a novel block-based background modeling method based on a hierarchical coarse-to-fine texture description. The proposed method is efficient for both illumination changes and shadow disturbance. Leonid Taycher et al. (2005) have proposed statistically consistent system for including feedback from the high-level motion model to modify adaptation behavior. Jiu Yue Hao et al. (2013) proposed background subtraction algorithm based on spatio-temporal background and foreground modeling. Qiang Ling et al. (2014) have proposed to adopt object tracking results to improve background modeling and foreground segmentation. Based on the feedback information, it divides a frame image into four types of regions and takes appropriate actions for different types of regions, which yields good performance of background modeling. According to the spatial relationship between the tracked object blocks, it groups the predicted object blocks into regions, and adjusts the segmentation thresholds adaptively, which suppresses the erroneous holes and splitting efficiently.

M.Khare et al. (2013) have proposed a new method for detection of moving objects using double change detection together with Daubechies complex wavelet transform. Reducing shift sensitivity and better edge detection properties of Daubechies complex wavelet transforms to make the method robust for detection of moving objects as compared to methods using real valued wavelet transform. Min-Hsiang

Yang et al. (2014) have proposed a novel coarse-to-fine detection theory algorithm to extract foreground objects based on non parametric background and foreground models represented by binary descriptors. Then update background and foreground models by a first in first out strategy to maintain the most recent observed background and foreground instances.

PROPOSED DESCRIPTOR

The Local Binary Patterns (LBP) descriptor was first presented by Ojala et al. (2002). The LBP descriptor describes each pixel by comparing its value with neighbors. If the neighboring pixel value is higher than or equal, then the value is set to 1, otherwise is set to 0. Then the concatenation of binary patterns over the neighborhood transformed into a decimal number as a unique descriptor for each pixel. The LBP is defined as:

$$LBP_{R,P} = \sum_{p=0}^{P-1} S\left(g_p - g_c\right) 2^p, \tag{1}$$

where g_c corresponds to the gray value of the central pixel and g_p is the gray value of neighbor pixels equally spaced on a circle of radius R and P is the size of the neighborhood. The threshold function $S(x)$ is defined as follows:

$$S(x) = \begin{cases} 1 & x \geq 0 \\ 0 & otherwise \end{cases} \tag{2}$$

Heikkila et al. (2002) have introduced Center Symmetric Local Binary Pattern (CS-LBP) descriptor. The CS-LBP descriptor is an effective extension of LBP descriptor, where it compares the gray values of pairs of pixels in center-symmetric direction and is defined as:

$$CS-LBP_{R,P} = \sum_{p=0}^{\left(\frac{P}{2}\right)-1} S\left(g_p - g_{p+\left(\frac{P}{2}\right)}\right) 2^p, \tag{3}$$

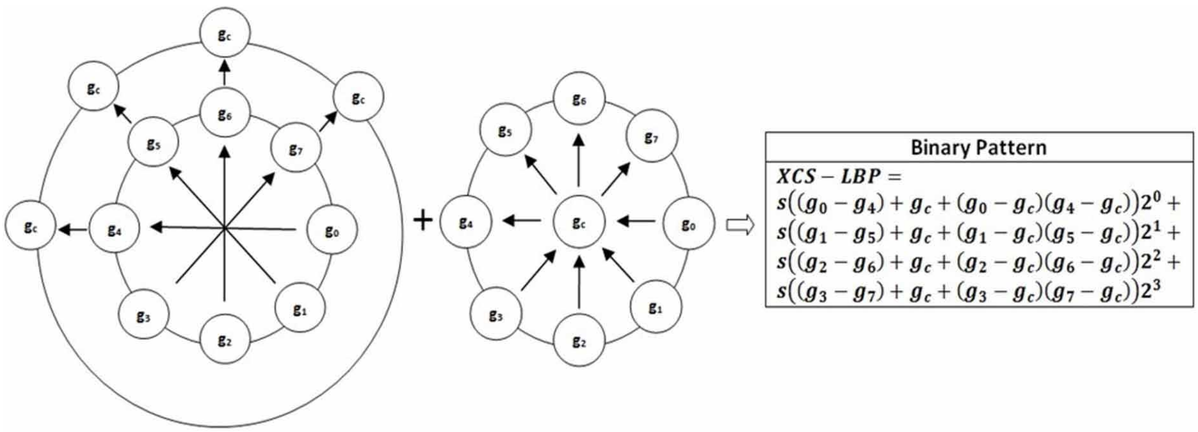
where g_p and $g_{p+\left(\frac{P}{2}\right)}$ correspond to gray values of the center-symmetry pair of pixels and the function $S(x)$ is threshold function defined as in the equation (2).

Caroline Silva et al. (2014) have introduced an extension of CS-LBP called as eXtended Center-Symmetric Local Binary Patterns (XCS-LBP) descriptor for moving object's detection. The working process of XCS-LBP is shown in Figure 2.

The XCS-LBP descriptor can be expressed as:

$$XCS-LBP_{R,P} = \sum_{p=0}^{\left(\frac{P}{2}\right)-1} S\left(f_1(p,c) + f_2(p,c)\right) 2^p, \tag{4}$$

Figure 2. The XCS-LBP descriptor



where f_1 and f_2 are defined as:

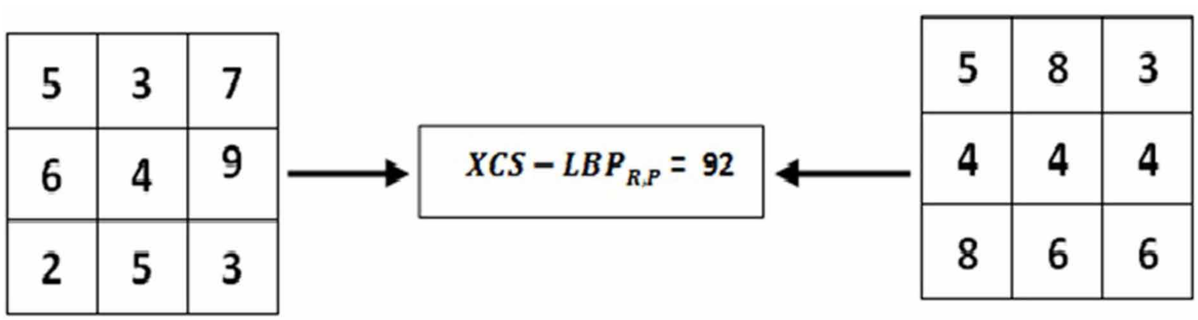
$$\begin{cases} f_1(p,c) = \left(g_p - g_{p+\left(\frac{P}{2}\right)}\right) + g_c \\ f_2(p,c) = \left(g_p - g_c\right)\left(g_{p+\left(\frac{P}{2}\right)} - g_c\right), \end{cases} \tag{5}$$

The threshold function $S(f_1+f_2)$ is defined as follows:

$$S(f_1 + f_2) = \begin{cases} 1 & if \ (f_1 + f_2) \geq 0 \\ 0 & otherwise \end{cases} \tag{6}$$

The background modeling process (Caroline Silva et al., 2014) proposed for moving object detection in video sequence based on XCS-LBP descriptor has three important drawbacks. The first drawback is that it produces the same binary code for different local structures. For example, consider two different 3x3 blocks, each belongs to two different frames (Figure 3). The central pixel neighborhood of each block is represented as the vector (9, 7, 3, 5, 6, 2, 5, 3) and (4, 3, 8, 5, 4, 8, 6, 6) respectively. It is verified that the XCS-LBP descriptor formed the same descriptor value 92 for both the blocks even though both belong to different structures. It is hard to say they have a similar local structure. The second drawback is that they are sensitive to noise. This is because, in XCS-LBP, the value of the center pixel in 3 x 3 local area is subtracted from its central symmetry pixels. For instance, the value of the center pixel is changed due to the occurrence of noise; this leads to different descriptor value than its original descriptor value. The XCS-LBP descriptor considers only spatial information and does not consider temporal moving information from the vehicle. The temporal moving information of a vehicle helps to detect slow moving vehicles accurately.

Figure 3. Demonstration of similar descriptor value generated for two different blocks



In order to overcome the drawbacks of XCS-LBP for moving vehicle's detection in traffic video, we proposed to extend XCS-LBP called as Modified SXCS-LBP descriptor for moving vehicle's detection in traffic video. The main motivation for our approach is that CRLBP (Completed Robust LBP) operator for texture classification proposed by Zhao et al. (2013) where the value of each center pixel in a 3 x 3 local area is replaced by its average local gray level computed using its neighbor pixels. Compared to central pixel gray value, average local gray level is more robust to noise and illumination variation. In order to avoid same binary code generated for different structures, we adopted the idea proposed by Guo et al. (2010), where the neighbor pixel's gray value is replaced by average of its neighbor pixel's gray value.

As we mentioned, we replace the centre pixel gray value by average gray value of neighbor of neighbor pixel gray values. The Average Local Gray Level $\left(ALG\right)_{g_i}$ of neighbor pixel g_i is defined as follows

$$\left(ALG\right)_{g_i} = \frac{\sum_{j=1}^{P}\left(g_j\right)+g_i}{P+1}, \tag{7}$$

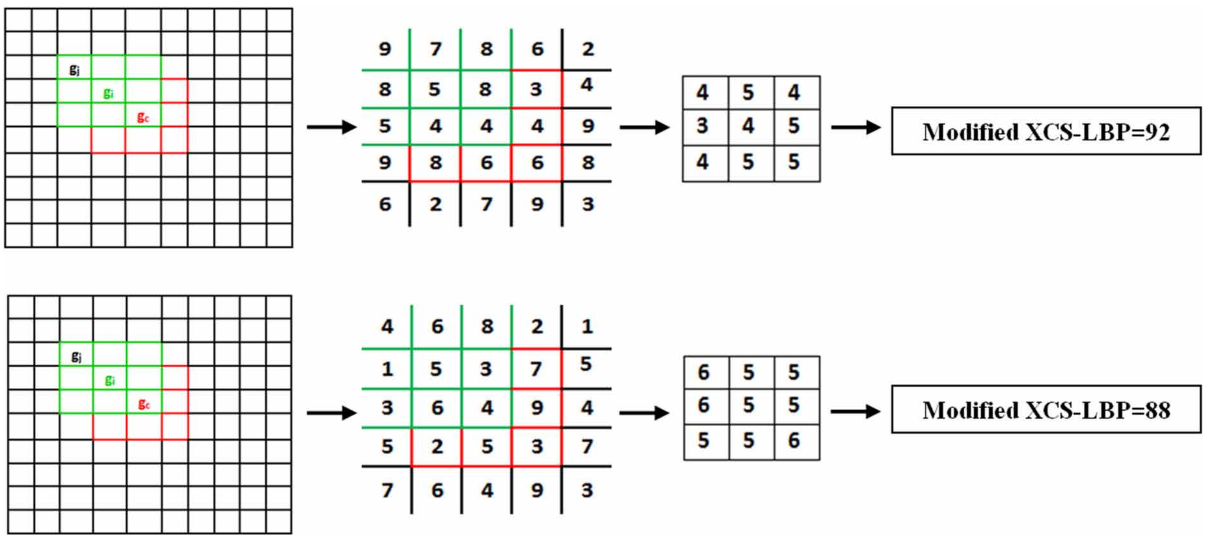
where $\left(ALG\right)_{g_i}$ is average gray value computed for neighbor pixel g_i (i=1,…,p) using its neighbor pixels g_j (j=1,…,p).

The Average Local Gray Level $(ALG)_c$ of center pixel is defined as follows:

$$\left(ALG\right)_c = \frac{\sum_{i=1}^{P}\left(ALG\right)_{g\,i}+g_c}{P+1}. \tag{8}$$

The image blocks shown in Figure 4 are an extension of image blocks shown in Figure 3, where the neighbor of neighbor pixels is also displayed. For the first block, g_c=4 is the center pixel of 3 x 3 local area marked by red color grid. Consider one of its neighbor's gray value g_i=5. The neighbor pixels of g_i=5 is represented by the vector g_j= (4,6,8,3,4,6,3,1) is marked by the green color grid. The average gray value of the neighbor pixel g_i=5 is computed using the average gray value of its neighbor pixels g_j= (4,6,8,3,4,6,3,1) including g_i=5. This process is continual for every neighbor pixel of the center pixel. Finally, we considered these newly computed neighbor pixel gray values while computing the average gray value of the center pixel. Figure 4 shows the computed center pixel average gray value for two

Figure 4. The demonstration of modified XCS-LBP descriptor for giving two different descriptor value for two different blocks shown in Figure 3.



given blocks. We can observe that 4 and 5 are the average gray level of the center pixel for the given two blocks. The Figure 3 shows that, we obtained same descriptor value (92) using XCS-LBP operator for two different blocks because the center pixel gray value 4 is used as a threshold. However, in case of Modified XCS-LBP, for the given two different blocks, we obtained different center pixel gray value (4 and 5). Hence, it is obvious that we obtained two different descriptor values (92 and 88) for two different blocks. Hence, it is verified that Modified XCS-LBP yields different descriptor values for two different image blocks. The Modified XCS-LBP operator is defined as:

$$Modified\ XCS-LBP_{R,P} = \sum_{p=0}^{(P/2)-1} S\left(f_1\left((ALG)_{g_i},(ALG)_c\right) + f_2\left((ALG)_{g_i},(ALG)_c\right)\right)2^P, \tag{9}$$

where f_1 and f_2 are defined as:

$$\begin{cases} f_1\left((ALG)_{g_i},(ALG)_c\right) = \left((ALG)_{g_i} - (ALG)_{g_i+\left(\frac{P}{2}\right)}\right) + (ALG)_c \\ f_2\left((ALG)_{g_i},(ALG)_c\right) = \left((ALG)_{g_i} - (ALG)_c\right)\left((ALG)_{g_i+\left(\frac{P}{2}\right)} - (ALG)_c\right). \end{cases} \tag{10}$$

where $(ALG)_{g_i}$ is defined as:

$$(ALG)_{g_i} = \frac{\sum_{j=1}^{P}(g_j) + g_i}{P+1}, \tag{11}$$

$$\left(ALG\right)_c = \frac{\sum_{i=1}^{P}\left(ALG\right)_{g\,i} + g_c}{P+1}, \tag{12}$$

The threshold function $S(f_1+f_2)$ is defined as in the equation (6).

The Modified SXCS-LBP descriptor is robust against illumination variation, insensitive to noise and invariant to monotonic changes in gray scale. It also supports the modeling of multi-model backgrounds, and it produces short histogram compared to original LBP.

Modified SXCS-LBP Descriptor

In order to consider temporal motion information in addition to spatial information, we added other two terms to existing Modified XCS-LBP descriptor. A new descriptor is called as Modified Spatially eXtended Center-Symmetric Local Binary Pattern (Modified SXCS-LBP) descriptor. The Modified SXCS-LBP descriptor is defined as follows:

$$Modified\ SXCS-LBP_{R,P} = Modified\ XCS-LBP_{R,P} + f\left(p\left(x,y,t\right) - \bar{\mu}\left(x,y,t-1\right)\right)2^{\left(\frac{P}{2}\right)}, \tag{13}$$

where $f(t)$ is binary temporal function used for describing temporal relationship and is defined as:

$$f\left(t\right) = \begin{cases} 0 & \left|p\left(x,y,t\right) - \bar{\mu}\left(x,y,t-1\right)\right| < 2.5 * \bar{\sigma}\left(x,y,t-1\right) \\ 1 & otherwise \end{cases} \tag{14}$$

where $\bar{\sigma}\left(x,y,t-1\right)$ and $\bar{\mu}\left(x,y,t-1\right)$ are estimated standard deviation and mean value respectively corresponding to current pixel $p(x,y,t)$. If $f(t)$ of current pixel $p(x,y,t)$ lies within the user defined threshold 2.5 multiplied with its standard deviation, then the current pixel is classified as background otherwise it is classified as foreground.

MOVING VEHICLES DETECTION

In this section, we introduce our approach to moving vehicle's detection based on background modeling and subtraction. Our proposed approach uses both detailed spatial texture, and temporal moving information extracted using Modified SXCS-LBP descriptor. For background modeling and subtraction, we adopted the method proposed by Marko Heikkila et al. (2006). Our approach involves two phases such as background modeling and moving vehicle's detection, which is described in the following subsections.

Background Modeling

We considered Modified SXCS-LBP histogram of each pixel as the feature vector for background modeling. At the formatted stage, each bin of the n Modified SXCS-LBP histogram is set as 0. The weight of each histogram is set as $1/n$. The Modified SXCS-LBP histogram of the pixel is computed over a circular region of radius R_{region} around the pixel using its neighbor pixels Modified SXCS-LBP descriptor value. In order to build the background model for the pixel, we consider the group of s weighted Modified SXCS-LBP histograms such as $(m_0, m_1, \ldots, m_s)$ of the pixel. We denote the weight of the s^{th} histogram at time instant t by $\omega s_{,t.}$ The background model histograms are sorted in decreasing order according to their weights. As a result, the most probable background histograms are on the top of the list and select the first B models as the background histograms as follows:

$$\omega_0 + \omega_1 + \ldots + \omega_B > T_p \, , \tag{15}$$

where T_p is the user defined parameter. If T_p is a smaller value, it should be modeling a uni-model background. In the case of multi-model background, a large value for T_p is recommended. Then the current histogram is compared with the selected B background histograms using the proximity measure.

While updating the background model, we compute the Modified SXCS-LBP histogram of the pixel in the new frame. In order to extract the temporal information, we estimate the mean and standard deviation of the pixel using the improved estimation method proposed by Pedro Gil-Jimenez et al. (2009). The mean and standard deviation of the pixel are defined as follows:

$$\bar{\mu}_t = \left(1-\beta\right)\bar{\mu}_{t-1} + \beta I_t \, , \tag{16}$$

$$\bar{\sigma}_t^2 = \left(1-\beta\right)\bar{\sigma}_{t-1}^2 + \frac{\beta}{2}\left(I_t - I_{t-1}\right)^2 , \tag{17}$$

where I_t is current pixel value, and I_{t-1} are the previous pixel values respectively, β is a learning rate. Next, the current histogram is compared with the selected B background histograms using the proximity measure.

First, we compare the new histogram m_t against the existing k model histograms using a distance measure. We use histogram intersection as the distance measure, the histogram intersection for the normalized histogram's m and h is defined as follows:

$$\cap\left(m,h\right) = \sum_{i=0}^{L}\left(m\left(i\right), h\left(i\right)\right), \tag{18}$$

where m and h are the current and existing histograms, i is the histogram bin index, and L is the number of histogram bins respectively. If the proximity is below the user defined the threshold value T_b for all background histograms, the pixel is considered as foreground. Then, the model histogram with the lowest weight is replaced with the new histogram and is given a low initial weight. The best matching model histogram is denoted by m_k is adopted with the new data by updating its bins as follows:

$$m_k = (1 - \alpha \mathrm{b}_{)} \mathrm{m}k + \alpha \mathrm{bh}_{,} \tag{19}$$

where αb $_i$s the user defined learning rate. In addition, the weight of all model histogram is also updated:

$$\omega k_{=} (1 - \alpha w)w_k + \alpha wMk, \tag{20}$$

where Mk i_s 1 for the best matching histogram and otherwise is 0. The αw is the learning rate. Bigger learning rate means faster adaption. Next, we need to decide which of the histograms of the model is most likely produced by the background processes. We use the persistence of the histogram as an evidence, because, the persistence of the kth h^{is}togram is directly related to its weight ωk,t.

$_{Mo}$ving Vehicles Detection

Moving vehicle's detection is achieved via comparison of the new histogram mk $a_g$ainst the existing B background histograms selected at the previous time instant. If a match is not found, the pixel is considered to belong to the Moving vehicle. Otherwise, the pixel is marked as background.

EXPERIMENTAL RESULTS AND DISCUSSION

The performance of the proposed method for moving vehicle's detection in traffic video is evaluated using publicly available datasets such as Background Models Challenge (BMC) dataset BMC dataset (Vacavant et al., 2012) comprises synthetic and real videos of outdoor situations acquired with a static camera under different weather condition variations such as the wind, sun, and rain.

In order to measure the accuracy of our approach for moving vehicle's detection, we used recall, precision and f-measure calculated based on pixel-wise processing. Recall gives the percentage of detected true positives as compared to the total number of positives in the ground truth. Precision gives the percentage of detected true positives as compared to the total number of pixels detected by the approach and f-measure is the weighted harmonic mean of precision and recall, which can be used to calculate the accuracy of the approach for moving vehicle's detection. The recall, precision and f-measure are defined as follows:

$$precision = \frac{TP}{TP + FP} \tag{21}$$

$$recall = \frac{TP}{TP + FN} \tag{22}$$

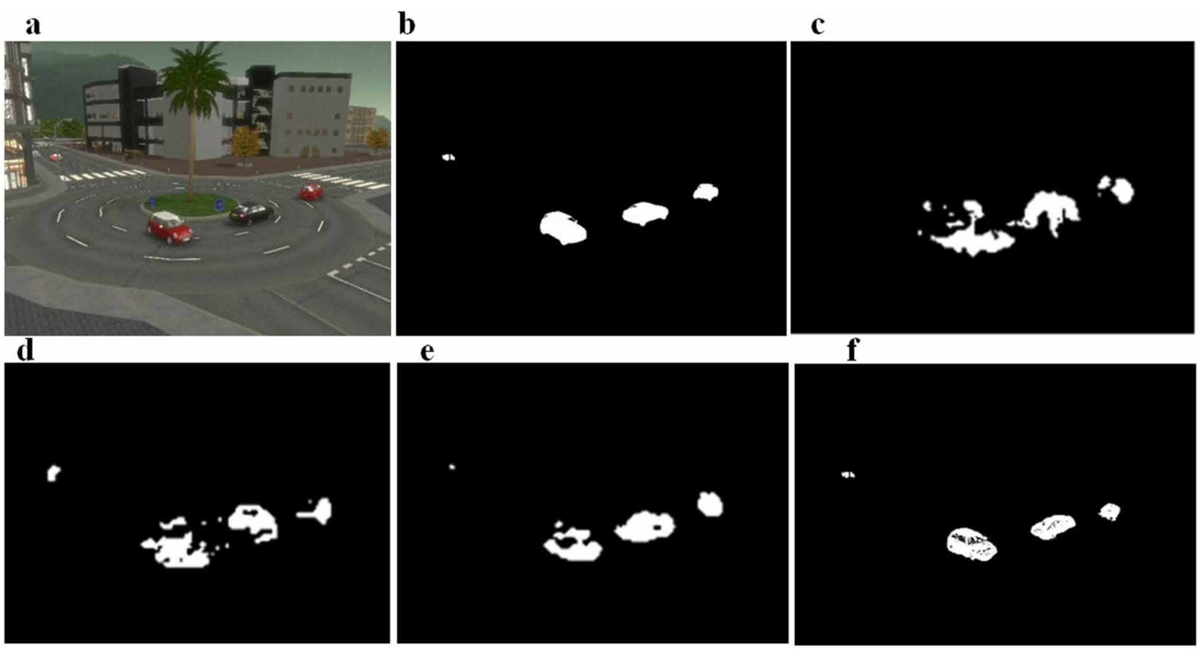
$$+\text{ f-}measure = \frac{2{*}Recall{*}Precision}{Recall + Precision} \tag{23}$$

where, *TP* (True Positive) is the number of pixels correctly detected as foreground pixels, FP (False Positive) is the number of background pixels detected as foreground ones, and FN (False Negative) is the number of foreground pixels detected as background ones. There are two stages involved while evaluating our approach. In the first stage, we compared the results of our approach quantitatively and qualitatively with existing texture based methods such as Original LBP (Ojala et al., 2002), CS-LBP (Heikkila et al., 2009) and XCS-LBP (Caroline Silva et al., 2014). In the second stage, we compared results of our approach with existing non texture based background subtraction methods such as Pixel Based Adaptive Segmentation (PBAS) method (M. Hofmann et al., 2012), Splitting Gaussian Mixture Models (SGMM-SOD) method (R. Evangelio et al., 2011) and Spectral (P. Jodoin et al., 2012).

Selection of Parameter Values

The radius R_{region} defines the region for histogram calculation. The radius R for the proposed Modified SXCS-LBP operator is R=2 and neighborhood size P=8. Choosing a large value of P makes the histogram long and, thus, computing the proximity becomes slow. Using the small number of neighbors makes the histogram shorter but also means losing more information. For histogram comparison, the proximity threshold Tp value lies between 0.6 and 0.7, which yields good results for our selected test sequences. According to the experiments, a good value for s lies between 2 and 5. The parameter T_b=0.8 is used to select the background histograms. The adaptation speed is controlled by two learning rate parameters such as αb and αw. According to the experiments, in most of the cases, the best results are achieved with small values for these parameters, i.e. αb=0.01 and αw=0.005.

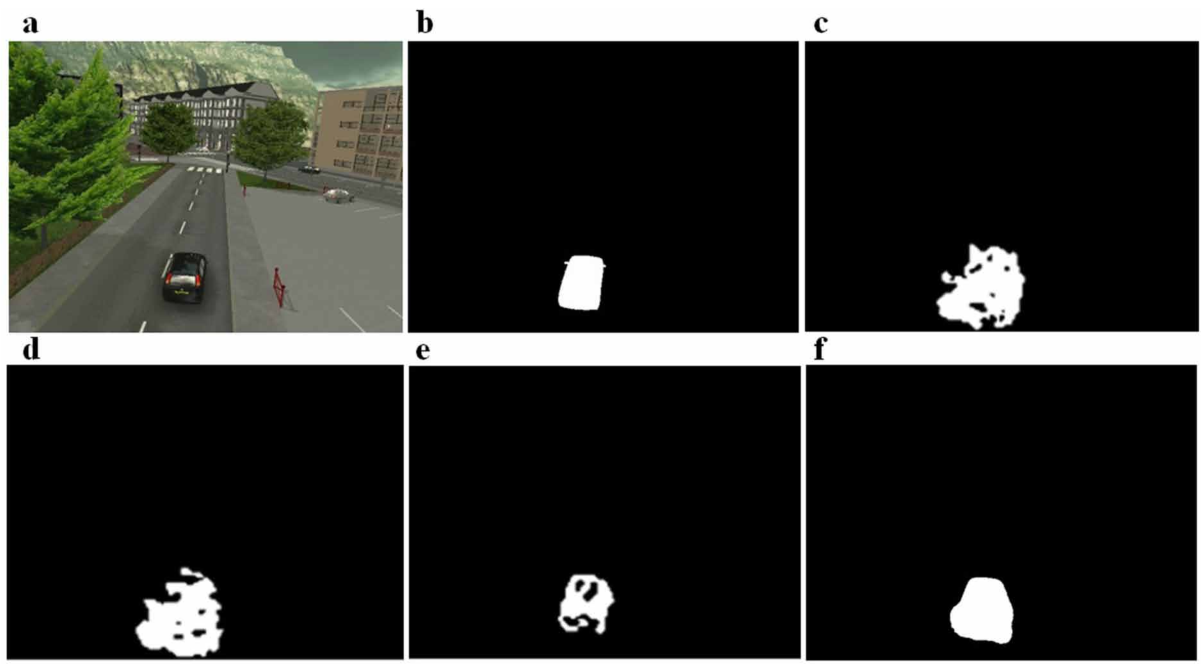
Figure 5. Vehicles detection results on synthetic rotary (frame # 1140) video frame: a) original frame, b) ground truth c) original LBP d) CS-LBP e) XCS-LBP f) our approach.



Experiments on BMC (Synthetic) Dataset

In this section, we presented the experimental results of our approach obtained using BMC Dataset. We conducted the experiments for moving vehicle's detection using two outdoor synthetic video sequences such as Rotary (frame # 1140 for the Scene 322) and Street (frame # 301 for the Scene 112) related to traffic scene which is selected from BMC (synthetic) Dataset. The Figure 5 and Figure 6 shows the visual comparison of our approach results with other texture based background subtraction methods such as original LBP, CS-LBP, and XCS-LBP for video sequences Rotary (frame # 1140) and Street (frame # 301) respectively. The visual comparison shows that the proposed descriptor yields the good result for vehicles detection compared to existing texture descriptors.

Figure 6. Vehicles detection results on synthetic street (frame # 301) video frame: a) original frame, b) ground truth c) original LBP d) CS-LBP e) XCS-LBP f) our approach.



The Table 1 and Table 2 shows the precision, recall and f-measure based quantitative comparison of our approach results with original LBP, CS-LBP and XCS-LBP descriptor for video sequences Rotary (frame # 1140) and Street (frame # 301) respectively. The proposed Modified SXCS-LBP descriptor has achieved highest recall, precision and f-measure compared to other three descriptors for video sequences such as Rotary and Street, which are having illumination variation.

The highest false detection rate obtained using CS-LBP descriptor is due to the fact that it does not consider center pixel value while computing each pixel descriptor value, which leads to missing some information of moving vehicle details. Further, XCS-LBP descriptor also yields highest false detection rate and is not suitable for detecting the moving vehicles in the video sequence which is having illumination variation. This is because, it produces same binary code for different local structure, and

Table 1. Quantitative comparison of our approach results with other descriptors based on recall, precision and f-measure for the frame # 1140(Scene 322) of BMC dataset

Descriptor	Recall	Precision	*f*-Measure
Original LBP	0.603	0.505	0.550
CS-LBP	0.647	0.504	0.566
XCS-LBP	0.829	0.793	0.810
Our approach	0.891	0.854	0.873

Table 2. Quantitative comparison of our approach results with other descriptors based on recall, precision and f-measure for the frame # 301(Scene 112) of BMC dataset

Descriptor	Recall	Precision	*f*-Measure
Original LBP	0.702	0.530	0.604
CS-LBP	0.839	0.512	0.636
XCS-LBP	0.803	0.793	0.798
Our approach	0.834	0.900	0.865

is sensitive to noise. The increase in detection rate for our approach is due to the fact that value of each center pixel in a 3 x 3 local area is replaced by its average local gray level computed using its neighbor pixels. Compared to central pixel gray value, the average local gray level is more robust to noise and illumination variation.

Table 3. Quantitative comparison of our approach results with other non-texture based background subtraction methods using average recall, average precision and f-measure for the synthetic rotary and street video sequence of BMC dataset

Video	Method	Average Recall	Average Precision	*f*-Measure
Synthetic Rotary	PBAS	0.713	0.643	0.675
	SGMM-SOD	0.743	0.654	0.695
	Spectral	0.736	0.655	0.693
	Our approach	0.793	0.731	0.760
Synthetic Street	PBAS	0.713	0.771	0.740
	SGMM-SOD	0.731	0.754	0.742
	Spectral	0.707	0.731	0.719
	Our approach	0.801	0.851	0.825

Finally, we evaluated our approach through comparison of results with the non texture based background subtraction methods using long duration synthetic Rotary and Street outdoor video sequences related to traffic scene. Table 3 shows the precision, recall and f-measure based quantitative comparison results of our approach with other non-texture background subtraction methods such as PBAS, SGMM-SOD, and Spectral method. The results presented in Table 3 are the average precision, average recall and f-measure obtained for each video sequence. The quantitative evaluation shows that our approach achieves highest average precision, average recall and f-measure compared to non texture based existing methods. The video sequences used for experimentation are having illumination variation and our approach extracts illumination invariant texture features which lead to detect the vehicles accurately even in the highest illumination variation conditions. The highest false detection rate for existing non texture based methods is due to the fact that they failed to extract illumination invariant texture features.

CONCLUSION

In this chapter, we introduced a novel approach for moving vehicle's detection using Modified SXCS-LBP descriptor based on background subtraction method. The experimental results obtained using synthetic and real road scenes of popular dataset such as BMC dataset demonstrates that the proposed Modified SXCS-LBP texture descriptor achieves the highest accuracy for moving vehicle's detection in traffic video and robust against illumination changes, insensitive to noise, and invariant to monotonic changes in gray scale. It is verified that our approach efficiently detects moving objects in surveillance video captured in the outdoor environment. Our approach extracts temporal moving information of vehicles, which helps to detect slow moving vehicles. The evaluation process demonstrates that our approach out performs the existing texture and non-texture methods for moving vehicle's detection in traffic video. The drawback of our proposed method is some of the vehicles stayed over a long time in the scene, our proposed method these stopped foreground vehicles are detected as background.

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