Research Insights

Innovative Strategies and Frameworks in Climate Change Adaptation

Emerging Research and Opportunities

Alexander G. Flor and Benjamina Gonzalez Flor

Innovative Strategies and Frameworks in Climate Change Adaptation:

Emerging Research and Opportunities

Alexander G. Flor
University of the Philippines Open University, Philippines

Benjamina Gonzalez Flor
University of the Philippines, Philippines

A volume in the Advances in Environmental Engineering and Green Technologies (AEEGT) Book Series

Published in the United States of America by
IGI Global
Engineering 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: Flor, Alexander G., 1953- | Flor, Benjamina Gonzalez, 1959-
Title: Innovative strategies and frameworks in climate change adaptation : emerging research and opportunities / by Alexander G. Flor and Benjamina Gonzalez Flor.
Description: Hershey PA : Engineering Science Reference, [2018] | Includes bibliographical references.
Identifiers: LCCN 2017010708| ISBN 9781522527671 (hardcover) | ISBN 9781522527688 (ebook)
Subjects: LCSH: Climatic changes--Research, | Climatic changes--Research--Philippines. | Climate change mitigation--Research. | Climate change mitigation--Research--Philippines.
Classification: LCC QC903 .F66 2018 | DDC 363.738/74561091724--dc23 LC record available at https://lccn.loc.gov/2017010708

This book is published in the IGI Global book series Advances in Environmental Engineering and Green Technologies (AEEGT) (ISSN: 2326-9162; eISSN: 2326-9170)

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All work contributed to this book is new, previously-unpublished material.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

Advances in Environmental Engineering and Green Technologies (AEEGT) Book Series

ISSN:2326-9162
EISSN:2326-9170

MISSION

Growing awareness and an increased focus on environmental issues such as climate change, energy use, and loss of non-renewable resources have brought about a greater need for research that provides potential solutions to these problems. Research in environmental science and engineering continues to play a vital role in uncovering new opportunities for a "green" future.

The **Advances in Environmental Engineering and Green Technologies (AEEGT)** book series is a mouthpiece for research in all aspects of environmental science, earth science, and green initiatives. This series supports the ongoing research in this field through publishing books that discuss topics within environmental engineering or that deal with the interdisciplinary field of green technologies.

COVERAGE

- Alternative Power Sources
- Sustainable Communities
- Electric Vehicles
- Waste Management
- Cleantech
- Radioactive Waste Treatment
- Renewable energy
- Contaminated Site Remediation
- Air Quality
- Green Technology

IGI Global is currently accepting manuscripts for publication within this series. To submit a proposal for a volume in this series, please contact our Acquisition Editors at Acquisitions@igi-global.com or visit: http://www.igi-global.com/publish/.

The Advances in Environmental Engineering and Green Technologies (AEEGT) Book Series (ISSN 2326-9162) is published by IGI Global, 701 E. Chocolate Avenue, Hershey, PA 17033-1240, USA, www.igi-global.com. This series is composed of titles available for purchase individually; each title is edited to be contextually exclusive from any other title within the series. For pricing and ordering information please visit http://www.igi-global.com/book-series/advances-environmental-engineering-green-technologies/73679. Postmaster: Send all address changes to above address.

Titles in this Series

For a list of additional titles in this series, please visit:
https://www.igi-global.com/book-series/advances-environmental-engineering-green-technologies/73679

Hydrology and Best Practices for Managing Water Resources in Arid and Semi-Arid Lands
Christopher Misati Ondieki (Kenyatta University, Kenya) and Johnson U. Kitheka (South Eastern Kenya University, Kenya)
Engineering Science Reference • copyright 2018 • 266pp • H/C (ISBN: 9781522527190) • US $205.00 (our price)

Computational Techniques for Modeling Atmospheric Processes
Vitaliy Prusov (University of Kyiv, Ukraine) and Anatoliy Doroshenko (National Academy of Sciences, Ukraine)
Information Science Reference • copyright 2018 • 460pp • H/C (ISBN: 9781522526360) • US $205.00 (our price)

Advanced Nanomaterials for Water Engineering, Treatment, and Hydraulics
Tawfik A. Saleh (King Fahd University of Petroleum and Minerals, Saudi Arabia)
Engineering Science Reference • copyright 2017 • 384pp • H/C (ISBN: 9781522521365) • US $200.00 (our price)

Handbook of Research on Inventive Bioremediation Techniques
Jatindra Nath Bhakta (University of Kalyani, India)
Engineering Science Reference • copyright 2017 • 624pp • H/C (ISBN: 9781522523253) • US $260.00 (our price)

Handbook of Research on Entrepreneurial Development and Innovation Within Smart Cities
Luisa Cagica Carvalho (Universidade Aberta, Portugal & CEFAGE - Universidade de Évora, Portugal)
Information Science Reference • copyright 2017 • 661pp • H/C (ISBN: 9781522519782) • US $235.00 (our price)

Applied Environmental Materials Science for Sustainability
Takaomi Kobayashi (Nagaoka University of Technology, Japan)
Information Science Reference • copyright 2017 • 416pp • H/C (ISBN: 9781522519713) • US $205.00 (our price)

701 East Chocolate Avenue, Hershey, PA 17033, USA
Tel: 717-533-8845 x100 • Fax: 717-533-8661
E-Mail: cust@igi-global.com • www.igi-global.com

Table of Contents

Section 3
Emerging Opportunities

Preface

INTRODUCTION

One of the most critical concerns in today's world is climate change: its global scale; its apparent inevitability; and its dramatic impact on our daily lives. There are two ways by which we can proactively engage with climate change: mitigation and adaptation. Mitigation refers to the reduction and sequestration of greenhouse gases that cause global warming. Identifying mitigation solutions requires the expertise of meteorologists, ecologists, engineers and economists. Adaptation, on the other hand, deals with strategies (and alternative technologies) that temper the consequences of climatic events. Adaptation deals with changes in human behavior and, as such, is the purview of social scientists.

Climate change adaptation is an emerging area of study that has yet to be entirely forged by the rigors of the social and behavioral sciences. Through this book, we propose the conduct of climate change adaptation analyses using new research perspectives, methods and tools. We present a research framework based on the behavioral model. We enumerate basic humanistic assumptions on climate change adaptation and introduce taxonomies of adaptive behaviors among vulnerable communities.

The target audience and potential users of this book include: climate change adaptation researchers; technical staff of legislators and policymakers from government regulatory bodies; faculty members of communication and environmental science academic departments; graduate and undergraduate students of development communication and environmental management; local government officials and nongovernment organization workers engaged in so-called *climate actions* or interventions; and social mobilization practitioners particularly from civil society.

Current books on climate change adaptation have not tackled research frameworks, methods and tools, concentrating mainly on country experiences

and case studies. In contrast, this book intends: to provide coherence to the current climate change adaptation discourse and reconcile it with mainstream behavioral, social and knowledge sciences; to contribute to the understanding of climate change resilience; and to provide a framework for the analysis of climate change responses. It deals with adaptation for the most basic of our concerns: food security. It discusses research strategies and frameworks on climate change adaptation within, what is referred to as the primary economic sector, agriculture. Although these strategies and frameworks are based on Philippine experiences, it is applicable to most countries in the Global South, specifically the most vulnerable to conditions associated with changing climates.

This book proposes research tools that may result in a better understanding of the adaptation phenomena. A clearer understanding, made possible by a conceptual framework, leads to more manageable investigations and more meaningful analyses. Moreover, it frames adaptation within a conceptual schema that allows for scientific inquiry. It also reconstructs climate change resilience from the point of view of vulnerable groups.

ORGANIZATION OF BOOK

The volume consists of three sections.

In Section 1, we discuss the concept of climate change resilience among vulnerable communities and propose measures of resilience. It contains an introductory chapter describing the reality of climate change from societal, professional and personal perspectives. Chapter 1 also attempts to explain the causes of climate change from a layperson's point of view.

In Chapter 2, we define the dominant climate change discourse and the adaptation narrative linking the latter with mainstream social sciences. Three of the most dominant threads in the global discourse are vulnerability, awareness and resilience. The climate change community submits that one's exposure to climate threats, sensitivity to climate extremes and adaptive capacity to climate impacts determine vulnerability to climate risks. Furthermore, the community uses the terms awareness and knowledge interchangeably when the behavioral and learning science traditions make clear distinctions and differentiations between the two. The current discourse also pays emphasis on the words resilience and sustainability and highlights the transdisciplinary nature of each.

In Chapter 3, we outline our theoretical framework for such research enumerating our assumptions and revealing our predisposition towards the neo-positivist, neo-behaviorist analytical lens. We then present the concept of adaptation taxonomies and provide one related to food security. This guided us in the development of assessment procedures for climate change adaptation.

In Section 2, we elaborate upon emerging research of the adaptation phenomenon using these procedures. Chapter 4 expounds on the research methods applying these within the context of food security. The methods cover two procedures: benchmarking and evaluation. We originally compiled these procedures in a report titled, *Climate Change Adaptation Among Farm Families and Stakeholders: A Toolkit for Assessment and Analysis* along with our colleagues from the Philippine Climate Change Adaptation Project.

In Chapter 4, we define benchmarking as the documentation, measurement and analysis of current adaptation practice in any given target group, organization or community for purposes of comparison, internal or external, to a given standard, *de facto* or otherwise. Generally, benchmarking is not done within the bounds of project parameters (i.e., time and resources) and project-determined outcomes. On the other hand, evaluation refers to baseline, mid-term, final and ex-post measurements of adaptation *vis a vis* given interventions. Evaluation is conducted within set project parameters and predetermined project outcomes. As an add-on, we included as appendices two training manuals that we employed in capacitating agricultural extension workers on assessing climate change adaptation. In the first one, we enumerate the Seven Steps in Benchmarking Climate Change Adaptation. In the second, we discuss the procedures used in the PhilCCAP assessment. After studying these two manuals, readers should be able to: benchmark climate change responsiveness; and evaluate climate change adaptation projects.

The rest of Section 2 reveals how we subjected the above methods to field validation. We devoted a chapter each to two case studies on the application of the aforementioned framework and tools.

Chapter 5 deals with the benchmarking of climate change resilience at organizational, community and sectoral levels. It describes climate change responsiveness profiles of three sectors: the academe, the youth, and a national government agency (NGA), the Department of Agriculture. Note that in this book, we define climate change responsiveness as a determinant of resilience, along with risks and resources. Responsiveness has three elements: the amount of knowledge gained (ΔK); the degree of attitude change (ΔA); and changes in practice (ΔP). Our focus on responsiveness has brought us beyond the risk discourse.

Chapter 6 reports on the final evaluation of the five-year Philippine Climate Change Adaptation Project as a case study. The objectives of the evaluation were to determine the percentage of households in the targeted areas who have adopted coping strategies, new technologies or improved farming practices to better cope with climate variability and extremes; to determine the percentage of stakeholders in the targeted areas who have participated in or are knowledgeable of activities demonstrated by the project to reduce vulnerability or improve adaptive capacity; to compare these percentages to baseline and midterm values; and to assess project performance vis a vis its development targets at the end of the project.

In Section 3, we identify emerging opportunities for employing research-based knowledge management and communication in climate actions or interventions. Chapters 7 and 8, respectively, propose knowledge management and communication strategies for this purpose.

Climate change does not target specific countries. It knows no national boundaries. It is manifesting itself as a concrete reality with its most devastating impact felt among the poorest, most vulnerable communities. It cannot be stopped, prevented or avoided. We can only mitigate its impact by reducing carbon emissions to delay or offset global warming. Communities and families, on the other hand, can only adapt and cultivate resilience. Adaptation that leads to resilience entails changes in knowledge, attitudes and practice. These changes need to be tracked systematically and scientifically. We hope that this work will contribute towards the systematic and scientific analysis of these changes to make us more equipped and prepared to face the coming challenges.

Acknowledgment

From August 2012 to November 2015, the authors of this book were involved in an initiative that held implications on both social policy and sociological theory. This enterprise, called the Philippines Climate Change Adaptation Project or PhilCCAP, was a five-year undertaking funded by the Global Environmental Fund and administered by the World Bank. Its purpose was to develop and demonstrate effective approaches and adaptive measures to increase resilience to climate change. Along with this pragmatic agenda was the theoretic effort to understand, interpret or explain links between knowledge, adaptation and resilience within an environment of climate risks.

PhilCCAP project designers assumed that with the onset of climate change in this agricultural country, the second most vulnerable in the world, the Philippines will have to deal first and foremost with food security. Changing weather patterns have direct impacts on agriculture and food production. Calamities such as floods and drought significantly decrease farm productivity and the ability of a country to feed its people. The project was conceptualized to increase adaptive capacities among farming communities by improving resilience under conditions of climate variabilities; enabling access to weather information and climate patterns; allowing access to risk management options; and strengthening farm ecosystems.

Engaged under the Asian Institute of Development Studies, we formed part of the PhilCCAP technical assistance study titled *Awareness and Knowledge of Climate Change and the Use of Adaptation Technologies* as knowledge management specialist and social marketing specialist respectively. The methods, strategies, frameworks and instruments contained in this book were products of our three-year long engagement with the project. Along with PhilCCAP and its sponsors, we wish to acknowledge the intellectual input of our colleagues: Wilbur Dee, project manager; Vicente Dayanghirang, agriculture trainor; Eduardo Sison, study director; Rogelio Concepcion, climate

change specialist; Nestor Baguinon, biodiversity expert; and Consorcia Reaño, statistician. The views and opinions expressed herein, however, are ours and do not necessarily reflect those of our colleagues, the Global Environmental Fund or the World Bank. Finally, we wish to thank the University of the Philippines for affording us the opportunity to complete this work through its gracious support.

Alexander G. Flor
University of the Philippines Open University, Philippines

Benjamina Paula G. Flor
University of the Philippines, Philippines

Section 1

Interrogating Climate Change Resiliencies Among Vulnerable Communities

Human influence has been detected
in the warming of the atmosphere and the ocean,
in changes in the global water cycle,
in reductions in snow and ice,
in global mean sea level rise,
and in changes in some climate extremes...
It is extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century.
IPCC, 2013

Chapter 1
Introduction

ABSTRACT

This introductory chapter describes the reality of climate change and its causes. It begins with a personal account of experiences, progresses to a societal perspective, and ends with a technical appraisal of the phenomenon. Experts characterize climate change by weather extremes, uncertainties and variabilities. The authors express their difficulty in appreciating the arguments of climate change deniers when their experience of the world constantly reminds them of these realities on a month-to-month, week-to-week, or even day-to-day basis. The authors give a non-technical description of the causes of climate change and argue for the anthropogenic view that it is caused by man, citing findings of the Intergovernmental Panel for Climate Change. They reiterate the assertion that climate change is both inevitable and irreversible.

REALITY OF CLIMATE CHANGE

It is Christmas Day of 2016 and, for us, it is a Christmas like no other. Our extended family which includes our children, their spouses and our grandchildren decided to celebrate this most joyous of holidays indoors to shield ourselves against Typhoon Nock Ten, a Category 4 tropical cyclone that was about to plow through the country's midsection, its eye missing the university town where we live by forty kilometers. This distance may be considered far, but not far enough. Meteorologists categorize Category 4 cyclones as Super Typhoons along with the Category 5, which, as of two years ago, was not even part of the classification system for storm warnings.

DOI: 10.4018/978-1-5225-2767-1.ch001

The typhoons that traverse the Philippines are getting stronger breaking the upper limit of what was regarded as extreme for so long. Moreover, for most of our lives, the typhoon season ended in October, when cooler air from the northeast signals the arrival of *Amihan,* a season of moderate trade winds and slight rainfall. Nowadays, the storms stretch into December. Last year, 2015, Typhoon Melor came in the middle of that month. This year, the storm waited until the last week, Christmas Day to be exact. Our typhoons are not only getting stronger. They are occurring at unusual times.

Experts submit that climate change is characterized by weather extremes, uncertainties and variabilities (Cardona et al., 2012; Solomon et al., 2007). In late March 2014, we were in Bangkok as the Thais were preparing for Songkran, the New Year festival. This Songkran was quite different from those of previous years. Up north, the mango trees had already bloomed off-season while in Bangkok acacia trees were shedding-off their leaves prematurely.

Songkran is celebrated not only in Thailand but in other countries in the Greater Mekong Subregion as well. In Laos, people call it Pi Mai, traditionally one of the hottest times of the year. In 2014, ambient temperatures in Vientiane shifted from 8 degrees Celsius in February to 36 degrees Celsius in March. It was so cold in the Northern provinces in late January that classes had to be suspended. Barely a couple of months later it has become so hot that you would welcome the cold water that Pi Mai well-wishers douse on you. For a tropical country that has known only two seasons, the rainy and the dry, this abrupt shift was most certainly a manifestation of climate extremes.

In many cases, climate extremes, climate uncertainty and climate variability would wreak havoc, especially to populations in vulnerable countries (Flor, 2016). The 2014 Vulnerability Index of Germanwatch named the Philippines as second most prone to climate change disasters after Bangladesh (Vidal, 2013). Typhoon Haiyan that struck Leyte province in November 2013 influenced that determination in no small measure.

A visit to Tacloban, Leyte in November 2014 left profound impressions on both of us. One year after the storm surge that ended thousands of lives and destroyed billions worth of property, there was a feeling of resignation among the living. Yet, indescribable emotions of anguish, despair and sorrow lingered on.

Climate change deniers would argue that tropical cyclones have plagued the Philippines since time immemorial (Comiso et al., 2013). Yes, indeed. However, these storms hardly encroached upon unprepared communities in November and were neither nearly as strong nor as destructive as Haiyan.

It is difficult to appreciate the arguments of climate change deniers when our experience of the world constantly reminds us of the contrary on a month-to-month, week-to-week, or even day-to-day basis. It is no longer a matter of convincing ourselves that our climate is changing but a matter of responding appropriately or adapting to survive.

CAUSES OF CLIMATE CHANGE

Why is the climate changing? In a nutshell, climate change is caused by increasing levels of carbon dioxide, nitrous oxide, methane gas and its derivative chlorofluorocarbons (CFCs) emitted into the air. These gases, often times referred to as greenhouse gases, absorb and release infrared radiation or heat within the earth's atmosphere. CFCs also deplete the ozone layer. The thinning and perforation of the ozone layer allows more heat from the sun to enter the earth's atmosphere. This heat, in turn, is trapped by greenhouse gases causing higher and higher surface temperatures resulting in the warming of the oceans and the entire planet (Houghton et al., 2001).

Global warming leads to the melting of glaciers and the edges of polar ice caps that may increase sea levels. Furthermore, warmer waters in our oceans cause hot air to interact with cold air from the extreme north or south. The more intense, dynamic interactions of hot and cold air result in violent storms. These storms are sucked in by lower atmospheric pressures causing the yearly 19 or so typhoons that ravage the Philippines, which lies at the western edge of the Pacific Ocean.

Greenhouse gases are byproducts of industrialization. The burning of fossil fuels and the breakdown of petroleum-based products such as fertilizers and plastics release greenhouse gases. Methane gas is expelled by livestock as bodily wastes. The large volumes of greenhouse gas emissions are exacerbated by rapid deforestation since trees absorb carbon dioxide.

By themselves, these activities do not cause global warming. However, the grand *scale* by which they occur today may be attributed as the root cause. In all of these activities, we see the hand of man. Hence, climate change is said to be anthropogenic or originating from human activity. This is where we differ from most climate change deniers, who believe that these processes have been going on for millions of years even without man in the picture.

However, the latest Report of the Intergovernmental Panel for Climate Change (2013) states that "human influence has been detected in the warming

of the atmosphere and the oceans… It is extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century."

CONCLUSION

The IPCC, made up of luminaries from the international scientific community, has established that climate change is both inevitable and irreversible. Too much industrialization has occurred; too many forests have been cut down; too great a volume of greenhouse gases has been released into the air to stem the tide. The most that can be done is to delay or mitigate climate change by limiting our carbon footprint, the amount of carbon dioxide that we cause to emit individually or collectively, thereby offsetting the rise of surface temperatures. In the meantime, communities can only prepare for and adapt to climate change and its impacts, to a large part prompted by a societal conversation spearheaded by scientists, policy makers and concerned citizens collectively referred to as the climate change community. The next chapter describes the prevailing or dominant discourse of this community particularly on the theme of climate change adaptation.

REFERENCES

Cardona, O. D., van Aalst, M. K., Birkmann, J., Fordham, M., McGregor, G., Perez, R., . . . Sinh, B. T. (2012). Determinants of risk: exposure & vulnerability. In Managing the risks of extreme events and disasters to advance climate change adaptation. Cambridge, UK: Cambridge University Press. doi:10.1017/CBO9781139177245.005

Comiso, J. C., Blanche, C. A., Sarigumba, T. I., Espaldon, V. O., & Lansigan, F. P. (Eds.). (2014). *Changing Philippine climate: impacts on agriculture and natural resources. Diliman*. Quezon City: University of the Philippines Press.

Flor, A. G. (2016). Resilience and sustainability, expanding and thickening the discourse. In Resilience and sustainability: fourteen narratives. Baguio: University of the Philippines Cordillera Studies Center.

Houghton, J. T., Ding, Y., Griggs, D. J., Noguer, M., van der Linden, P. J., Dai, X., & Johnson, C. et al. (2001). *Climate Change 2001: The Scientific Basis*. Cambridge, UK: Cambridge University Press.

Intergovernmental Panel on Climate Change. (2013). *Climate Change 2013: The Physical Science Basis. Technical Summary.* Final Draft. Retrieved from http://www.climatechange2013.org/images/uploads/WGIAR5_WGI-12Doc2b_FinalDraft_TechnicalSummary.pdf

Solomon, S., Manning, M., Marquis, M., Avery, K. B., Tignor, M., & Miller, H. L. (Eds.). (2007). Climate change: the physical science basis. Cambridge, UK: Cambridge University Press.

Vidal, J. (2013, Nov. 14). Philippines rockets up list of countries most vulnerable to disaster. *The Guardian*.

Chapter 2
Climate Change Discourse and Adaptation Narrative

ABSTRACT

This chapter defines the dominant climate change discourse and the adaptation narrative linking the latter with mainstream social sciences. As commonly observed, the current discourse on climate change adaptation is rich and dynamic. However, because of the diversity of disciplines engaged in it, the narrative at times would lack coherence as seen in discussion threads on vulnerability, awareness and resilience. The climate change community submits that one's exposure to climate threats, sensitivity to climate extremes and adaptive capacity to climate impacts determine vulnerability to climate risks. Furthermore, the community uses the terms awareness and knowledge interchangeably when the behavioral and learning science traditions make clear distinctions and differentiations between the two. The current discourse also pays emphasis on the words resilience and sustainability and highlights the transdisciplinary nature of each. The authors present their arguments on how these discussion threads should be effectively treated.

INTRODUCTION

Current Climate Change Discourse

When the climate change community convenes, we see an assorted group. First, we have the politicians who have made climate change into a political

DOI: 10.4018/978-1-5225-2767-1.ch002

platform followed by technocrats and policy makers who paint extreme scenarios that prompt us to act. They are ably supported by academics and scientists armed with voluminous meteorological and biogeophysical data. The most vocal in the community come from civil society organizations who feel that they, representing the interests of vulnerable communities, carry the heaviest burden and have the biggest stake in the discussion.

Three of the most dominant threads in the global discourse on climate change adaptation are vulnerability, awareness and resilience.

Vulnerabilities

The climate change community submits that one's exposure to climate threats, sensitivity to climate extremes and adaptive capacity to climate impacts determine vulnerability to climate risks. The IPCC (2012) forwards the following function:

Vulnerability = f (exposure, sensitivity, adaptive capacity)

To increase adaptive capacities of communities, we look at the threats and risks that climate change poses. Changing climates result in storms that are more powerful during the stormy season, more destructive floods and landslides during the wet season, and more intense droughts and wildfire during the dry season. The coming of these once regular and predictable seasons becomes erratic. The conditions for their occurrences become uncertain and would vary from one area to another. They carry far-reaching consequences on every social sector.

Rural and urban communities are vulnerable to highly destructive storms and to the breakdown of social services that is expected to follow. Those living in coastal areas are vulnerable to storm surges. Those in the lowlands are vulnerable to floods. Those in the uplands are prone to landslides. Farms will be vulnerable to drought and industries to power failures. Entire populations will suffer from the lack of food and water. Even their shelter and health will be threatened not to mention their lives. Those with the least access to resources, the most deprived, the least fit, the elderly and the young are the most helpless.

How can so-called *climate actions* or interventions be planned for such a diverse lot under such diverse circumstances and conditions?

In the Philippines, the Climate Change Commission designed a National Climate Change Action Plan (NCCAP) that employed a practical approach in clustering programs and activities along priority themes in which sectoral agencies and interest groups can easily relate with. The thematic clusters include: food security, water sufficiency, ecosystem and environmental stability, human security, industries and services, sustainable energy, and knowledge and capacity development.

In this book, we focus on analyzing adaptation for the theme of first priority: food security. How do farming communities adapt to climate change to ensure food security?

Most stakeholders agree that our primary resource for climate change adaptation is knowledge – knowledge of the causes, effects, dynamics and impact; knowledge of who will be affected most, where-how-when it will impact greatest. This has prompted the Philippine climate change community, in general, and the Climate Change Commission, in particular, to include "knowledge and capacity development" among the seven priority themes.

Awareness vs. Knowledge

As commonly observed, the current discourse on climate change adaptation is rich and dynamic. However, because of the diversity of disciplines and research traditions engaged in it, the narrative at times would lack coherence.

A case in point is the use of the phrases "level of awareness" and "level of knowledge" interchangeably. The behavioral and learning science traditions make clear distinctions and differentiations between awareness and knowledge. More than half a century ago, Bloom (1956) devoted an entire learning domain for knowledge he called the cognitive domain. Similarly, Beal et al. (1957) and Rogers (1962) considered awareness as the first level of adoption, which, in Bloom's taxonomy, falls within another category called the psychomotor domain. The adaptation discourse should be consistent with these traditions. Not only should we base climate change adaptation research on the biogeophysical sciences. We should inform it on the social and behavioral sciences as well.

Resiliencies

The current discourse also puts emphasis on the words resilience and sustainability. Moreover, it highlights the transdisciplinary nature of each.

We acknowledge that resilience and sustainable development have several dimensions. Very few people are aware, however, that both terms, resilience and development, were borrowed from biology. Hilhorst (in Flor, Ciencia & Sta Maria, 2016) rightly notes that resilience was initially used among environmentalists in reference to ecosystems. Eventually, the word came to describe individuals and societies, several types of which have been proposed. McGonigal (2014) talks about physical, mental, emotional and social resilience of the individual. With regard to groups, Joseph (2012) elaborates on natural resilience, adaptive resilience and restored resilience.

Within the climate change sector, resiliency (or the measure/ degree of resilience) is assumed the inverse of vulnerability. In a paper we presented at the 2014 International Conference on Climate Change Adaptation held in Vientiane, we introduced the phrase climate change resiliencies (the plural form of resiliency). In our paper, we argued that, as in the case of individual resilience and group resilience, there are at least three types of climate change resiliencies: ecosystem resilience; community resilience; and individual resilience. All three types are defined by the above function and measured with a vulnerability index incorporating all three factors. Furthermore, we proposed that: climate change resiliency is determined by the degree of risks (or the statistical probability that a threat such as storm surge or landslides will occur); the availability of resources to alleviate the threat; and responsiveness to climate change. Thus, the function:

$$CCR = f(CCRp, Rk^{\circ}, Rs)$$

where:

CCR = climate change resiliencies
CCRp = climate change responsiveness
Rk° = degree of risks
Rs = availability of resources

This proposed function submits that timely and effective response is a product of knowledge, attitude and practice or KAP. One would argue that such a construct may be applied to communities and individuals but would also wonder if it can be applied to an ecosystem. At the risk of sounding anthropomorphic, the exchange of information is not only a feature of man but is a critical function of all organisms, ecosystems included, as well. This point is a bit complicated and deserves some perspective and elaboration.

Four decades ago, Talisayon (1983) published a paper on public policy and the theory of living systems. One of the arguments presented in the paper was that every living system must perform three critical functions in order to exist. The first critical function is the exchange of materials with other living systems and its environment. The second is the exchange of energy with other living systems and its environment. The third is the exchange of information with other living systems and its environment.

Note that there are several levels of living systems. A living system can be a unicellular organism or a complex organism such as man. At a higher level, it can be an ecosystem or even a social system. A critical function, on the other hand, is action that must be performed in order to maintain existence or in order to survive. Among ecologists, the exchange of materials when applied to an ecosystem is exemplified by the water cycle. The exchange of energy is manifested in the Krebs cycle or the carbon cycle. But where in ecology is the exchange of information demonstrated? This "exchange of information" is nothing more than communication. Which biological process (with a status similar to the water cycle or the Krebs cycle) is it reflected?

Although the exchange of information or communication is one of the basic functions of living systems, where is it situated in the environmental discourse?

There is a gaping hole in the narrative that can be filled by what we call environmental communication (Flor and Gomez, 1993). But it should be noted that this communication is not exclusive to man or man-made institutions. Environmental communication is a function of all living systems at all levels. It includes receiving and transmitting signals from other organisms and ecosystems. In the same manner as our ancestors did. In the same way as indigenous peoples still do (Flor, 2016).

This perspective, which we call the deep ecology approach to environmental communication (Flor, 2004), is the reason why we are sensitized today to climate change bio-indicators or what Concepcion (2009) calls *biosignals* transmitted by organisms and ecosystems alike. This is why we promote interpretative centers or ecomuseums. Interpretive centers employ a multimedia experience to enhance the understanding of nature. They aid and stimulate the discovery process by tapping the audience's intellectual and emotional connection to nature. Interpretive centers thrive in presentation strategies that are user-friendly and interactive. In fact, interpretive centers may be a specialized fixture for the interpretation and articulation of biosignals to increase climate change responsiveness or CCRp.

Going back to the CCR function, note that it differentiates between a threat and a risk in the sense that the latter is a measure of probability. It also sadly implies that the resource poor are by their circumstances, less resilient. With its environmental, social and economic interfaces, the above function highlights the transdisciplinary nature of climate change resiliencies.

With regard to development, the etymology of the word reveals it to be the French antonym for envelopment or containment. In the 17th century, development pertained to the natural, unhindered growth of an organism or colonies of organisms. However, in the 20th century, economists began using it as a more technical, less politically laden synonym for progress. Our engagement in the development discourse began in the seventies, during what development observers refer to as the Second Development Decade (Ongkiko and Flor, 2003). At the time, we were questioning the constructs that were prevalent in the sixties, i.e., GNP as the development yardstick and the so-called trickledown effect. But it was years later, during the Third Development Decade, when sustainability became mainstreamed and development was defined by economic, social and environmental goals. To drive home the importance of sustainability, the post 2015 agenda of the international development assistance community had been re-christened as the Sustainable Development Goals or SDGs. As in the case of our resiliency function above, the SDGs accentuate the transdisciplinary nature of sustainability.

Social Sciences and the Adaptation Narrative

As stated, there are several actors in our societal conversation on climate change. Their voices range from the dominant to the subdued. Among the scientists, those that ring out loud and proud belong to meteorologists who claim supremacy over the field. Then come the carbon experts made up of chemists, engineers, biologists and even foresters. In the middle of the spectrum are economists and knowledge managers armed with indicators and impact measurements. At the far end are sociologists, community development workers and members of civil society who, with impassioned but somewhat competing voices, articulate on resilience and sustainability. However, when the topic of the conversation shifts to adaptation, resiliencies and vulnerabilities, the center stage should go to the latter. Adaptation is both a societal and a personal response.

In the case of the Philippines, its National Framework on Climate Change Adaptation envisions a climate risk-resilient nation with healthy, safe, prosperous and self-reliant communities, and thriving and productive ecosystems. As stated earlier, we note that climate change resilience is not

only a quality of ecosystems. More importantly, it is a characteristic of social systems, specifically families and communities. What then makes a family, a community climate change resilient?

It would be best to look towards the social and behavioral sciences to answer this question. Employing these sciences as a take-off point, we return to our CCR function and reiterate that climate change resiliency among communities is a function of three factors: climate change responsiveness (inclusive of mitigation, adaptation and coping); availability of and access to resources (natural, livelihood, economic and programmatic); and degree of risks (population, landscape, geography and other vulnerabilities):

CCR = f (Responsiveness, Resources, Risks…)

The first among these factors, climate change responsiveness, is the purview of the behavioral sciences (Bouton, 2007; Miller & Escobar, 2004) while the remaining two falls within the scope of economics and the management sciences. From the behaviorist's point of view, climate change responsiveness is a result of exposure to this phenomenon. A community's response to climate change manifests in three domains: cognitive; affective; and psychomotor. Corresponding to these domains, climate change responsiveness has three elements: knowledge gain; attitude change; and practices adopted. Using the stimulus-response (SR) theory, we can say that climate change exposure is the stimulus while knowledge, attitude and practice (KAP) is the response.

Climate change knowledge may be classified as explicit (weather extremes, weather uncertainties, weather variability, hazards) or tacit (indigenous or local, biosignals, crop damage). On the other hand, climate change attitudes may be regarded as mindsets (denial, apathy, apprehension, resignation, involvement) or motivations (human safety, food security, etc.). Lastly, climate change related practice might be categorized as: coping mechanisms (short-term alternatives); and adaptation strategies (long-term). Ideally, adaptation should not result in added higher order risks to the community. Otherwise, it may be considered as maladaptation. It is worthwhile noting here that KAP are not mutually exclusive. Knowledge, attitude and practice are correlated.

CONCLUSION

An accompanying hypothesis to the resiliency theory of change is that knowledge gain leads to attitude change, while attitude change leads to practice

or adaptation. To achieve climate change resilience, interventions should not be limited to actions that merely address the bio-geophysical. Actions that address the behavioral context increasing climate change responsiveness should likewise be implemented. The succeeding chapter recapitulates our arguments and structures a theoretical framework as well as a methodological framework that would guide climate change adaptation analysis.

REFERENCES

Beal, G. M., Rogers, E. M., & Bohlen, J. M. (1957). Validity of the concept of stages in the adoption process. *Rural Sociology*, *22*(2).

Bloom, B. S. (1956). *Taxonomy of educational objectives*. Boston, MA: Allyn and Bacon.

Bouton, M. E. (2007). *Learning and behavior: A contemporary synthesis*. Sunderland, MA: Sinauer.

Concepcion, R. N. (2009). *Final report: Agriculture. Adaptation to climate change and conservation of biodiversity*. Tokyo: United Nations University.

Flor, A. G. (2004). *Environmental communication: Principles, approaches and strategies.* UP Open University.

Flor, A. G., Sta. Maria-Abalos, C.F., & Ciencia, A.N. (Eds.). (2016). Resilience and sustainability: fourteen narratives. Baguio: University of the Philippines Cordillera Studies Center.

Flor, A. G. (2016). Resilience and sustainability, expanding and thickening the discourse. In Resilience and sustainability: fourteen narratives. Baguio: University of the Philippines Cordillera Studies Center.

Flor, A. G., & Gomez, E. D. (1993). *Environmental communication: Considerations in curriculum and delivery systems development*. Los Baños: UPLB Institute of Development Communication and the USAID Natural Resources Management Project.

Flor, A. G., & Ongkiko, I. V. C. (2003). *Introduction to development communication*. Los Baños: UP Open University and SEAMEO SEARCA.

Joseph, G. (2012). *Act Resilient: The three types of resilience*. Retrieved from http://www.act-resilient.org/Site/Blog/Entries/2012/8/28_The_Three_Types_of_Resilience.html

McGonigal, J. (2014). *SuperBetter: Show me the science*. Retrieved from http://janemcgonigal.com/2014/01/06/superbetter-show-me-the-science/

Miller, R., & Escobar, M. (2004). Learning: Laws and Models of Basic Conditioning. In Stevens' handbook of experimental psychology: Vol. 3. Learning, motivation and emotion (3rd ed.). New York: Wiley.

Rogers, E. M. (1962). *Diffusion of innovations*. Glencoe, IL: Free Press.

Talisayon, S. D. (1983). *New development goals and values in response to the global environmental crisis.* Oxford University Press.

ADDITIONAL READING

Daze, A., Ambrose, K., & Earhart, C. (2009). *Climate vulnerability and capacity analysis handbook*. CARE International.

Chapter 3
Frameworks

ABSTRACT

This chapter presents the authors' theoretical and methodological frameworks for assessing climate change adaptation. These were framed on the basis of behavioral science and learning theory. A neo-behaviorist lens has been employed in explaining adaptation following the neo-positivist tradition where inquiry is guided by a theoretical framework and implemented with mixed methods of mutually reinforcing qualitative and quantitative strands. The adaptation theme situated within these frameworks is food security. The examples of adaptation practices and technologies all pertain to food and agriculture. The context of adaptation is the agrarian community or the farm family.

INTRODUCTION

Basic Assumptions

Our theoretical and methodological frameworks take off from the following assumptions:

- Climate change is caused by global warming. Global warming leads to the rise of sea levels, climate extremes such as powerful tropical storms and droughts, as well as increased variability and uncertainty in weather patterns.

DOI: 10.4018/978-1-5225-2767-1.ch003

- The hazards caused by climate change directly experienced in the tropics are storms, floods and landslides, droughts and wildfires. These vary according to the landscape, i.e., upland, lowland or coastal. The largest vulnerable group in these landscapes is the farm family. Upland farming families are at high risk from landslides during the wet season and forest fires during the dry season. Lowland farming families are at risk from floods during the rainy season and drought during the summer months. Coastal fishing families are prone to storm surge and rising sea levels (Comiso et al., 2014).
- The farm family primarily relates to climate change through their field of exposure to it, which involves: their experiences in changing weather patterns; their appreciation of bio signals that deviates from the norm; and the damage to their lives, property and livelihood. One of the biggest impacts of climate change to the agricultural household is food insecurity.
- In this age, climate change is anthropogenic or triggered/exacerbated by man. Although irreversible, it may be mitigated to a limited degree by controlling carbon emissions that lead to global warming. Other than mitigation, practical responses to climate change are adaptation and coping.
- Climate change adaptation is a social learning process. The stimulus to social learning is exposure to climate change. The resulting response has three dimensions: knowledge, attitudes and practice (KAP). Significant changes on KAP may be observed over time given direct interventions that stimulate climate change adaptation. At any given time, these interventions may be recalibrated or fine-tuned depending on the KAP changes observed.

These assumptions serve as a take-off point for our constructs on climate change adaptation.

Neo-Positivist and Neo-Behaviorist Lens

Employing a neo-positivist/neo-behaviorist lens, we propose the following constructs:

1. Climate change resilience of a community or family is a function of: climate change responsiveness (mitigation, adaptation and coping); availability of resources (natural, livelihood, economic and programmatic

or program-sourced); and degree of risks (population, landscape, geography and other conditions). This construct can be represented by the following function:

CCR = f (Responsiveness, Resources, Risks…).

2. Climate change responsiveness manifests in three domains: cognitive; affective; and psychomotor. Corresponding to these domains, climate change responsiveness has three elements: knowledge gain; attitude change; and practices adopted.
3. Climate change responsiveness is determined by climate change exposure. Using the stimulus-response (SR) theory, we can say that climate change exposure is the *stimulus* while knowledge, attitude and practice (KAP) is the *response*.
4. Climate change exposure may be categorized as:
    a. Environmental (landscape or agroecosystem related)
        i. Sea rise and storm surges in coastal areas
        ii. Flooding and drought in lowland areas
        iii. Landslides and fires in upland areas
    b. Factual or informational
        i. Basic services (weather information, hazard maps)
        ii. Media (community media and mass media)
    c. Procedural
        i. Programs
        ii. Strategies
        iii. Technologies/Best Practice
    d. Experiential
        i. Climate extremes
        ii. Climate uncertainty
        iii. Climate variability
5. At the household level, climate change knowledge may be classified as explicit (weather extremes, weather uncertainties, weather variability, hazards) or tacit (indigenous or local, *biosignals* or crop damage)
6. Climate change attitudes may be classified as mindsets (denial, apathy, apprehension, resignation, involvement) or motivations (human safety, food security, water security, habitat security, and energy security).
7. Climate change determined practice may be categorized as: coping mechanisms (short-term generally non-agricultural alternatives); and adaptation strategies (long-term agricultural options/technologies

progressively occurring with the following stages: awareness, interest, decision and adoption). Ideally, adaptation should not result in added higher order risks to the community. Otherwise, it may be considered as maladaptation.

8. Knowledge gain affects attitude change while attitude change influences practice (Bouton, 2007).
9. Documentation and measurement of climate change knowledge, attitudes and practice (KAP) of a group, organization or a community collectively make up its Climate Change Responsiveness Profile. Through these KAP metrics, a CCRp Index for a group, organization or community can be derived.

Found in Figure 1 is a conceptual model of climate change adaptation among farm households.

Taxonomy for Climate Change Adaptation

The conceptual model may be presented in tabular form revealing a so-called taxonomy of adaptation. In 1956, Benjamin Bloom introduced a taxonomy of learning objectives classified under cognitive, affective and psychomotor domains. In the tradition of behavioral science and learning theory, an initial

Figure 1. Climate change stimulus-response model for farm families

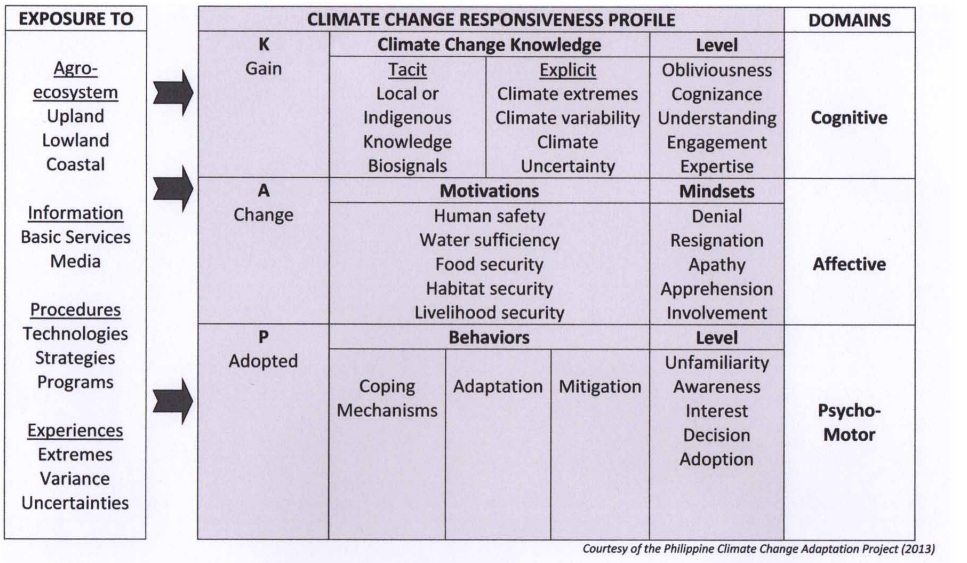


Table 1. Bloom's (1956) taxonomy of learning objectives

Domains	Types	KAP
Cognitive	Tacit knowledge	• Local or indigenous knowledge • Bio signals (e.g., return of pests and diseases, changes in flowering time)
	Explicit knowledge	• Weather extremes (temperature rise, flooding, storms) • Weather variability (Rainfall) • Weather uncertainty (changes in rainfall patterns)
Affective	Mindsets	• Denial • Resignation • Apathy • Apprehension • Involvement
	Motivations	• Human safety • Water sufficiency • Food security • Habitat security • Livelihood security
Psychomotor	Coping mechanisms	Health, sanitation and nutrition, Stockpiling, Foraging for unconventional food sources, Off farm employment, Knowledge sharing, Information seeking, Networking, Relocation, Alternative house designs and yard layout
	Adaptation	Cropping pattern adjustments (diversification, crop rotation) Varietal change, Tapping value chains, Early warning systems, Backyard food conservation, Farm waste conservation, Irrigation, water impounding, Terracing, hedgerows, wind breaks, fire breaks, buffer zones
	Mitigation	Organic farming, Methane capture, Residue management, Cover crops, Reforestation, Agroforestry, Nutrient management, Tillage management, Restoration of degraded areas, Pasture management, Alternate wetting and drying irrigation

Courtesy of the Philippine Climate Change Adaptation Project (2013).

taxonomy of climate change responsiveness of a farm family was drafted and presented in the following matrix.

This classification of climate change responses is a tabular representation of the constructs enumerated earlier. The taxonomy, in turn, becomes the basis for the methods and tools that will be presented in the succeeding chapter.

REFERENCES

Bloom, B. S. (1956). *Taxonomy of educational objectives*. Boston, MA: Allyn and Bacon.

Bouton, M. E. (2007). *Learning and behavior: A contemporary synthesis*. Sunderland, MA: Sinauer.

Comiso, J. C., Blanche, C. A., Sarigumba, T. I., Espaldon, V. O., & Lansigan, F. P. (Eds.). (2014). *Changing Philippine climate: impacts on agriculture and natural resources. Diliman*. Quezon City: University of the Philippines Press.

ADDITIONAL READING

Asian Institute of Development Studies, Inc. (2013). *Climate change adaptation among farm families and stakeholders: A toolkit for assessment and analysis*. Quezon City, Philippines: Philippine Climate Change Adaptation Project.

Flor, A. G., & Flor, B. G. (2016). Theoretical and mixed methodological frameworks for research on climate change resiliencies. In Resilience and sustainability: fourteen narratives. Baguio: University of the Philippines Cordillera Studies Center.

Section 2
Emerging Research

Human communities and ecosystems
can be characterized using a systems perspective. That is, both of them
are systems in the sense of being comprised of structures and processes at specific spatial-temporal scale ranges…
By conceptualizing human communities and ecosystems as complex adaptive systems, systemic properties such as resilience or adaptive capacity can be compared.
Lance Gunderson
Ecology and Society, 2010

Chapter 4
Research Methods and Tools

ABSTRACT

This chapter details the research methods for assessing climate change adaptation among farm families. The methods cover two types of procedures: benchmarking and evaluation. The authors define benchmarking as the documentation, measurement and analysis of current adaptation practice in any given target group, organization or community for purposes of comparison, internal or external, to a given standard, de facto or otherwise. Benchmarking is not done within the bounds of project parameters (i.e., time and resources) and project-determined outcomes. On the other hand, evaluation refers to baseline, mid-term, final and ex-post measurements of adaptation practice vis a vis given interventions. Evaluation is conducted within set project parameters and project-determined outcomes.

INTRODUCTION

Our constructs on climate change adaptation enumerated in the previous chapter lead us to two applied research methods, benchmarking and evaluation (Flor & Flor, 2016).

Benchmarking

The main method for analyzing climate change responsiveness or CCRp is benchmarking. Benchmarking refers to the documentation and analysis of responsiveness, in general, or climate change adaptation, in particular, of

DOI: 10.4018/978-1-5225-2767-1.ch004

any given target group, organization or community for purposes of future comparison, internal or external, not within the bounds of project parameters (I.e., time, resources) and project-determined outcomes.

Benchmarking provides the current state of climate change responsiveness (including adaptation) of a subject or target group. Since climate change has a spatial dimension, subjects or target groups would have a geographic or locational attribute. Hence, subjects of the benchmarking procedure would be: communities (e.g., towns, villages etc.); groups living within certain geographical boundaries; or organizations. Benchmarking would be most applicable to groups highly vulnerable to climate change.

The benchmarking procedure is exploratory. It is not based on assumptions about the group, organization or community being studied. It does not test hypotheses nor establishes correlations but is descriptive in nature. However, it makes use of probing questions allowing respondents to volunteer information themselves.

Mixed Methods Design

The use of Mixed Methods Research Design in the conduct of climate change responsiveness benchmarking is recommended. Mixed methods design is neo-positivist in nature since its conclusions are based on the analysis of empirical data that has been specified in a conceptual framework.

Integrated mixed methods involve both quantitative and qualitative strands. The QUAN strands in benchmarking refer to: the sampling tool that identifies respondents; a one-shot survey that generates the climate change responsiveness (CCRp) profile; the measurement of ΔKAP; and the resultant ratings in the CCRp Scorecard. The QUAL strands are composed of: focus group discussions (FGD); and key informant interviews (KII).

The QUAN and QUAL strands are fully integrated since individual strands or methods are dependent upon or will supplement one another. The items solicited in the one-shot survey will depend on the responses from the FGD. Consequently, the questions asked in the KII will depend on the answers in the one-shot survey and the CCRp Profile generated. Finally, the CCRp scorecard can only be accomplished after the key informant interviews.

Measurement

Climate change adaptation is one of several behaviors that fall under climate change responsiveness. Climate change responsiveness may be determined by measuring knowledge gain, attitude change and practice (or behavioral change) based on earlier work in learning (Bloom, 1956; Miller & Escobar, 2006). Since benchmarks are done for future internal or external comparison purposes, we recommend the use of ordinal or ranking scales.

- **Measuring Knowledge Gain (ΔK):** As an element of CCRp, knowledge gain may be measured by comparing the current degree of climate change knowledge of a community to a future degree of knowledge of the same community. In benchmarking, the current degrees of knowledge among different communities may likewise be compared with one another. A five-point scale may be employed, each point representing a "level" within the cognitive domain. These points are: *1-Obliviousness; 2-Cognizance; 3-Understanding; 4-Engagement; and 5-Expertise.* These levels are operationalized as:
  - *Oblivious* (Level 1 means research respondent has no knowledge of the subject matter)
  - *Cognizant* (Level 2 means respondent has heard of the subject matter but does not have personal knowledge of it)
  - *Understands* (Level 3 indicates that the respondent comprehends the subject matter)
  - *Engaged* (Level 4 means respondent has given the subject matter some thought and has drawn conclusions or constructs about it)
  - *Expert* (Level 5 means respondent claims some degree of authority over subject matter beyond his understanding and cognitive engagement)

Each level of knowledge corresponds to a "rank" in a hierarchy of five. These levels may be used to measure both tacit (local, indigenous, biosignals) knowledge and explicit knowledge exemplified by climate change extremes, variability and uncertainty.

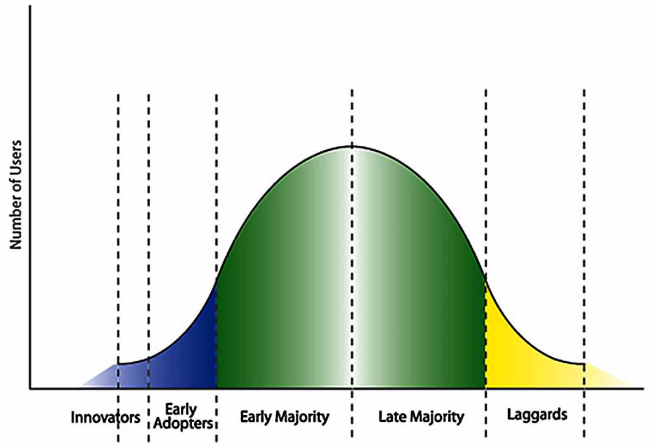
- **Measuring Attitude Change (ΔA):** Attitudes refer to the disposition or feelings (including mindsets and motivations) of respondents towards

climate change knowledge, adaptation strategies, coping mechanisms and mitigation means. Mindsets range from denial, apathy, resignation, apprehension and involvement. Motivations include concerns for life (human safety), water supply (water security), sustenance (food security), dwelling (habitat security) and livelihood. Attitude change (ΔA) may be measured by assigning ranked scores for these five motivations and five mindsets. The number of motivations that a subject signifies gets an equivalent number of points. In other words, if a subject signifies all five motivations then five points are given; if a subject names three motivations, then three points are given; and so on. Mindsets are categorized as follows:

- *In Denial* (response is categorized as Level 1 if research respondent is in denial of climate change)
- *Apathetic* (response is categorized as Level 2 if research respondent accepts the fact but has no strong feelings about it)
- *Resigned* (response is categorized as Level 3 if research respondent accepts a fact and is resigned to its eventuality)
- *Apprehensive* (response is categorized as Level 4 if research respondent accepts a fact and is apprehensive about it)
- *Involved* (response is categorized as Level 5 if research respondent accepts a fact and does something about it)

- **Measuring Behavioral Change (ΔB):** In our taxonomy, climate change related behaviors are classified as mitigation, adaptation and coping practices, inclusive of best practice. These practices may be measured using a five-point categorical scale with the following interpretations and scores: *1-Unfamiliar; 2-Aware; 3-Interested; 3-Decided; and 5-Adopted.*
  - *Unfamiliar* (Level 1 response means research respondent does not know the practice)
  - *Aware* (Level 2 response means respondent knows about the practice but does understand it)
  - *Interested* (Level 3 response means respondent sees potential in the practice)
  - *Decided* (Level 4 response means respondent has assessed the technology after trying)
  - *Adopted* (Level 5 means respondent is aware, is interested, has tried, has evaluated and is practicing the technology)

Figure 1. Rogers technology adoption model



The above measurements are based on. Initially, the agricultural technology adoption research tradition studied by Beal et al. (1957) and Rogers (1962), made use of the acronym AIDA, which in turn, was inspired by the advertising field. In the latter, AIDA stands for Attention, Interest, Desire and Action. Upon its application as a model for agricultural extension and communication in the sixties and seventies, the acronym began to represent stages in the adoption process, i.e., Awareness, Interest, Decision, and, finally, Adoption. For purposes of benchmarking, a baseline level (Unfamiliar) was added preceding the AIDA levels.

Analyzing Ranked Data

The ordinal or ranked measurements of knowledge, attitude and practice are based on individual responses gathered during the survey. How will the ranked data be processed to arrive at a collective picture? Statistically, the median and mode are the values of choice for measuring central tendencies of ranked or ordinal data. For our purposes, the modal value of the responses should represent the general trend and will thus be recommended in this analysis.

The mode is the value along the five-point scale, which appears or occurs most often in the data set. The modal values for each of the items in the survey instrument will be identified and will represent the levels of knowledge, attitude and practice of the community, group or organization being benchmarked for

climate change responsiveness. For instance, the modal value for the level of explicit knowledge on weather variability is "1" for Community A, then we can say that Community A is *Oblivious* to weather variabilities. Similarly, if the modal value for mindsets of Community B is "3," then it may be concluded that Community B is *Resigned* to climate change.

FGD

Focus group discussions will be facilitated with the help of a set of guide questions based on behaviors associated with climate change adaptation observed in earlier studies (Lasco et al, 2011; Lasco et al., 2012). Identify ten to fifteen opinion leaders or representatives that may serve as participants in a focus group discussion (FGD) on climate change knowledge, attitude and practice (KAP). Convene the focus group. Explain the purpose of the discussion, i.e., to determine their community's KAP response to climate change. Facilitate the discussion using the FGD Guide Questions. Document the group's responses to the FGD questions.

Found below is an example of an FGD Guide to initiate benchmark data gathering:

FGD Benchmarking Guide

1. **Knowledge:**
    a. During the past 10 or so years, what recurring, continuous or permanent changes have you observed in temperature and rainfall?
    b. What problems have you had with increase in types and growth of weeds and major infestations or disease outbreaks in your farm in the past ten years?
    c. What signs in your immediate environment have you observed that will indicate possible weather in the coming days? What signs do you normally observe?
2. **Attitude:**
    a. Do you believe that your experiences are related to what is referred to as climate change?
    b. If so, how do you feel about it? Are you affected by it? Are you resigned to it? Are you worried and apprehensive? Are you doing something about it?

c. What motivates you to do something about climate change? Your safety? Water sufficiency? Food security? Your property? Your livelihood?

3. **Practice:**
   a. How do you cope to the changes to protect or improve your family, well-being, livelihood or farming activities? Do you:
      i. Stockpile food
      ii. Forage for unconventional food sources
      iii. Engage in off-farm employment
      iv. Share knowledge, seek information, network with others
      v. Relocate
      vi. Use alternative house designs and yard layouts
   b. In your neighborhood, which of the following initiatives are being practiced to adapt to temperature and rainfall pattern changes:
      i. Residue management
      ii. Cropping pattern adjustments (diversification, crop rotation)
      iii. Varietal change
      iv. Crop insurance
      v. Early warning systems
      vi. Backyard food conservation
      vii. Farm waste conservation
      viii. Irrigation water impounding
      ix. Terracing, hedgerows, wind breaks, fire breaks, buffer zones
   c. In your neighborhood, which of the following technologies are being applied:
      i. Organic farming
      ii. Methane capture
      iii. Cover crops
      iv. Reforestation
      v. Agroforestry
      vi. Nutrient management
      vii. Tillage management
      viii. Restoration of degraded areas
      ix. Pasture management
      x. Alternate wetting and drying irrigation

The responses in the FGD are documented, reproduced and distributed as primary reference to members of the research team. The FGD documentation will serve as a basis for modifications on the one-shot survey template.

One Shot Survey

As stated earlier, benchmarking makes use of the mixed methods approach. The main QUAN strand is the one shot survey. It is also the main primary data gathering procedure.

A master template for the one-shot survey instrument is found below. It may be modified based upon the responses given during the FGD. Alternatively, modifications may be based upon given standards of climate change knowledge, attitudes and coping/adaptation/mitigation practices.

CCRp Profile

Based on a modal analysis of benchmarking data gathered through the survey, a Climate Change Responsiveness Profile may be generated. The survey responses will be subjected to modal analyses to situate the subject within the levels, which can then be shaded accordingly to generate the CCRp Profile. Found below is the proposed format for a CCRp Profile in Table 2.

The matrix in Table 2 corresponds with the climate change responsiveness taxonomy proposed in Chapter 3.

CCRp Scorecard

The CCRp Profile will be validated through key informant interviews. Once the levels indicated in the profile are vetted, scores can now be assigned to each response. The levels should be considered as a five-point ranking scale with each level corresponding to an equivalent score. Once scores are assigned, the data becomes interval in nature and may now be subjected to mean as the measure of central tendency.

Supposing the subject's knowledge on weather extremes is rated "4 "then its score becomes "4." The mean scores are computed for each domain. The mean averages are then derived resulting in an overall Climate Change Responsiveness Rating for the community, organization or group studied: five (5) considered as very high; 4 as high; 3 as moderate; 2 as low; and 1 as very low.

Table 1. Template for one shot survey instrument

Fields	KAP	Level				
		1	2	3	4	5
Knowledge		**Oblivious**	**Cognizant**	**Understands**	**Engaged**	**Expert**
Tacit knowledge	Local or Indigenous knowledge					
	Bio signals					
Explicit knowledge	Weather extremes					
	Weather variability					
	Weather uncertainty					
Mindsets/Attitudes		In Denial	Apathetic	Resigned	Apprehensive	Involved
Motivations		Human Safety	Water	Food	Habitat	Livelihood
Practice		**Unfamiliar**	**Aware**	**Interested**	**Decided**	**Adopted**
Coping mechanisms	Stockpiling					
	Foraging for unconventional food sources					
	Off-farm employment					
	Knowledge sharing/ Information seeking/Networking					
	Relocation					
	Alternative house design and yard layout					
Adaptation	Residue management					
	Change in cropping patterns					
	Varietal change					
	Crop Insurance					
	Early warning systems					
	Backyard food conservation					
	Farm waste conservation					
	Irrigation, water impounding					
	Terracing, hedgerows, wind/fire breaks, buffers					
Mitigation	Organic farming					
	Methane capture					
	Reforestation					
	Cover crops					
	Agroforestry					
	Nutrient management					
	Tillage management					
	Restoration of degraded areas					
	Pasture management					
	Alternate wetting and drying irrigation					

Courtesy of the Philippine Climate Change Adaptation Project (2013).

Table 2. CCRp profile

Ecosystem: Upland/Lowland/Coastal Community/Group/Organization: As of:						
Fields	**KAP**	**Mode**				
		1	**2**	**3**	**4**	**5**
Tacit knowledge	Local or Indigenous knowledge					
	Bio signals					
Explicit knowledge	Weather extremes					
	Weather variability					
	Weather uncertainty					
Mindsets	In Denial/Apathetic/Resigned/Apprehensive/Involved					
Motivations	Human safety/Water/Food security/Habitat/Livelihood					
Coping mechanisms	Stockpiling					
	Foraging for unconventional food sources					
	Off farm employment					
	Knowledge sharing/ Information seeking/Networking					
	Relocation					
	Alternative house design and yard layout					
Adaptation	Residue management					
	Change in cropping patterns					
	Varietal change					
	Crop Insurance					
	Early warning systems					
	Backyard food conservation					
	Farm waste conservation					
	Irrigation, water impounding					
	Terracing, hedgerows, wind/fire breaks, buffers					
Mitigation	Organic farming					
	Methane capture					
	Reforestation					
	Cover crops					
	Agroforestry					
	Nutrient management					
	Tillage management					
	Restoration of degraded areas					
	Pasture management					
	Alternate wetting and drying irrigation					

Courtesy of the Philippine Climate Change Adaptation Project (2013).

Table 3. Climate change responsiveness (CCRp) scorecard

Domains	Types	Response	Scale					Score		
			1	2	3	4	5			
Knowledge	Tacit knowledge	Local or Indigenous knowledge								
		Bio signals								
	Explicit knowledge	Weather extremes								
		Weather variability								
		Weather uncertainty								
Total K score										
Average K score										
Attitude	Mindsets	In Denial/Apathetic/Resigned/Apprehensive/Involved								
	Motivations	Human safety/Water/Food security/Habitat/Livelihood								
Total A score										
Average A score										
Practice	Coping mechanisms	Stockpiling								
		Foraging for unconventional food sources								
		Off farm employment								
		Knowledge sharing/ Information seeking/Networking								
		Relocation								
		Alternative house design and yard layout								
	Adaptation	Residue management								
		Change in cropping patterns								
		Varietal change								
		Crop Insurance								
		Early warning systems								
		Backyard food conservation								
		Farm waste conservation								
		Irrigation, water impounding								
		Terracing, hedgerows, wind/fire breaks, buffers								
	Mitigation	Organic farming								
		Methane capture								
		Reforestation								
		Cover crops								
		Agroforestry								
		Nutrient management								
		Tillage management								
		Restoration of degraded areas								
		Pasture management								
		Alternate wetting and drying irrigation								
Total P score										
Average P score										
Overall total										
Overall CCRp rating										

Courtesy of the Philippine Climate Change Adaptation Project (2013).

Summary

In summary, the Climate Change Responsiveness Benchmarking Procedure entails the following steps:

- First, identify the vulnerable group to be benchmarked for climate change responsiveness.
- Second, identify ten to fifteen opinion leaders or representatives that may serve as participants in a focus group discussion (FGD) on climate change knowledge, attitude and practice (KAP). Convene the focus group. Explain the purpose of the discussion, i.e., to determine their community's KAP response to climate change. Facilitate the discussion using the FGD Guide Questions. Document the group's responses to the FGD questions.
- Third, modify the One Shot Benchmarking Survey Instrument based on the FGD responses.
- Fourth, from a complete enumeration of the population of the community or the members of the vulnerable group, identify the survey respondents using the sampling.
- Fifth, conduct the survey on the identified respondents using the modified instrument.
- Sixth, conduct modal analyses of the responses. Using the template of this chapter, shade the corresponding levels based on the modal values arrived at to generate the Climate Change Responsiveness Profile.
- Seventh, validate the CCRp Profile through three key informant interviews. Modifications may be made on the items should two or more of the informants agree on the changes.
- Eighth, accomplish the Climate Change Responsiveness Scorecard. Assign corresponding scores to the mode scale of each item.
- Ninth, get the mean scores per domain. Compute for the overall mean to arrive at the community's CCRp Score.

An abridged, seven-step version of the benchmarking for climate change adaptation procedure was compiled as a manual by PhilCCAP as a practical guide for field workers (APPENDIX A).

Project Evaluation

Project evaluation constitutes part of the project monitoring and evaluation process. It refers to baseline, mid-term, final and ex-post measurements and analysis of CCA practice conducted within the bounds of project parameters and project-determined outcomes.

A detailed step-by-step version of the project evaluation procedure was compiled as a manual by PhilCCAP as a practical guide for field workers (APPENDIX B).

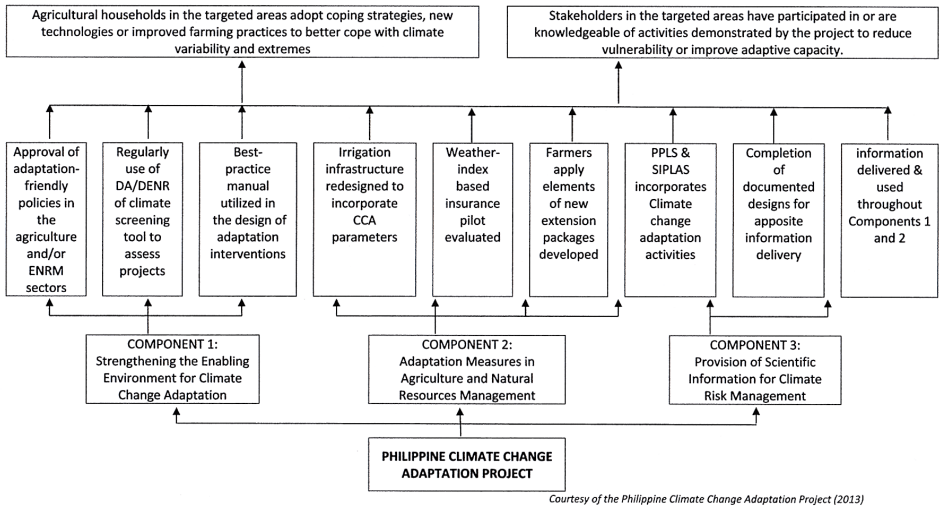
Evaluation is based on a project results matrix that provides a narrative summary of project interventions, intermediate outcome indicators, final outcome indicators and activities. Without a project results matrix (otherwise called a logical framework or logframe) evaluation cannot be executed. Should this be lacking or missing, the researcher must reconstruct the project design matrix for evaluation purposes.

For illustration purposes, few reproduced the results chain of PhilCCAP, a diagrammatic representation of a project results matrix (Figure 2).

Quasi Experimental Design

Ideally, the evaluation should employ fully integrated multi-level mixed methods within a randomized quasi-experimental design. In a randomized

Figure 2. PhilCCAP project results matrix



Courtesy of the Philippine Climate Change Adaptation Project (2013)

quasi-experimental design, respondents will be sampled out of the complete list (universe) of project beneficiaries from the target communities as the experimental group. A separate set of non-beneficiaries from communities having similar characteristics to the project communities will likewise be sampled as the control group. Both groups will be subjected to baseline, midterm evaluation and final evaluation studies. KAP changes in the experimental group will be compared to those of the control group to determine if the target communities indeed benefited from the project.

Baker (2000) argues that a non-randomized quasi-experimental design is the best alternative when true-experimental designs cannot be conducted due to several field constraints.

Sampling

Stratified random sampling should be used to obtain independent samples from the two populations: farm households that are beneficiaries of project under evaluation and farm households that are not. The strata are given below. Sample size from each will be such that 20 percent difference in the proportion will be declared significant with 90 percent probability. If possible, control samples or samples from the non-project sites are necessary to eliminate variation resulting from factors associated with time.

A stratified sampling design will be used where farm households will be stratified according to elevation and size of farm. For elevation, three strata are identified: 1) highlands or farms at areas with high elevation; 2) medium elevation and lastly, 3) the coastal farms or those located low elevation. Within each elevation, farm households will be classified into two according to the size of the farms. Within each elevation-farm size classification, a simple random sample of farms or farm households will be obtained. The total number of households will be obtained as

$$n = \frac{\sum_{i=1}^{L} N_i^2 P_i Q_i \,/\, \alpha_i}{N^2 D + \sum_{i}^{L} N_i P_i Q_i}$$

where n is the total number of farm households to be observed, N_i is the total number of farm households in the ith stratum, P_i is an estimate of proportion of the population knowledgeable of climate change for stratum i, $Q_i = (1\text{-}P_i)$

and α_i is the fraction of the observations allocated to stratum I, and $D=B^2/4$, where B is the bound on the error of estimation. In the absence of historical estimates for Pi and Qi, a value of 0.5 is assumed for each.

The next two chapters will demonstrate how these procedures, namely, benchmarking and evaluation, were applied in the Philippine setting. These case studies will illustrate the differences in approach and analysis of the two procedures.

REFERENCES

Baker, J. L. (2000). *Evaluating the impact of development projects on poverty: A handbook for practitioners*. Washington, DC: The World Bank. doi:10.1596/0-8213-4697-0

Beal, G. M., Rogers, E. M., & Bohlen, J. M. (1957). Validity of the concept of stages in the adoption process. *Rural Sociology*, *22*(2).

Bloom, B. S. (1956). *Taxonomy of educational objectives*. Boston, MA: Allyn and Bacon.

Flor, A. G., & Flor, B. G. (2016). Theoretical and mixed methodological frameworks for research on climate change resiliencies. In Resilience and sustainability: fourteen narratives. Baguio: University of the Philippines Cordillera Studies Center.

Lasco, R. D., Habito, C. M. D., Delfino, R. J. P., Pulhin, F. B., & Concepcion, R. N. (2011). *Climate change adaptation for smallholder farmers in Southeast Asia*. Los Baños: World Agroforestry Centre.

Lasco, R. D., Veridiano, R. K. A., Habito, C. M. D., & Pulhin, F. B. (2012). *Mitigation and adaptation strategies for global change*. Los Baños: World Agroforestry Centre; doi:10.1007/s11027-012-9411-5

Miller, R., & Escobar, M. (2004). Learning: Laws and Models of Basic Conditioning. In Stevens' handbook of experimental psychology: Vol. 3. Learning, motivation and emotion (3rd ed.). New York: Wiley.

Rogers, E. M. (1962). *Diffusion of innovations*. Glencoe, IL: Free Press.

ADDITIONAL READING

Asian Institute of Development Studies, Inc. (2013). *Climate change adaptation among farm families and stakeholders: A toolkit for assessment and analysis*. Quezon City, Philippines: Philippine Climate Change Adaptation Project.

Asian Institute of Development Studies, Inc. (2015). *Good climate change adaptation practices manual*. Quezon City, Philippines: Philippine Climate Change Adaptation Project.

Chapter 5
Case Study:
Benchmarking Climate Change Resilience at Organizational, Community, and Sectoral Levels

ABSTRACT

This chapter describes how the benchmarking procedure was applied on three groups at different levels of scale: organizational, community, and sectoral. It presents the climate change responsiveness profiles of three sectors: the academe, the youth, and a national government agency, the Department of Agriculture. Climate change responsiveness is defined as a determinant of resilience, along with risks and resources. Responsiveness has three elements: the amount of knowledge gain (ΔK); the degree of attitude change (ΔA); and the change in action or practice (ΔP). Climate change responsiveness (CCRp) profiling used a scorecard with a five-point scale: 1 as very low, 2 as low, 3 as moderate, 4 as high, and 5 as very high. Data gathering was conducted online through the Survey Monkey. Responses from almost 300 respondents resulted in the following scores: Department of Agriculture - 3.93 (high); the academe - 2.8 (moderate), and the youth sector - 2.59 (moderate).

INTRODUCTION

The following case study provides us with an example on how climate change adaptation benchmarking is done. It was conducted in the third quarter of 2015. The research featured in this chapter is a multisectoral assessment of

DOI: 10.4018/978-1-5225-2767-1.ch005

climate change responsiveness. However, it employed the one-shot survey method only sans focus group discussions and key informant interviews because of the differing scale of the respondent groups.

Rationale

Agriculture is considered a key risk driver in climate change. According to the Philippine National Framework Strategy on Climate Change 2010-2022, it generates a fifth (18%) of the Gross Domestic Product, a third of the country's total employment, and is the provider of food for Filipinos. Climate change undermines agriculture and national food security and in consequence, may drive poverty levels up and gravely affect economic development.

The respondents of this study include staff from the Department of Agriculture sampled nationally, 99 faculty and staff members from selected universities, and 93 respondents from the youth sector totaling 293 stakeholders.

Why the Academe?

The academe plays a significant role in advancing climate change adaptation in the Philippines. The academe is well represented at the policy making level, serving as sectoral representatives in the advisory board and extending assistance as technical experts to legislators and national agencies such as the Climate Change Commission. Aside from its part in formulating strategies and policies, the academe plays a prominent role in educating the people on climate change-related issues and topics. From the arts to the sciences, members of the academe have initiated debates, discussion and research on this phenomenon and its effects to society. For the academe, 99 respondents participated composed of professors, graduate students and university researchers coming from academic institutions. As the issue of climate change has greatly engaged the academe, including its threat to agriculture, it was important to know the responsiveness of their constituents towards climate change.

Why the Youth?

The youth is an important stakeholder in climate change adaptation since they are the ones "who will inherit the Earth." According to UNESCO, youth is the

transitional period between the dependence brought about by childhood and the independence of adulthood coupled with the awareness of interdependence as active members of the community. Youth is also sometimes defined as the age between leaving compulsory education and starting first employment. However, particularly for the sake of statistical consistency, age becomes the main determinant to segregate this sector from others. UNESCO identifies youth as persons between the ages of 15 to 24. This definition is used by all UN systems in all areas of concern such as demography, education, employment, and health. In the Philippines, Republic Act 8044, more popularly known as the Youth in Nation-Building Act of 1995, declares "youth is the critical period in a person's growth and development from the onset of adolescence towards the peak of mature, self-reliant, and responsible adulthood comprising the considerable sector of the population from the age of 15 to 30 years."

Despite the varying definitions of the youth sector, it is understood that youth plays a vital role in society. They will soon become adults and will be assigned various leadership tasks. They will become the future pillars of the community and country. At the same time, they will responsible for passing on the shortcomings of the past to the future. This shows the importance of analyzing knowledge, attitudes, and practices of young people on crucial issues such as climate change. The Youth in Nation Building Act further highlights this vital role as the law sponsors programs and activities on youth development to get young people on the right track and influence them to arouse their interest in contributing to nation building.

With the advent of climate change and the need for people to mitigate, adapt, and cope with the phenomenon, it is but natural for the youth to be engaged in the process. This benchmarking will gauge the knowledge, attitudes, and practices of the youth on climate change adaptation related to food security. While the age range considered for youth in the Philippines is 15 to 30 years old, for the sake of diversity, the 15-24 age range from UNESCO was considered. Respondents who were identified online were composed of young professionals, out-of-school youth, and students. Most of the respondents came from the National Capital Region, Cavite, Batangas, and Laguna while some came from Ilocos Sur, Nueva Ecija, Pampanga, Rizal, Mindoro, Cebu, Davao, and Maguindanao.

Why the Department of Agriculture?

National Government Agencies play a big role in mainstreaming climate change adaptation in the Philippines. The Department of Agriculture's primary mandate is the promotion of agricultural development. Its mission is "to help and empower the farming and fishing communities and the private sector to produce enough, accessible and affordable food for every Filipino and a decent income for all." The department's role in ensuring food and livelihood security is immense.

Research Question

What is the climate change responsiveness profile of these stakeholders?

METHODOLOGY

Design

One-shot survey design was employed. The study was conducted online. The coverage was national. A total of 293 respondents were surveyed coming from a multisectoral group such as staff from the Department of Agriculture (100), the youth sector (93), and faculty and staff from selected universities (99).

Variables and Measurement

Climate change responsiveness was determined by measuring knowledge gain, attitude change and practice (or behavioral change) using the five point scales discussed in the previous chapter.

Knowledge Gain (ΔK) as an element of CCRp may be measured by comparing the current degree of climate change knowledge of a community to a future degree of knowledge of the same community. A five-point scale was employed, each point representing a "level" within the cognitive domain. To reiterate, these levels are operationalized as:

1. Oblivious (means respondent has no knowledge about the subject);
2. Cognizant (means respondent has heard about the subject but does not have personal knowledge about it)
3. Understands (means respondent comprehends the matter)

4. Engaged (means subject has given the matter some thought and has drawn conclusions or constructs about it)
5. Expert (means subject has some degree of authority over the subject because of his/her understanding and cognitive engagement)

Each level of knowledge corresponds to a "rank" in a hierarchy of five. These levels may be used to measure both tacit (local, indigenous, biosignals) knowledge and explicit knowledge exemplified by weather extremes, variability, and uncertainty.

Attitudes refer to the disposition or feelings (including mindsets and motivations) of respondents towards climate change knowledge, adaptation strategies, coping mechanisms and mitigation means. Mindsets range from denial, apathy, resignation, apprehension and involvement. Motivations include concerns for life (human safety), water supply (water security), sustenance (food security), dwelling (habitat security), and livelihood.

In terms of mindsets, the following scores are assigned per response:

1. In Denial (given if research subject is in denial of climate change)
2. Apathetic (given if subject accepts a fact but is apathetic about it)
3. Resigned (given if subject accepts a fact and is resigned to its eventuality)
4. Apprehensive (given if subject accepts a fact and is frightened about it)
5. Involved (given if subject accepts a fact and does something about it)

According to our taxonomy, climate change related behaviors are classified as mitigation, adaptation and coping practices, inclusive of best practice.

Practices were measured using a five-point categorical scale with the following interpretations:

1. Unfamiliar means the respondent does not know anything about the strategy
2. Aware means the respondent knows about the strategy but does not understand it
3. Interested means the respondent may adopt the strategy if more explanations are done
4. Decided means the respondent is aware, understands, interested and ready to adopt the strategy depending on availability of resources
5. Adopted means the respondent is aware, understands, interested, decided, and implemented the strategy

Data Gathering Procedure

Survey monkey was used to gather the responses. In some occasions where respondents cannot access the link, self-administered questionnaires were distributed especially among faculty and staff in the academe.

RESULTS AND DISCUSSION

Department of Agriculture

For the Department of Agriculture (DA), overall CCRp score was 3.93, which is considered relatively high. It can be seen that results tend to cluster towards "decided" and "adopted" or "interested." The Department of Agriculture is an information rich agency. They have access to training programs, first-hand information, exposure with farmers and fisherfolk, and primary documents on the effects of climate change in the agriculture sector. They also have a policy and implementation program on climate change. The DA staff tend to have a collective mind and to be a central group in terms of access to information. The agency is information rich given their access to primary data, experts, training, and resources. The department plays a key role in climate change because of the nature of their mandate-provision of food to the Filipino people and provision of opportunities to farmers and fisherfolk. They can be considered one of the major authorities concerning the issue.

This implies that DA respondents are highly responsive since it is their mandate to promote climate change adaptation strategies. This is also a good indication that DA staff is doing their job. This also implies that they do not need any training considering that they have undergone almost all types of training in agriculture-related concerns. However, the modal score is reflective only of at least 43-50 percent of respondents. This means that not everyone is sensitized. Since they are from DA, they have to be trained even if they are merely involved in administrative or non-technical knowledge and skills. The attribution of CCA advocates should be strengthened within the department. They are very much involved and obviously, their motivation is food security. The department has created a policy and implementation program on climate change. With the survey results, it can be concluded that while their knowledge, attitude, and practices tend to cluster toward higher levels of the scale, there is still a big room for growth among the employees

Table 1. Department of Agriculture's climate change responsiveness profile

Organization: The Department of Agriculture As of: September 2013						
Fields	**KAP**	**Mode**				
		1	**2**	**3**	**4**	**5**
Tacit knowledge	Local or Indigenous knowledge					
	Bio signals					
Explicit knowledge	Weather extremes					
	Weather variability					
	Weather uncertainty					
Mindsets	In Denial/Apathetic/Resigned/Apprehensive/Involved					
Motivations	Human safety/Water/Food security/Habitat/Livelihood					
Coping mechanisms	Stockpiling					
	Foraging for unconventional food sources					
	Off farm employment					
	Knowledge sharing/ Information seeking/Networking					
	Relocation					
	Alternative house design and yard layout					
Adaptation	Residue management					
	Change in cropping patterns					
	Varietal change					
	Crop Insurance					
	Early warning systems					
	Backyard food conservation					
	Farm waste conservation					
	Irrigation, water impounding					
	Terracing, hedgerows, wind/fire breaks, buffers					
Mitigation	Organic farming					
	Methane capture					
	Reforestation					
	Cover crops					
	Agroforestry					
	Nutrient management					
	Tillage management					
	Restoration of degraded areas					
	Pasture management					
	Alternate wetting and drying irrigation					

in terms of climate change adaptation. This room for improvement can make the department a really credible agency and a recognizable force in mainstreaming climate change issues. As the old adage says, "you can't give what you don't have." The public relies on the department. In order to deliver, the DA must commit the entire agency, not just a selected few, with higher levels of understanding and application regarding the matter.

Table 1 is the Department of Agriculture's Climate Change Responsiveness (CCRp) Profile. For each survey item, the mode or the most frequently occurring answer was shaded in the profile.

The Table 1 profile formed the basis for accomplishing the CCR Scorecard found in Table 2.

The Academe

A total of 99 respondents composed of professors, graduate students, and university researchers were surveyed. Respondents from the academe had an overall CCRp index of 2.88, which means low responsiveness to knowledge, attitudes, and practice towards climate change. This shows that the academe has some information on the items presented to them but are not necessarily experts on these concepts. Their understanding or comprehension may be based on the more vibrant exchange of information in the academe. Personal experience may also factor in, but not as significant, given that a concept under tacit knowledge fell under the "cognizant" scale.

The mid-range score may also be attributed to the inclusion of some members of the academe with less or no agricultural background as respondents. Under tacit knowledge, the mode for local or indigenous knowledge is 3, which corresponds to "understand." This means people in the academe, even those without agricultural backgrounds, know and will be able to explain local practices and beliefs related to environmental reaction towards weather differences or variability. However, under the same category, biosignals model fell under two scales: 2, deemed as cognizant and 3, deemed as understand. This means that there are equal number of respondents who are cognizant and those who understand. Being cognizant means that they have heard about biosignals but they do not have personal experience about it. This can be explained by the fact that most respondents come from urban areas where these biosignals are hardly felt, noticed or given thought about. Their knowledge on these biosignals may have come from stories passed on to them brought about by continuous acculturation through immigration.

Table 2. Climate change responsiveness scorecard

Domains	Types	Response	Scale					Score		
			1	2	3	4	5			
Knowledge	Tacit knowledge	Local or Indigenous knowledge						3		
		Bio signals						4		
	Explicit knowledge	Weather extremes						4		
		Weather variability						4		
		Weather uncertainty						4		
Total K score									19	
Average K score										3.8
Attitude	Mindsets	In Denial/Apathetic/Resigned/ Apprehensive/Involved						4		
	Motivation	Human safety/Water/Food security/Habitat/ Livelihood						3		
Total A score									7	
Average A score										3.5
Practice	Coping mechanics	Stockpiling						4		
		Foraging for unconventional food sources						4		
		Off farm employment						4		
		Knowledge sharing/ Information seeking/ Networking						4		
		Relocation						4		
		Alternative house design and yard layout						4		
	Adaptation	Residue management						4		
		Change in cropping patterns						4		
		Varietal change						4		
		Crop Insurance						4		
		Early warning systems						4		
		Backyard food conservation						4		
		Farm waste conservation						4		
		Irrigation, water impounding						4		
		Terracing, hedgerows, wind/fire breaks, buffers						4		
	Mitigation	Organic farming						4		
		Methane capture						4		
		Reforestation						4		
		Cover crops						4		
		Agroforestry						4		
		Nutrient management						4		
		Tillage management						4		
		Restoration of degraded areas						4		
		Pasture management						4		
		Alternate wetting and drying irrigation						4		
Total P score									100	
Average P score										4
Overall total								126		
Overall CCRp rating								3.93		

On the other hand, those who understand meant that they could comprehend the topic due to personal experiences. This is supported by the fact that some respondents are exposed to agriculture due to: a) the nature of their work in the institution they are part of, especially those that offer agriculture-related courses; and b) location of residency wherein community income is determined by crop production, especially in some areas in Cavite. Some of the respondents also asked during the data gathering what biosignals are including those who work in agriculture-related settings. After brief explanations, some expressed that they were actually familiar with it but not the with the term biosignal. As such, these were not reflected in the assessment. However, results also showed how tacit this kind of knowledge is. Respondents knew about it but they do not particularly give a name to it.

In terms of attitudes, majority of academe member's mindsets fall under "involved." As such, it can be deduced that people from the academe are willing to support causes that can somehow slower or reverse the processes and lessen the effects of climate change. Their "involved" mindset might be related to their exposure to literature, field studies and texts as this is a subject widely discussed in the academe. Numerous projects on climate change are also piloted or begin in academic institutions. Another probable cause for this is being subjected to weather conditions that have negative impacts on academic activities and is further supported by their motivation, which is mostly human safety. This is backed by the idea that certain circumstances set actions. This can also be explained by the academe's field of interest in terms of climate change, which is more likely, the victim's interest that explains their intent of supporting any action to improve their situation because they bear the costs of climate change. Considering the area from where most of the respondents come from, it can be said that flooding is one of the main concerns for them, especially some places that are not experiencing flood before are now being plagued by it and most people are experiencing health deterioration brought about by these events. With this, it can be said that somehow, even if respondents come from different areas where there are different cultures toward agriculture-related issues, people have mutual concerns regarding preservation of human safety by being willing to be involved in any movement towards recovery of security.

Practices refer to actions related and influenced by knowledge and attitude related to climate change. This domain has three categories, namely; coping mechanisms, adaptation, and mitigation. The overall mode for this domain is 2.84, which means almost moderate but still less than moderate. This result confirms the previous outcome for knowledge, which is also the same,

and these are confirmed by the respondent's involved mindsets and their motivation, human safety.

A point to note also is that for the non-applicability of adaptation practices, a number of respondents have expressed their familiarity with the adaptation practices but they lack the willingness to adopt them. Cultural dimensions or some degrees of conflict of interest may also influence adoption of certain technologies. Since respondents are representatives of different institutions, they may be catering to different services or involved in practices that may be affected negatively if ever mitigation practices will be adopted. Adoption of practices also has a possibility of transcending values, ethics or workload and of course, if this would mean loss of income, full mitigation and its sustainability will be difficult to ensure. This can also be explained by the "diffuse theory of culture" (Trompenars and Hampden-Turner, 1997) where respondents separate their work from their private lives, meaning, respondents may be at the time being, thinking of these practices as work-related practices and not as personal mitigation strategies.

Under coping mechanisms, most respondents answered "interested" for foraging for conventional food sources, networking/knowledge sharing/ information seeking and alternative house design and layout. This means that since most of them are not thoroughly knowledgeable about agricultural practices, they are willing to adopt these strategies only if more explanations can be done, but the shaping of these messages must be tailored according to cultural differences among these institutions for culture acts as filter that may cause for the acceptance or rejection of messages. This previous result is highlighted by their interest (3) in networking/knowledge sharing/information seeking. This is again supported by the fact that most respondents come from urban areas where the following strategies are not if ever, explicitly practiced. Nevertheless, it should be considered that understanding these concepts may not thoroughly mean adoption of these strategies as there might be difference in applicability in areas where they come from. Under the same category, most respondents are "aware" of stockpiling, off-farm employment and relocation. This means that they know such strategies exist but they do not understand them. Relocation is particularly an area of interest as this is a coping mechanism frequently discussed in the mass media. Relocation for people in dangerous areas are now being encouraged and non-compliance means offense. However, since this study deals with agriculture and not just residential areas, the place of relocation must also be a land situated in areas with favorable conditions so that it can still be used for farming and other agriculture-related practices.

Under adaptation, the respondents are "interested" in residue management, change in cropping patterns, varietal change, crop insurance, farm waste conservation, irrigation/water impounding and terracing hedgerows, wind/fire breaks, buffers. With these results, it can be deduced that respondents have heard about the practices and possibility of adoption may be considered if these will be fully explained to them. They are also decided when it comes to early warning signs. This means that they are aware and interested about the strategy and they are almost ready to adopt the strategy if resources will be made available to them. This choice is reflected by their involved mindset and their motivation for preserving human safety. Another result is that adaptation may be dependent on its applicability on the respondents. Given the "decided" score on backyard food conservation, either the location or its ease to the respondent will trump up the level from just "interested."

For mitigation, respondents are "interested" on organic farming, cover crops, agroforestry, nutrient management, tillage management, alternate wetting and drying irrigation and restoration of degraded areas. It is believed that their needs to have more information on these specific strategies for use in mitigation but have already gained notice from almost all respondents. On the other hand, respondents are unfamiliar with methane capture, which says that they do not know anything about it. As methane capture needs a specific technology to apply it, the strategy greatly differs from others and would most likely need more scientific data for understanding. It does not receive much exposure from the media and compared to the other strategies, this is more focused on landfills and livestock farms. Respondents are "aware" of pasture management but they need more information about it and they are definitely "decided" on reforestation, meaning that they are ready to adopt the strategy provided they have enough resources and opportunity for it. Again, this shows that exposure on the concept means a higher probability of using the mitigation strategy. Reforestation has been a chronic staple in environmental studies and issues of the country.

Considering the results, which is mostly 3 or aware, these can be attributed to nature of the respondents where some are not agriculture practitioners, meaning some strategies are not applicable to them and their profession is not directly inflicted by negative effects of climate change; as there are instructors of different courses not necessarily agriculture-related therefore agricultural concepts are not their forte; and there would be too many considerations if some strategies would be considered such as availability of resources and opportunity to do so.

Specifically, the low scores can be attributed to coping mechanisms such as off farm employment; relocation had a mode of 2, which implies that knowledge level is low. In addition, under mitigation, methane capture, had a score of 2 as not everyone knows this mitigating strategy. Thus, a score of 2.84 on knowledge level implies that respondents need to increase their knowledge level especially on biosignals. Knowledge like stockpiling, off-farm employment, and relocation should be taught to stakeholders as possible coping mechanisms. In terms of attitudes, respondents' mindset had been rated as involved. This is relatively good since they are open to the foreseen impacts and are ready to face the challenge should the need arise. The most important motivation for the respondents to have a positive attitude is human safety. Respondents believe that human safety should be the foremost concern over food security.

Found in Table 3 is the academe's CCRp Profile immediately followed by the Scorecard. For each survey item, the mode or the most frequently occurring answer was shaded in the profile.

The Youth Sector

Respondents from the youth sector were composed of students, out-of-school youth, and young professionals. It is quite noticeable that the tacit and explicit knowledge of young people come from direct experiences. They have knowledge with climate change and its effects on weather extremes, variability, and uncertainty, and they at least understood them because they have been actually experiencing those weather changes. They are cognizant with biosignals probably due to the technicality of the term and since its scope was not discussed in the form. The youth is generally apprehensive with regard to climate change. Most of the youth sector regards human safety as the main motivating factor in being apprehensive about climate change. Respondents came from different regions. Thus, they may have different experiences. Some of them, particularly those from Metro Manila have suffered from floods. This could be a reason why housing and human safety mattered to them most. This is also similar to respondents from Cavite, Mindoro, and Cebu provinces where some areas are affected by sea turmoil. Those coming from the provinces may be more aware and interested in agricultural activities related to climate change than those from the cities. The young respondents also showed a particular interest in most of the coping mechanisms, mitigation, and adaptation methods that can be done about the issue. They are interested

Table 3. Academe's climate change response profile

Community: The Academe As of: September 2013						
Fields	**KAP**	**Mode**				
		1	**2**	**3**	**4**	**5**
Tacit knowledge	Local or Indigenous knowledge					
	Bio signals					
Explicit knowledge	Weather extremes					
	Weather variability					
	Weather uncertainty					
Mindsets	In Denial/Apathetic/Resigned/Apprehensive/Involved					
Motivations	Human safety/Water/Food security/Habitat/Livelihood					
Coping mechanisms	Stockpiling					
	Foraging for unconventional food sources					
	Off farm employment					
	Knowledge sharing/ Information seeking/Networking					
	Relocation					
	Alternative house design and yard layout					
Adaptation	Residue management					
	Change in cropping patterns					
	Varietal change					
	Crop Insurance					
	Early warning systems					
	Backyard food conservation					
	Farm waste conservation					
	Irrigation, water impounding					
	Terracing, hedgerows, wind/fire breaks, buffers					
Mitigation	Organic farming					
	Methane capture					
	Reforestation					
	Cover crops					
	Agroforestry					
	Nutrient management					
	Tillage management					
	Restoration of degraded areas					
	Pasture management					
	Alternate wetting and drying irrigation					

Table 4. Climate Change Responsiveness (CCRp) scorecard

Domains	Types	Response	Scale					Score		
			1	2	3	4	5			
Knowledge	Tacit knowledge	Local or Indigenous knowledge						3		
		Bio signals						2		
	Explicit knowledge	Weather extremes						3		
		Weather variability						3		
		Weather uncertainty						3		
Total K score									14	
Average K score										2.8
Attitude	Mindsets	In Denial/Apathetic/Resigned/ Apprehensive/Involved						5		
	Motivation	Human safety/Water/Food security/Habitat/ Livelihood						1		
Total A score									6	
Average A score										3
Practice	Coping mechanics	Stockpiling						2		
		Foraging for unconventional food sources						3		
		Off farm employment						2		
		Knowledge sharing/ Information seeking/Networking						3		
		Relocation						2		
		Alternative house design and yard layout						3		
	Adaptation	Residue management						3		
		Change in cropping patterns						3		
		Varietal change						3		
		Crop Insurance						3		
		Early warning systems						4		
		Backyard food conservation						3		
		Farm waste conservation						3		
		Irrigation, water impounding						3		
		Terracing, hedgerows, wind/fire breaks, buffers						3		
	Mitigation	Organic farming						3		
		Methane capture						1		
		Reforestation						4		
		Cover crops						3		
		Agroforestry						3		
		Nutrient management						3		
		Tillage management						3		
		Restoration of degraded areas						3		
		Pasture management						2		
		Alternate wetting and drying irrigation						3		
Total P score									71	
Average P score										2.84
Overall total								71		
Overall CCRp rating								2.88		

to take part in actions and initiatives toward the mitigation of the effects of climate change and on learning how to cope and adapt to these effects. They were also interested in most of the coping mechanism except foraging for unconventional food sources and off farm employment, to which respondents only expressed their awareness. Moreover, they are interested in methods that are not farming related. Stockpiling, knowledge sharing, relocation, and alternative house design and layout are not exactly related to the sciences of farming and agriculture. Noticeably, they are interested with coping mechanisms related to housing, as housing ranked second in the motivations affecting the attitude of respondents toward climate change.

These results are countered in the adaptation part because the mode shows that young people are interested to learn different adaptation methods even if they are farming related. The results, however, are justified by that fact that majority considers human security as their attitudinal motivation. For instance, security is manifested in their interest in early warning systems and terracing hedgerows, wind/fire, breaks and buffers.

While coping mechanisms and adaptation are recent additions to the study of climate change, mitigation is the more commonly known action toward the phenomenon. The young people are unfamiliar of scientific methods such as methane capture, agroforestry, tillage management, pasture management, and alternative drying and irrigation. They expressed interest in organic farming, cover crops, nutrient management and restoration of degraded areas. These results may have been attained on the basis of the familiarity of the terms that are less technical than others are. Nonetheless, the percentages of results for young people who are unfamiliar, aware, and interested with the mitigation methods against climate change are not very far from each other. On the whole, only a small percentage of respondents expressed their oblivion on knowledge about climate change. No one claimed full expertise of the issue. In addition, very few said that they are in denial and apathetic towards the issue. Only very minimal said that they have decided to take actions either and that they have already adopted the methods.

It can be noticed from the results that there was a decrease from knowledge (2.8) to attitude (2.5). This only proves that while many of the youth who have responded to the survey are either cognizant or understanding of the issue, not everybody has the motivation and mindset that something should be done about climate change. Overall, the youth sector somehow understands the issue of the inevitable climate change. Young people may not have the complete expert knowledge of the issue, but at the very least, they know

enough to understand that there is something wrong and proper actions should be done. This is further proven as their attitude is generally apprehensive. As the average score for practices (2.56) denotes, they have also expressed interest to learn coping mechanisms, adaptations, and mitigation methods even if they are unfamiliar with most of the more technical strategies.

For the youth sector, tacit knowledge on biosignals had a score of 2. This implies that respondents need to be trained on this particular area. Similarly, in terms of practice, they do not observe foraging neither for unconventional food sources nor off farm employment strategies. In terms of mitigation measures, methane capture is also not being practiced as well as tillage management, pasture management, and alternate wetting and drying irrigation. Being apprehensive means, the youth is ready to assume some responsibilities given the tasks. A score of 2.59 means a low CCRp index and implies that resiliency is low and needs to be beef up with capacity building programs. This means that the youth sector as intermediaries of change has to be trained on specific climate change adaptation strategies so they will be in a better position to promote CCA strategies and make the Filipino agricultural households more resilient and responsive to erstwhile climate change impacts. In the Philippines, the youth plays a major role in nation building. Hence, their participation needs recognition and support. After all, human safety is their number one motivation to face the challenge of climate change. It can further be implied that the information age plays an important role in shaping and influencing the youth toward nation-building aspirations, which include actions on climate change as this, can be both an environmental and a societal concern. For one, what was once an agricultural age became industrial and now information age. Since young people are more interested in surfing the Internet and playing different games through hand-held, portable, and even sensor-operated gadgets, they are less familiar and interested with agriculture. This could be one reason why higher results were not met for survey questions on knowledge and practice related to farming.

The information age brings forth not only abundance in information but also accessibility. This means that young people should have been well informed on climate change because of the easy access into the repository of data regarding the subject not only related to literature in the Philippines but across the globe. However, there has also been information overload because of the minimal consumption of information. Young people engaged themselves in processing information related to entertainment more frequently than they do in more important issues such as climate change. In addition,

Table 5. Youths' climate change responsiveness profile

Group: The Youth As of: September 2013						
Fields	**KAP**	**Mode**				
		1	**2**	**3**	**4**	**5**
Tacit knowledge	Local or Indigenous knowledge					
	Bio signals					
Explicit knowledge	Weather extremes					
	Weather variability					
	Weather uncertainty					
Mindsets	In Denial/Apathetic/Resigned/Apprehensive/ Involved					
Motivations	Human safety/Water/Food security/Habitat/Livelihood					
Coping mechanisms	Stockpiling					
	Foraging for unconventional food sources					
	Off farm employment					
	Knowledge sharing/ Information seeking/Networking					
	Relocation					
	Alternative house design and yard layout					
Adaptation	Residue management					
	Change in cropping patterns					
	Varietal change					
	Crop Insurance					
	Early warning systems					
	Backyard food conservation					
	Farm waste conservation					
	Irrigation, water impounding					
	Terracing, hedgerows, wind/fire breaks, buffers					
Mitigation	Organic farming					
	Methane capture					
	Reforestation					
	Cover crops					
	Agroforestry					
	Nutrient management					
	Tillage management					
	Restoration of degraded areas					
	Pasture management					
	Alternate wetting and drying irrigation					

Table 6. Climate change responsiveness (CCPr) scorecard

Domains	Types	Response	Scale					Score		
			1	2	3	4	5			
Knowledge	Tacit knowledge	Local or Indigenous knowledge						3		
		Bio signals						2		
	Explicit knowledge	Weather extremes						3		
		Weather variability						3		
		Weather uncertainty						3		
Total K score									14	
Average K score										2.8
Attitude	Mindsets	In Denial/Apathetic/Resigned/ Apprehensive/Involved						4		
	Motivation	Human safety/Water/Food security/Habitat/ Livelihood						1		
Total A score									5	
Average A score										2.5
Practice	Coping mechanics	Stockpiling								
		Foraging for unconventional food sources								
		Off farm employment								
		Knowledge sharing/ Information seeking/ Networking								
		Relocation								
		Alternative house design and yard layout								
	Adaptation	Residue management								
		Change in cropping patterns								
		Varietal change								
		Crop Insurance								
		Early warning systems								
		Backyard food conservation								
		Farm waste conservation								
		Irrigation, water impounding								
		Terracing, hedgerows, wind/fire breaks, buffers								
	Mitigation	Organic farming								
		Methane capture								
		Reforestation								
		Cover crops								
		Agroforestry								
		Nutrient management								
		Tillage management								
		Restoration of degraded areas								
		Pasture management								
		Alternate wetting and drying irrigation								
Total P score									64	
Average P score										2.56
Overall total								83		
Overall CCRp rating								2.59		

with this overload, the attention span of online users particularly young people decreases as more and more information pop up in the virtual space. The online community has also developed a type of culture than only those who have well penetrated the virtual world can understand.

Results of the survey showed that the youth needs to know more and be further motivated to decide on getting involved and adapted to climate change. More work should be done in imparting to them proper knowledge on climate change and it may not necessarily be on the technical side but more on the practical side. Of course, understanding the scientific perspective is important but with the attention span and inherent lack of interest of most of the young people, teaching them on the practicalities of coping with, adapting on, and mitigating climate change can catapult them into involvement and action.

Found below is the youth's CCRp Profile immediately followed by the Scorecard. For each survey item, the mode or the most frequently occurring answer was shaded in the profile.

It can be concluded that all stakeholders need specific training in terms of knowledge and skills enhancement given the role that they play in promoting CCA based on the results of the survey.

CONCLUSION

Most surveyed respondents had a knowledge level of climate change from understanding to expert. While this knowledge level is commendable, there is a need to further increase stakeholder's knowledge level especially on biosignals and to have a standard understanding of the same. Attitudes while mostly involved would require more conscientization and value formation to better promote CCA with the right disposition. Practice in terms of coping, adaptation, and mitigation needs further honing given that only one out of 3 is practicing the strategy. Thus, a generic training on climate change adaptation strategies for the different stakeholders shall be developed but customized based on need and roles that stakeholders are expected to play. It is obvious that DA respondents are more knowledgeable, has the right attitude and practice levels since they are mandated to do so.

ADDITIONAL READING

Asian Institute of Development Studies, Inc. (2013). *Climate change adaptation among farm families and stakeholders: A toolkit for assessment and analysis*. Quezon City, Philippines: Philippine Climate Change Adaptation Project.

Asian Institute of Development Studies, Inc. (2015). *Good climate change adaptation practices manual*. Quezon City, Philippines: Philippine Climate Change Adaptation Project.

Chapter 6
Case Study:
Evaluation of Climate Change Adaptation Interventions

ABSTRACT

The following case study deals with the Final Evaluation Study of the Philippine Climate Change Adaptation Project. It illustrates how the project evaluation procedure may be used on a climate change adaptation intervention. The study found that 34.18% of farm householders surveyed in the pilot areas were practicing or intending to practice PhilCCAP adaptation technologies. Compared to the baseline figure of 12.47%, there was an increase of 22.42% among farm household adopters of PhilCCAP technologies. A computed value for Outcome Indicator 1 of 34.18% exceeds by 14.18% the target of 20.00% by the end of Year 5. The final results for the stakeholders also proved encouraging. An Outcome Indicator 2 value of 46.53% was computed, which overshot the end of project target of 35.00 percent by 11.53. Compared to the baseline figure of 11.27% among stakeholder respondents, the computed final value for Outcome Indicator 2 represents a leap of 35.26%. The Final Evaluation Study concludes that based on PhilCCAP's two outcome indicators the project has been successful in developing and demonstrating approaches that enabled targeted communities to adapt to the potential impacts of climate variability and change at project's end.

DOI: 10.4018/978-1-5225-2767-1.ch006

INTRODUCTION

The next case study deals with the final evaluation of a climate change adaptation project. It is illustrative of the project evaluation procedure discussed in Chapter 4.

Background

The Government of the Philippines through a grant from the GEF-Special Climate Change Fund (SCCF) and the World Bank has completed the first phase of the Philippine Climate Change Adaptation Project (PhilCCAP). The five-year project, executed by the Department of Environment and Natural Resources (DENR), the Department of Agriculture (DA), the Department of Science and Technology (DOST), the Climate Change Commission (CCC) and several other agencies, aimed to develop and demonstrate effective approaches and adaptive measures to increase the country's resilience to climate change. The project also intended to strengthen existing institutional and decision-making frameworks for climate change adaptation and demonstrate cost-effective adaptation strategies for both agriculture and natural resource management.

PhilCCAP attempted to increase farming communities' adaptive capacity by: (a) improving farm management capability under conditions of climate risk; (b) providing access to information on weather forecasting and climate patterns; (c) increasing access to risk management options such as the weather index insurance; and (d) strengthening ecosystems.

The project has four (4) components.

- Component 1 provides for the integration of climate change adaptation into the agriculture and natural resources sectors and strengthens the capabilities of relevant government agencies.
- Component 2 aims to help poor rural communities adapt to the effects of climate change, by demonstrating both tangible reductions in climate-related risk and increased resilience to climate change.
- Component 3 seeks to improve the ability of end users, especially in the agriculture and natural resources sectors, to access more reliable scientific information.
- Component 4 supports project coordination functions through DENR's Foreign Assisted Projects Office (FASPO).

PhilCCAP was a pilot project. It was implemented in seven municipalities of three provinces located in three regions: the municipalities of Tuguegarao and Penablanca in Cagayan Province, Region II; the municipalities of Janiuay, Pototan, Dumangas and Mina in Iloilo Province, Region VI; and the municipality of Siargao in Surigao Province, CARAGA Region. The Department of Agriculture was responsible for the interventions conducted in Regions II and VI while the Department of Environment and Natural Resources coordinated the design and development of interventions for the CARAGA Region.

This report deals with interventions delivered by the Department of Agriculture under PhilCCAP in Regions II and VI.

Rationale

PhilCCAP's development objective is *to develop and demonstrate approaches that would enable targeted communities to adapt to the potential impacts of climate variability and change*.

The attainment of this objective is gauged through two project outcome indicators:

1. *Twenty percent (20%)* of households surveyed in the targeted areas adopt coping strategies, new technologies or improved farming practices to better cope with climate variability and extremes.
2. Among stakeholders surveyed in the targeted areas *thirty-five percent (35%)* have participated in or are knowledgeable of activities demonstrated by the project to reduce vulnerability or improve adaptive capacity.

Project outcome information is necessary to assess the success of PhilCCAP in demonstrating cost effective adaptation measures to farmers, in increasing awareness on adaptation and on providing guidance on the potential for scaling up these activities.

For PhilCCAP, 2016 marked the fifth year or end of its five-year timeframe. A Final Evaluation of project performance based on the two outcome indicators was conducted by the Agricultural Training Institute. This document is the Draft Report of the Final Evaluation Study

Objectives

The objectives of the study were:

1. To determine the percentage of households in the targeted areas who have adopted coping strategies, new technologies or improved farming practices to better cope with climate variability and extremes;
2. To determine the percentage of stakeholders in the targeted areas who have participated in or are knowledgeable of activities demonstrated by the project to reduce vulnerability or improve adaptive capacity; and
3. To compare these percentages to baseline and midterm values collected during Years 1 and 3 of the project;
4. To assess the progress and performance of the project vis a vis its development targets for the end of Year 5.

FRAMEWORK

Under PhilCCAP Component 2, the Asian Institute of Development Studies developed a Toolkit designed to rigorously measure, monitor, and analyze progress towards the two aforementioned project indicators. The Toolkit includes two frameworks that the Final Evaluation Study employed to guide its analyses: the project results matrix framework; and a conceptual framework for climate change responsiveness.

Results Chain

As designed, PhilCCAP's project results matrix may be summarized by the results chain found in Chapter 4 as Figure 2.

The results chain illustrates the sequential relationships among PhilCCAP's three main interventions represented by its first three components, their target outputs and their resulting outcomes:

- Agricultural households in the targeted areas adopt coping strategies, new technologies or improved farming practices to better cope with climate variability and extremes.
- Stakeholders in the targeted areas have participated in or are knowledgeable of activities demonstrated by the project to reduce vulnerability or improve adaptive capacity.

Project performance was assessed through the indicators of these two outcomes.

Conceptual Framework

To rigorously measure, monitor, and analyze progress towards PhilCCAP's project indicators, the Toolkit team deconstructed two constituent concepts used in current climate change adaptation discourse, *knowledge* and *adoption,* making the operationalization of these terms more consistent with the behavioral sciences. Knowledge and adoption were classified under different (social) learning domains, the cognitive and the psychomotor domains, respectively. This differentiation enabled the Team to:

- Assess resilience as a function of response/ responsiveness
- Establish categories and types of individual, group or community responses to climate change ranging from knowledge gain/loss (**ΔK**) to attitude shifts (**ΔA**) and change in practice (**ΔP**) or behavioral change;
- Measure these changes and compare their differences over time; and
- Provide coherence to the climate change adaptation discourse from the social and behavioral sciences points of view.

For instance, knowledge, as mentioned, is classified under the cognitive domain. Consistent with knowledge management (KM), knowledge would be categorized into two types: tacit and explicit. Bio-indicators or bio-signals indicative of climate change are examples of tacit knowledge. Local knowledge is categorized under this grouping also. Scientific knowledge of climate change such as climate variability and extremes is categorized as explicit knowledge.

Similarly, attitudes are classified under the affective domain. These are grouped and measured through an ordinal scale under mindsets and motivations categories.

Lastly, practice is situated under the psychomotor domain and categorized as coping mechanisms, adaptation and mitigation. Coping mechanisms are short-term responses to immediately deal with climate change caused disasters and contingencies. Adaptation refers to long-term changes to technological or cultural management options to address long-term effects of climate change. Mitigation involves practices related to the reduction, sequestration and elimination of carbon and other greenhouse gases.

Figure 1, Chapter 3, illustrates the conceptual model for assessing climate change resilience as a function of responsiveness. It assumes that climate change adaptation is a social learning process and is based on the stimulus – response theory.

Climate change related stimuli to farm families include exposure to: changes in the agro-ecosystem (upland, lowland or coastal); climate change information from the media or agencies providing basic social services; coping, adaptation and mitigation procedures (technologies, strategies or programs); and experiences of climate extremes, variability and uncertainties. Responses to climate change related stimuli are categorized as knowledge gain/loss; attitude change; and adoption of practices.

METHODOLOGY

Coverage

This Final Evaluation constitutes part of the project monitoring and evaluation process. The study limits itself to the assessment of PhilCCAP performance at the end of the project's five-year lifespan, 2016.

Chapter 4 presented two types of climate change adaptation assessment procedures: *benchmarking* and *evaluation*. To review, benchmarking refers to the documentation and analysis of current CCA practice in any given target group, organization or community for purposes of internal or external comparison to a given standard, de facto or otherwise. It is *not* done within the bounds of project parameters (i.e., time, resources) and project-determined outcomes.

On the other hand, evaluation refers to baseline, midterm, final and ex-post measurements and analysis of CCA practice vis some vis given interventions. Evaluation is conducted within set project parameters and project-determined outcomes, in this particular case, PHILCCAP timelines, resources and final outcomes. This study adopts procedures for an evaluation study and not a benchmarking study.

The Final Evaluation was exclusively based on project development outcome indicators, which dealt specifically with knowledge (K) levels and practice (P) levels. It discussed attitudes (A) only in relation with adoption. Hence, the analysis did not cover all of the fields provided in the taxonomy presented above.

The study focused on climate change adaptation technologies introduced under PhilCCAP by the Agricultural Training Institute, the Bureau of Soils and Water Management, PAG-ASA, the International Rice Research Institute, the Philippine Crop Insurance Corporation and the National Irrigation Administration. It did not include tacit knowledge, specifically indigenous and local knowledge on bio-signals or bio-indicators, data that preceded PhilCCAP interventions and can adequately be covered in the Toolkit's benchmarking methodology rather than its evaluation methodology.

As in the case of the baseline and midterm studies, this evaluation covered the pilot areas under the Department of Agriculture. Its respondents came from six of the seven PhilCCAP pilot municipalities: Tuguegarao and Penablanca in Cagayan Province, Region II; and Janiuay, Dumangas, Mina and Pototan in Iloilo Province, Region VI.

Design

Ideally, evaluation should be guided by a project results matrix that provides a narrative summary of project interventions, intermediate outcome indicators, final outcome indicators and activities. Without a project results matrix (otherwise known as a logical framework or log frame) evaluation cannot be executed.

Chapter 4 recommends that evaluations employ fully integrated multi-level mixed methods within a randomized quasi-experimental design. In a randomized quasi-experimental design, respondents are sampled out of the complete list (universe) of project beneficiaries from the target communities as the experimental group. A separate set of non-beneficiaries from communities having similar characteristics to the project communities are likewise sampled as the control group. Both groups are subjected to baseline, midterm and final evaluation studies. KAP changes in the experimental group are compared to those of the control group to determine if target communities indeed benefited from the project. Baker (2000) argues that a non-randomized quasi-experimental design is the best alternative when true-experimental designs cannot be conducted due to several field constraints. Unfortunately, in this case, even the adoption of the quasi-experimental design has been challenged by project realities.

Firstly, the baseline figures wherein the midterm values are to be compared were collected in the course of pretesting the instruments developed for the Toolkit. This severely limited the number of respondents for the baseline.

However, rigor dictates that a similarly limited sampling scheme for the midterm and final evaluations was unadvisable.

Secondly, the same group of respondents tapped for the baseline cannot be mobilized for the midterm study.

Thirdly, control communities or municipalities have not been identified within the PhilCCAP piloting scheme. Pinpointing communities that had not served as beneficiaries of any climate change adaptation intervention would prove to be a challenging task, considering that the Philippines as a country is one of the most vulnerable to climate change impacts and adaptation is done widely as a matter of survival.

Hence, the alternative was to adopt a one-shot survey design.

Respondents and Sampling

The survey made use of two types of respondents, each one linked to a specific outcome indicator: the farm household; and the stakeholder.

The farm householder respondent would inform Project Outcome Indicator 1. Its unit of analysis is the household in each of the pilot municipalities.

A stratified sampling design was employed for this type of respondent. Farm households were stratified according to elevation and size of farm. For elevation, three strata were identified: 1) uplands or farms at areas with high elevation; 2) medium elevation and lastly, 3) coastal farms or those located in areas with the lowest elevation, i.e., beside the sea. Within each elevation, farm households were classified into two according to the size of the farms. Within each elevation-farm size classification, a simple random sample of farms or farmer households was obtained.

Stakeholder respondents inform Project Outcome Indicator 2. Its unit of analysis is the stakeholder agency representative from each of the pilot regions. In this study, stakeholder respondents were composed of officials and staff of partner agencies, local government units, nongovernment organizations and civil society who accomplished and returned their questionnaires. The sampling framework cannot apply to them because the universe for both regions is undetermined.

Instruments

The Toolkit included data gathering instruments for both benchmarking and evaluation. This study made use of two evaluation instruments: one for the

farm householder respondent; and the other for the stakeholder respondent. The former is formatted as an interview schedule, which required an interviewer for the farm householder. The latter is a self-administered questionnaire. APPENDICES B and C give abridged versions of the interview schedule for farmer households and the questionnaire for stakeholder respondents sans items that do not relate to PhilCCAP evaluation.

These two evaluation instruments were similar but not identical to the instruments used in the Baseline Study. The baseline instruments underwent slight changes after their pretesting and the field-testing of the Toolkit. However, it is assumed that the data gathered referred to identical fields.

Operationalization

Performance in achieving PhilCCAP's project outcomes was determined by comparing project indicator levels at baseline and final measurement points. The indicator values pertain to respondents' knowledge and adoption levels of climate change adaption technologies introduced by PhilCCAP. These technologies are:

- The Palay Check System (PCS) introduced by ATI under the Climate Smart Farmers' Field Schools
- Integrated Farming System (IFS) also introduced by ATI under the Climate Smart Farmers' Field Schools
- The Climate Change Adaptation Practices (CCAP module of the ATI Climate Smart Farmers' Field Schools
- Weather Index Based Crop Insurance (WIBCI) introduced by PhilRice and the Philippine Crop Insurance Corporation (PCIC)
- Small Automated Weather Stations (SAWS) introduced through PAGASA
- Decision Support System (DSS) developed by IRRI
- Retrofitting of Irrigation Systems (RIS) by the National Irrigation Administration (NIA)

The value for Outcome Indicator 1 was arrived at through the following procedure:

Firstly, levels of practice (or adoption levels) among farm householder respondents were measured for each of the PhilCCAP technologies enumerated above. A five-point categorical scale was employed with the corresponding

interpretations: *1-Unfamiliar; 2-Aware; 3-Interested; 4-Decided; and 5-Adopted.* In a scale of 1 to 5:

1. *Unfamiliar* (1 means respondent is unaware of the practice)
2. *Aware* (2 means respondent is conscious of the practice but does understand it)
3. *Interested* (3 means respondent sees potential in the practice)
4. *Decided* (4 means respondent has made a judgment on the technology after personally assessing)
5. *Adopted* (5 means subject is aware, interested, evaluated and has now embraced the technology)

Secondly, frequency distributions of responses for each technology were computed per adoption level as well as their corresponding percentages.

Thirdly, the mean percentages for each adoption level were derived resulting in the overall proportion of responses among adoption levels.

Lastly, the mean percentages of Level 4 (Decided) and Level 5 (Adopted) were added, the sum of which represents the value for *Outcome Indicator 1: agricultural households in the targeted areas adopting new technologies or improved farming practices to better cope with climate variability and extremes.*

Similarly, for Outcome Indicator 2, the value was arrived at through the following procedure:

Firstly, knowledge levels among stakeholder representatives from the pilot areas were measured with a five-point scale, each point representing a "level" within the cognitive domain. These levels are: *1-Obliviousness; 2-Cognizance; 3-Understanding; 4-Engagement; and 5-Expertise.* They are operationalized as:

1. *Oblivious* (1 means research respondent has no knowledge about the subject matter)
2. *Cognizant* (2 means respondent has heard about the subject matter but does not have personal knowledge about it)
3. *Understands* (3 means respondent comprehends the subject matter)
4. *Engaged* (4 means respondent has given the subject matter some thought and has drawn conclusions or constructs about it)
5. *Expert* (5 means respondent has some degree of authority over the subject matter because of his understanding and cognitive engagement)

Secondly, frequency distributions of responses for each technology were computed per knowledge level as well as their corresponding percentages.

Thirdly, the mean percentages for each knowledge level were derived resulting in the overall proportion of responses among knowledge levels.

Lastly, the mean percentages of Level 4 (Engaged) and Level 5 (Expert) were added, the sum of which represents the midterm value for *Outcome Indicator 2: stakeholders have participated in or are knowledgeable of activities demonstrated by the project to reduce vulnerability or improve adaptive capacity*.

Data Analysis

The ordinal or ranked measurements of knowledge, attitude and practice given above are based on individual responses gathered during the survey. How will the ranked data be processed to arrive at a collective picture? The Toolkit recommends the use of the mode or median to paint the collective picture. Statistically, the mode or median should provide the measure of central tendency particularly in knowledge gain and level of practice wherein scores were not assigned. However, the statistical mean was used in the baseline and midterm analyses. Hence, the mean was also employed in this final evaluation for purposes of comparison.

The Chi-Square test was also applied on the levels of practice among the farm household respondents in Regions II and Region VI to text if a significant difference exists between the decision cum adoption levels per regional locale. Finally, simple comparisons on the outcomes were made between the two project indicators.

RESULTS AND DISCUSSION

This section presents the results of the final evaluation and discusses its findings on project performance based on the two project outcome indicators:

- Twenty percent (20%) of households surveyed in the targeted areas adopt coping strategies, new technologies or improved farming practices to better cope with climate variability and extremes.
- Among stakeholders surveyed in the targeted areas, thirty-five percent (35%) have participated in or are knowledgeable of activities demonstrated by the project to reduce vulnerability or improve adaptive capacity.

The study operationalized "new technologies, improved farming practices and activities demonstrated by the project" as the following technologies introduced under PhilCCAP: Palay Check System (PCS); Integrated Farming System (IFS); the Climate Change Adaptation Practices (CCAP) module of the ATI Climate Smart Farmers' Field Schools; Weather Index Based Crop Insurance (WIBCI); Small Automated Weather Stations (SAWS); Decision Support System (DSS); and Retrofitting of Irrigation Systems (RIS).

Before the presentation of final evaluation results, a review of the findings of both the baseline and midterm studies would be in order.

Review of Baseline Results

As already mentioned, the baseline findings were arrived at within conditions of constraint. Data were gathered as part of the field-testing of the Toolkit and pretesting of the data-gathering instruments contain therein. Thus, the ideal number of respondents for a baseline study was not achieved. Furthermore, the data-gathering instruments have not yet undergone the benefit of improvement and revision.

There were a total of 237 farm-household respondents surveyed in five municipalities: Tuguegarao and Penablanca in Region II; and Janiuay, Pototan and Dumangas in Region VI. The municipality of Mina in Region VI was not yet actively involved in the project during the conduct of the data gathering and did not form part of the baseline study locale.

Of the 237 farmer household respondents, 109 were males and 128 females. Since the respondents were sampled, it may be said that with this distribution, there were more female members in the farmer-household compared to males. The baseline study surmised that women were likewise heavily involved in farming activities. An implication forwarded by the study argued that climate change adaptation strategies must be made more gender-sensitive given the role that women play in farming.

On the other hand, there were 79 stakeholder-respondents. Unlike in the case of the farmer household group, more than half (50) of the stakeholders were males and they were more mature. The age range of the stakeholder-respondents ranged from 18 to 63 or older many of them falling between 53 and 57 years of age. The baseline study pointed to the maturity of the stakeholder-respondents as contributory to their levels of technical knowledge. Stakeholder positions likewise varied with the majority serving as agricultural technicians or technologist.

Project Outcome Indicator 1 Baseline Result

What was the percentage of households in the targeted areas who adopted new technologies or improved farming practices under PhilCCAP, i.e., Palay Check System (PCS); Integrated Farming System (IFS); the Climate Change Adaptation Practices (CCAP) module of the ATI Climate Smart Farmers' Field Schools; Weather Index Based Crop Insurance (WIBCI); Small Automated Weather Stations (SAWS); Decision Support System (DSS); and Retrofitting of Irrigation Systems (RIS)?

As a whole, the majority (32.67%) was unfamiliar with these technologies. Almost a quarter (24.42%) was aware of these technologies. Almost a third (29.8%) was interested. Only a minority (9.53%) has actually adopted with a smaller proportion (2.94%) deciding to adopt them but is not able to. Adding the values for the Decided and Adopted levels, we can say that 12.47 percent of the farmer households have already adopted PhilCCAP technologies during the project baseline. Comparing this to the 20 percent target, the difference is 08.53 percent. Thus, a significant proportion of farmer households within the pilot areas were already practicing some of the technologies that PhilCCAP was introducing.

Table 1 presents the breakdown of level of practice among farm-household-respondents during the baseline. It may be seen that much of the adopted technologies were part of the Climate Smart Farmers Field School curriculum of ATI.

Table 1. Baseline outcome indicator 1 measurements: level of practice among farmer households in Philccap pilot areas

PhilCCAP Adaptation Technologies	Level of Practice				
	Unfamiliar	Aware	Interested	Decided	Adopted
PCS	32.2	25.99	22.03	3.39	16.38
IFS	19.02	28.26	30.98	3.8	17.93
CCAP	21.74	29.89	32.07	2.72	13.59
WIBCI	45.1	21.57	28.1	2.61	2.61
DSS	33.9	23.16	30.51	4.52	7.91
SAWS	43.79	18.34	31.95	1.78	4.14
RIS	32.95	23.7	32.95	1.78	4.14
Mean	**32.67**	**24.42**	**29.8**	**2.94**	**9.53**

Project Outcome Indicator 2 Baseline Result

What was the percentage of stakeholders surveyed in the targeted areas who have participated in or are knowledgeable of activities demonstrated by the project to reduce vulnerability or improve adaptive capacity i.e., Palay Check System (PCS); Integrated Farming System (IFS); the Climate Change Adaptation Practices (CCAP) module of the ATI Climate Smart Farmers' Field Schools; Weather Index Based Crop Insurance (WIBCI); Small Automated Weather Stations (SAWS); Decision Support System (DSS); and Retrofitting of Irrigation Systems (RIS)?

Understandably, under baseline conditions, the majority (54.24%) of the stakeholder respondents were still oblivious of the technologies being introduced by the PhilCCAP. Almost a quarter (23.64%) answered that they were cognizant with these technologies having been briefed on them. A significant proportion (10.26%) felt that they understood these technologies. However, only 8.38 percent of them said that they were engaged in these practices. The least number (2.89%) claimed that they were experts in these already. Combining the proportions of the last two knowledge levels, Engaged and Expert, we arrive at the sum of 11.27 percent. This represents the proportion of stakeholder respondents in the pilot areas who have actually participated in or are knowledgeable of activities demonstrated by PhilCCAP. Comparing it to the target figure of 35.00 percent by Year 5, we arrive at the difference of 23.73 percent.

Table 2 gives the breakdown of baseline responses from the stakeholder respondents.

Table 2. Baseline outcome indicator 2 measurement: level of knowledge among Philccap stakeholders in pilot areas

PhilCCAP Adaptation Technologies	Level of Knowledge				
	Oblivious	Cognizant	Understands	Engaged	Expert
PCS	50.52	28.87	8.76	7.73	4.12
IFS	49.73	26.49	11.35	10.27	2.16
CCAP	47.37	29.67	12.92	8.13	1.91
WIBCI	51.31	24.61	11.52	8.38	4.19
SAWS	61.33	22	6.67	8	2
DSS	61.76	16.91	10.29	8.09	2.94
RIS	57.69	16.91	10.29	8.09	2.94
Mean	**54.24**	**23.64**	**10.26**	**8.38**	**2.89**

Review of Midterm Results

The Midterm Evaluation Study had a total of 2386 farmer household respondents, 1568 (65.71%) coming from two municipalities in Region II and 818 (34.28%) coming from four municipalities in Region VI. Almost half (46.56%) came from the municipality of Penablanca in Cagayan province. The least number (3.94%) of respondents came from the municipality of Dumangas, Iloilo province.

On the other hand, in the Midterm Evaluation Study, only 38 stakeholder respondents accomplished and returned their questionnaires. The majority (68.42%) came from Region II. Only 12 (31.57%) PhilCCAP stakeholders from Region VI served as respondents. Unlike in the case of the farmer respondents, the male stakeholders (60.53%) outnumber the females (39.47%).

Project Outcome Indicator 1 Midterm Results

For the midterm, what was the percentage of households in the targeted areas who adopted new technologies or improved farming practices under PhilCCAP, i.e., Palay Check System (PCS); Integrated Farming System (IFS); the Climate Change Adaptation Practices (CCAP) module of the ATI Climate Smart Farmers' Field Schools; Weather Index Based Crop Insurance (WIBCI); Small Automated Weather Stations (SAWS); Decision Support System (DSS); and Retrofitting of Irrigation Systems (RIS)?

Around a quarter (26.85%) said they were still unfamiliar with the technologies. Compared with the baseline's 32.67 percent, there was a reduction of 05.83 percent who were unfamiliar with PhilCCAP interventions during the project's midpoint.

An almost equivalent proportion (26.16%) of the farmer households surveyed answered that they were aware of these technologies and practices, an increase of 01.74 percent. However, the proportion of those interested dropped to 28.78 percent from 29.8 percent, a difference of 1.02 percent. Nevertheless, those who have decided to adopt these technologies jumped from 2.94 percent to 10.13 percent. Surprisingly, though, there was a slight drop of farmer respondents who were adopting these technologies from 9.53 percent to 8.08 percent, a difference of 1.45 percent.

Combining the Decided and Adopted levels, we arrive at the proportion of 18.21 percent of farmer households who are practicing or intending to practice PhilCCAP adaptation technologies. Combined to the baseline figure

for Outcome Indicator 1 (12.47%), there was an increase of 5.74 percent among farmer household adopters of PhilCCAP technologies from the baseline to the midterm.

The 18.21 percent value for Outcome Indicator 1 arrived at during the midterm reveal a difference of only 1.79 percent from the target proportion of 20.00 percent by the end of Year 5.

Table 3 provides the breakdown of proportions in the midterm for Outcome Indicator 1.

Project Outcome Indicator 2 Midterm Results

How did the project fare among the stakeholder respondents at the midterm? What was the percentage of stakeholders surveyed who have participated in or are knowledgeable of activities demonstrated by the project to reduce vulnerability or improve adaptive capacity i.e., Palay Check System (PCS); Integrated Farming System (IFS); the Climate Change Adaptation Practices (CCAP) module of the ATI Climate Smart Farmers' Field Schools; Weather Index Based Crop Insurance (WIBCI); Small Automated Weather Stations (SAWS); Decision Support System (DSS); and Retrofitting of Irrigation Systems (RIS)?

The midterm results for the stakeholders are even more encouraging. Among the stakeholders surveyed only 6.86 percent now claim that they are oblivious to PhilCCAP technologies. There has been a decrease of 47.38 percent from the baseline among those who had no knowledge of these practices. However,

Table 3. Midterm outcome indicator 1 measurements: level of practice among farmer households in PhilCCAP pilot areas

PhilCCAP Adaptation Technologies	Level of Practice				
	Unfamiliar	Aware	Interested	Decided	Adopted
PCS	28.67	24.81	26.87	10.2	9.45
IFS	20.4	25.1	33.21	12.59	8.69
CCAP	21.68	26.64	28.45	12.1	11.13
DSS	28.84	24.27	28.46	10.08	8.35
SAWS	28.88	26.66	28.8	9.49	6.17
WCIP	28.97	26.83	28.3	9.32	6.59
RIS	30.52	28.8	27.37	7.14	6.17
Mean	**26.85**	**26.16**	**28.78**	**10.13**	**8.08**

there was also a corresponding decrease of those who were cognizant of the technologies, from 23.64 percent to 13.14 percent. However, there was a big jump in the Understanding level from 10.26 percent to 34.86 percent, a difference of 23.88 percent. There was also a significant increase in the Engagement level, from 8.38 percent to 26.86 percent, a difference of 18.48. Furthermore, those who consider themselves as experts in these practices have increased from 2.89 percent to 18.29 percent, 15.4 percent from the baseline.

Combining the Engagement and Expert levels, we arrive at the Midterm Outcome Indicator 2 value of 45.15 percent. Compared to the baseline figure of 11.27 percent, this figure represents a leap of 33.88 percent. This Midterm Outcome Indicator 2 value *overshot* the end of project target of 35.00 percent by 10.15. It should be noted, however, that the respondents were limited to 38 only.

Table 4 provides a breakdown of midterm measurements for Outcome Indicator 2 per PhilCCAP adaptation technology.

Results of the Final Evaluation

The Final Evaluation Study had a total of 2500 farm householder respondents, 1613 (64.52%) coming from two municipalities in Region II and 887 (35.48%) coming from four municipalities in Region VI. More than half (55.40%) came from the municipality of Penablanca in Cagayan province. The least number (9.12%) of respondents came from the municipality of Tuguegarao.

Table 4. Midterm outcome indicator 2 measurement: level of knowledge among PhilCCAP stakeholders in pilot areas

PhilCCAP Technologies	Level of Knowledge				
	Oblivious	Cognizant	Understands	Engaged	Expert
PCS	16	12	30	14	28
IFS	4	16	40	24	16
CCAP	2	14	40	28	16
DSS	8	14	36	22	20
SAWS	6	14	38	30	12
WIBCI	6	10	30	36	18
RIS	6	12	30	34	18
Mean	**6.86**	**13.14**	**34.86**	**26.86**	**18.29**

Table 5. Distribution of farm householder respondents

Pilot	Frequency	Percentage
Municipality	**Distribution**	
Region II		
Penablanca	1,385	55.40%
Tuguegarao	228	9.12%
Subtotal	**1,613**	**64.52%**
Region VI	887	35.48%
Total	**2,500**	**100.00%**

Table 6. Distribution of stakeholder respondents

Region	Sample Size	Percentage	Female	Percentage	Male	Percentage
Region II	17	48.57%	11	64.71%	6	35.29%
Region VI	18	51.43%	4	22.22%	14	77.78%
Total	**35**	**100%**	**15**	**42.86%**	**20**	**57.14%**

Unfortunately, the farm householder data was not gender disaggregated since, in many instances, both husband and wife were interviewed at the same time. In such cases, both offered responses in consultation with one another. Furthermore, the Region VI data was not disaggregated according to municipality.

Table 5 gives the distribution of farm householder respondents.

On the other hand, the stakeholder respondents' data for the Final Evaluation were gender disaggregated since the instrument used was a self-administered questionnaire. Only 35 stakeholder respondents accomplished and returned their questionnaires. Eighteen (51.43%) came from Region VI. Seventeen (48.57%) PhilCCAP stakeholders from Region II served as respondents. The 20 male stakeholders (57.14%) outnumber the 15 females (42.86%).

Table 6 provides the frequency distribution of stakeholder respondents by region and gender.

Project Outcome Indicator 1 Final Evaluation Results

At project's end, what was the percentage of households in the targeted areas who adopted new technologies or improved farming practices under

PhilCCAP, i.e., Palay Check System (PCS); Integrated Farming System (IFS); the Climate Change Adaptation Practices (CCAP) module of the ATI Climate Smart Farmers' Field Schools; Weather Index Based Crop Insurance (WIBCI); Small Automated Weather Stations (SAWS); Decision Support System (DSS); and Retrofitting of Irrigation Systems (RIS)?

A little more than a quarter (26.28%) said they were still unfamiliar with the technologies. Compared with the baseline's 32.67 percent, there was a reduction of 06.39 percent who were unfamiliar with PhilCCAP interventions during the project's end.

A slightly lower percentage (23.74%) of the farm householders surveyed answered that they were aware of these technologies and practices, a decrease of 0.68 percent from the baseline and 2.42 percent from the midterm. However, the proportion of those interested dropped sharply to 15.09 percent from 28.78 percent during the midterm and 29.8 percent from the baseline, a difference of 13.69 percent and 14.71 percent respectively. Nevertheless, those who have decided to adopt these technologies jumped from 2.94 percent to 6.64 percent from baseline to final figures. Furthermore, there was a sharp increase of farm household respondents who adopted these technologies from 9.53 percent to 28.25 percent, a difference of 18.72 percent from Year 1 to Year 5.

Combining the Decided and Adopted levels, we arrive at the proportion of 34.89 percent of farm householders who were practicing or intending to practice PhilCCAP adaptation technologies. Compared with the baseline figure for Outcome Indicator 1 (12.47%), there was an increase of 22.42 percent among farm household adopters of PhilCCAP technologies from the beginning to the end of the project.

The 34.89 percent value for Outcome Indicator 1 arrived at during the final evaluation has exceeded the target percentage of 20.00 percent by 14.89 percent at Year 5.

Table 7 provides the breakdown of at end of project for Outcome Indicator 1.

Project Outcome Indicator 2 Final Evaluation Result

How did the project fare among the stakeholder respondents when it ended? What was the percentage of stakeholders surveyed who have participated in or are knowledgeable of activities demonstrated by the project to reduce vulnerability or improve adaptive capacity i.e., Palay Check System (PCS); Integrated Farming System (IFS); the Climate Change Adaptation Practices (CCAP) module of the ATI Climate Smart Farmers' Field Schools; Weather

Table 7. Final evaluation outcome indicator 1 measurements: level of practice among farmer households in PhilCCAP pilot areas

PhilCCAP Adaptation Technologies	Level of Practice				
	Unfamiliar	Aware	Interested	Decided	Adopted
PCS	41.68	16.56	8.28	6.08	27.4
IFS	16.48	13	14.12	6.64	49.76
CCAP	9.4	23.68	12.92	7.24	46.76
WIBCI	16.57	15.65	15.37	6.85	45.56
DSS	34.64	41.56	15.12	3.48	5.2
SAWS	31.2	16.72	24.8	11.96	15.32
RIS	33.96	39	15.04	4.24	7.76
Mean	**26.28**	**23.74**	**15.09**	**6.64**	**28.25**

Index Based Crop Insurance (WIBCI); Small Automated Weather Stations (SAWS); Decision Support System (DSS); and Retrofitting of Irrigation Systems (RIS)?

The final results for the stakeholders also proved encouraging. Among the stakeholders surveyed only 4.49 percent now claim that they are oblivious to PhilCCAP technologies. There has been a decrease of 49.75 percent from the baseline among those who had no knowledge of these practices. However, there was also a corresponding decrease of those who were cognizant of the technologies, from 23.64 percent to 11.43 percent. However, there was a big jump in the Understanding level from 10.26 percent to 37.55 percent, a difference of 27.29 percent. There was also a significant increase in the Engagement level, from 8.38 percent to 31.02 percent, a difference of 23.64 percent. Furthermore, those who consider themselves as experts in these practices have increased from 2.89 percent to 15.51 percent, a difference of 12.62 percent from the baseline. Combining the Engagement and Expert levels, we arrive at the final evaluation Outcome Indicator 2 value of 46.53 percent, which overshot the end of project target of 35.00 percent by 11.53. Even more significant, when comparing the baseline figure of 11.27 percent among stakeholder respondents to the computed final value for Outcome Indicator 2, the difference represents a leap of 35.26 percent.

Table 8 provides a breakdown of final evaluation measurements for Outcome Indicator 2 per PhilCCAP adaptation technology.

Table 8. Final evaluation outcome indicator 2 measurements: level of knowledge among PhilCCAP stakeholders in pilot areas

PhilCCAP Adaptation Technologies	Level of Knowledge				
	Oblivious	Cognizant	Understands	Engaged	Expert
PCS	8.57	5.71	31.43	31.43	22.86
IFS	2.86	5.71	22.86	45.71	22.86
CCAP	2.86	8.57	17.14	48.57	22.86
WIBCI	5.71	11.43	40	22.86	20
DSS	5.71	17.14	48.57	22.86	5.71
SAWS	2.86	11.43	45.71	28.57	11.43
RIS	2.86	20	57.14	17.14	2.86
Mean	**4.49**	**11.43**	**37.55**	**31.02**	**15.51**

Summary of Results

In summary, the final evaluation of PhilCCAP found that there was a significant increase in the computed values for Outcome Indicators 1 and 2 from the baseline to the final surveys, respectively, 22.42 percent and 35.26 percent. The end of project target percentages for Indicators 1 and 2 were exceeded by 14.89 percent and 11.53 percent, respectively.

SUMMARY AND CONCLUSION

Summary

A Final Evaluation Study of the Philippine Climate Change Adaptation Project was conducted: to determine the percentage of households in the targeted areas who have adopted coping strategies, new technologies or improved farming

Table 9. Summary

Indicator	Levels				
	Target	Baseline	Final	Difference With Baseline	Difference With Target
1 (ΔP)	20	12.47	34.89	22.42	14.89
2 (ΔK)	35	11.27	46.53	35.26	11.53

practices to better cope with climate variability and extremes; to determine the percentage of stakeholders in the targeted areas who have participated in or are knowledgeable of activities demonstrated by the project to reduce vulnerability or improve adaptive capacity; to compare these percentages to baseline and midterm values collected during Years 1 and 3 of the project; and to assess progress and performance of the project vis a vis the following development targets for the end of Year 5:

- Twenty percent (20%) of households surveyed in the targeted areas adopt coping strategies, new technologies or improved farming practices to cope better with climate variability and extremes (Outcome Indicator 1).
- Among stakeholders surveyed in the targeted areas, thirty-five percent (35%) have participated in or are knowledgeable of activities demonstrated by the project to reduce vulnerability or improve adaptive capacity (Outcome Indicator 2).

This study constitutes part of the project monitoring and evaluation process. It focused on climate change adaptation technologies introduced under PhilCCAP by the Agricultural Training Institute, the Bureau of Soils and Water Management, PAG-ASA, the International Rice Research Institute, the Philippine Crop Insurance Corporation and the National Irrigation Administration. As in the case of the baseline and midterm studies, this evaluation covered the pilot areas under the Department of Agriculture. Its respondents came from six of the seven PhilCCAP pilot municipalities: Tuguegarao and Penablanca in Cagayan Province, Region II; and Janiuay, Dumangas, Mina and Pototan in Iloilo Province, Region VI.

A one-shot survey was conducted on two types of respondents, each one linked to a specific outcome indicator. The farmer household respondent would inform Project Outcome Indicator 1. Stakeholder respondents inform Project Outcome Indicator 2.

The study operationalized "new technologies, improved farming practices and activities demonstrated by the project" as the following technologies introduced under PhilCCAP: Palay Check System (PCS); Integrated Farming System (IFS); the Climate Change Adaptation Practices (CCAP) module of the ATI Climate Smart Farmers' Field Schools; Weather Index Based Crop Insurance (WIBCI); Small Automated Weather Stations (SAWS); Decision Support System (DSS); and Retrofitting of Irrigation Systems (RIS).

The Final Evaluation Study had a total of 2500 farmer household respondents and 35 stakeholder respondents. Around a quarter of the respondents said, they were still unfamiliar with the technologies. An almost equivalent proportion answered that they were aware of these technologies and practices.

The study found that 34.89 percent of farmer households surveyed in the pilot areas were practicing or intending to practice PhilCCAP adaptation technologies. Compared to the baseline figure of 12.47 percent, there was an increase of 22.42 percent among farmer household adopters of PhilCCAP technologies. The end of project Outcome Indicator 1 computed value was 14.89 percent higher than the target of 20.00 percent by the end of Year 5.

The final evaluation results for the stakeholders were similarly encouraging. Among the stakeholders surveyed only 4.49 percent declared that they are oblivious to PhilCCAP technologies. There were also significant increases in understanding and engagement. Those who consider themselves as experts in these practices have increased from 2.89 percent in 2012 to 15.29 percent in 2016. An Outcome Indicator 2 value of 46.53 percent was computed. This *exceeded* the end of project target of 35.00 percent by 11.53.

Conclusion

The Final Evaluation Study concludes that based on PhilCCAPs two outcome indicators the project has been successful in developing and demonstrating approaches that would enable targeted communities to adapt to the potential impacts of climate variability and change at the end of the project (Year 5). The study found that:

1. At the end of the project, 34.89 percent of households in the targeted areas have adopted coping strategies, new technologies or improved farming practices to better cope with climate variability and extremes.
2. At the end of the project, 46.53 percent or proportion of stakeholders in the targeted areas have participated in or are knowledgeable of activities demonstrated by the project to reduce vulnerability or improve adaptive capacity.
3. Compared to the baseline figure of 11.47 percent, there was an increase of 22.42 percent among farmer household adopters of PhilCCAP technologies. Compared to the baseline figure of 11.27 percent among stakeholder respondents, this figure represents a leap of 35.26 percent.

4. The computed value for Outcome Indicator 1 exceeded the end of project target of 20.00 percent by 14.89. Furthermore, the end of project Outcome Indicator 2 value overshot the Year 5 target of 35.00 percent by 11.53.

ADDITIONAL READING

Asian Institute of Development Studies, Inc. (2013). *Climate change adaptation among farm families and stakeholders: A toolkit for assessment and analysis*. Quezon City, Philippines: Philippine Climate Change Adaptation Project.

Asian Institute of Development Studies, Inc. (2015). *Good climate change adaptation practices manual*. Quezon City, Philippines: Philippine Climate Change Adaptation Project.

Flor, A. G. (2016). *Final evaluation of the Philippine climate change adaptation project.* Quezon City: Agricultural Training Institute.

Section 3
Emerging Opportunities

Vulnerability and exposure are dynamic,
varying across temporal and spatial scales, and depends on economic, social, geographic, demographic, cultural, institutional, governance, and environmental factors...
Lack of resilience and capacity to anticipate,
cope with, and adapt to extremes and change
are important causal factors of vulnerability.
Cardona, et al,
Special Report of Working Groups I&II
IPCC, 2012

Chapter 7
Knowledge Management Strategy

ABSTRACT

The preceding chapters present a systematic argument for those within the climate change community to explore opportunities for interventions that would increase knowledge, change attitudes for the better, and lead to the practice of climate change adaptation. However, exploring these opportunities should be guided by a framework. In this chapter, we propose one such framework, a knowledge management strategy for climate change adaptation. This knowledge management strategy does not only belong under the cognitive domain as argued in Chapter 3. In fact, it straddles all three domains since the affective and psychomotor domains are also influenced by knowledge. Its major assumption is that climate change response (knowledge, attitudes, and practice) can be increased and enhanced through knowledge sharing and reuse.

INTRODUCTION

Why KM?

KM is an evolving discipline that considers an organization's intellectual capital as a manageable and potentially profitable asset (Leibmann, 1999). It is based upon the assumption that today's global economy is knowledge-based and that knowledge is a primary commodity as well as a valuable resource that can generate or lead to other resources (Flor, 2001).

DOI: 10.4018/978-1-5225-2767-1.ch007

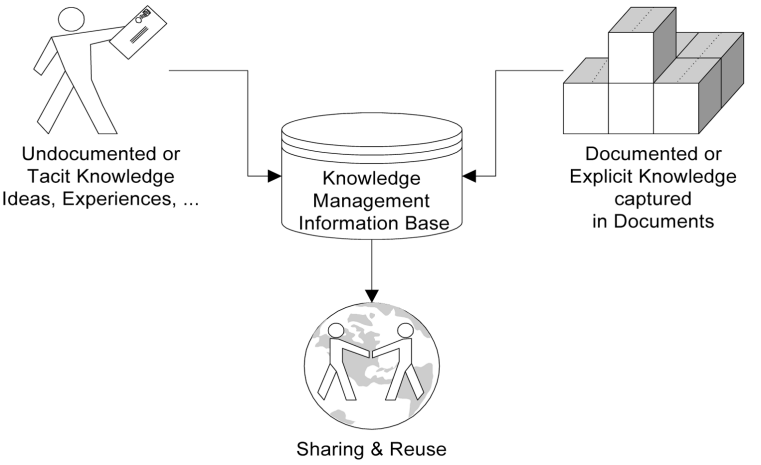
KM entails digitally capturing documented and tacit knowledge and storing these for sharing and reuse. Thus, knowledge is managed through a complete intranet system (inclusive of Internet) and guided by organizational policies that provide incentives to knowledge sharing.

The goal of knowledge management is the sharing and reuse of intellectual capital (Leibmann, 1999). Although, distinctions are made between undocumented or tacit knowledge and documented or explicit knowledge, both are captured digitally and stored in a knowledge base. These are also made available digitally in a variety of multimedia formats for sharing and reuse.

Information Overload

Knowledge resources on climate change are currently building up from diverse sectors (the academe, research and development sector, the government sector, the international development assistance sector, etc.). These resources should now be leveraged and brought to bear at the soonest on this inescapable threat. However, are these resources adequately maximized or managed? Unfortunately, a substantive portion may be caught in the deluge of information products or lost (as T.S. Elliot puts it) in the multitude of platforms and sources that compete for our attention and utilization.

Figure 1. The goal of knowledge management



Most Available Resource

Knowledge management is what academics refer to as a convergent discipline or a transdiscipline. Traditionally, it has been associated with library or information science, communication science, information technology and knowledge economics, not to mention the management sciences. Additionally, its complex character has been significantly influenced by its evolutionary trajectory. KM, both as discipline and practice, began in the private sector in the early nineties. Since then, it has been adopted by the international development assistance community and the government sector. Its evolution from a corporate area of study to a developmental discipline influenced by at times conflicting thrusts of its associated fields has resulted in diversified schools of thought within the KM purview. Not all these schools of thought and their attendant techniques are relevant or applicable to climate change. Nevertheless, knowledge is the most available resource to mitigate or adapt to climate change. As a society and as a country, we should know how we can mitigate or adapt to climate change. KM is essential because resilience is the result of knowing one's options or alternatives.

KM4C2

In support of the Climate Change Act of 2009 (RA 9729) and the Philippine Strategy on Climate Change, the Department of Environment and Natural Resources with support from the Deutsche Gesellschaft fur Internationale Zusammenarbelt or GIZ, initiated the development of a knowledge management for climate change (KM4C2) framework that would provide the basis for an overall KM Strategic Plan (2012-2016). DENR Special Order 2011-446 created a Working Group on KM4C2 composed of one permanent representative and one alternative representative from the sixteen DENR offices.

KM4C2 has been designed in 2011 by Flor (2011). On that year, a KM Strategic Plan covering the years 2012-2016 has been drafted. A Budget and Operational Plan has also been prepared. However, the first task under the Plan has yet to be initiated.

Nevertheless, the following components have been proposed for KM4C2: a Strategic Framework; a Community of Practice; a physical (brick and mortar) infrastructure; an array of functionalities; and content. These will be reviewed individually in this section.

Strategic Framework

The KM4C2 Strategic Framework contains: a Vision Statement for KM4C2; a Mission Statement for KM4C2 implementors; a Goal Statement for the KM4C2 Program; and a set of Strategic Thrusts that has a one-to-one correspondence to the components of the KM4C2 Program.

KM4C2 Strategic Framework may be summarized in the following matrix (Table 1).

Community of Practice

KM4C2 will host a community of practice or CoP, a concept closely associated with KM. The CoP was a progression from the CoIs or *communities of interest* that characterized the early Internet workgroups, which essentially shared notes, information and insights on areas of common interest, beginning with CERN theoretical, experimental and applied physics and eventually progressing to

Table 1. KM4C2 stratframe matrix

Vision Statement	We envision a comprehensive knowledge management system that leverages all existing knowledge resources on climate change adaptation and mitigation	
Mission Statement	Our mission is to initiate and consummate a program that would establish, maintain and provide support services for an operational and functional climate change knowledge management system.	
Goal Statement	Our goal is to contribute to the attainment of *climate change resiliency* by 2016 through nationwide access to and sharing of knowledge resources	
Strategic Thrusts	**Strategies**	**Program Components**
Systems Development	Adoption of service oriented architecture (SOA) Employing a Web Content Management System (WCMS)	Content Management System
Content Development	Adoption of the Dublin Core Metadata Standard and participation in the DCMI Adoption of auto-capture strategies Adoption of knowledge harvesting	Metadata System Knowledge Capture Component Knowledge Products Design, Development and Production
Capacity Development	Increase national ownership and partnership building on KM4C2 Strengthen institutional capacity for KM4C2 Improve organizational capacity for KM4C2 Improve quality of KM4C2 systems & products Accelerate knowledge generation on KM4C2	Capacity Development Component Long term degree programs Short Term training Benchmarking visits
Resource Center Development	Documents management Environmental Interpretation	Resource Center & Repository Climate Change Interpretive Facility
Operations Research	Adoption of results-based management paradigm and theories of change	Monitoring and Evaluation

Internet protocols (W3C). When CoIs ventured into collaborative solutions of common problems, they transformed into so-called workgroups evolving to the next level, the CoP. However, many of today's CoPs offer solutions to problems but stop short of implementing these solutions, preferring to adopt the KM business protocol of sharing and reuse.

The problems that confront us nowadays, such as climate change, are to a scale that often requires policy interventions, not merely technological solutions. CoPs must now delve into the policy process and progress into *communities of champions* or CoCs. From CoIs that share information and CoPs that share solutions, we must move into CoCs that mobilize sectors through information, knowledge and advocacy. Thus, the KM4C2 strategic framework provides for the members of the working group to become the Core Community of Champions for Climate Change (C5).

Physical and Virtual Dimensions of *KM4C2*

Knowledge management operates both on the physical and virtual planes. Digitized documents and knowledge products have hardcopy and softcopy versions. Both are managed manually and electronically, within physical space and cyberspace.

Similarly, the KM4C2 initiative has both a physical and a virtual dimension. The physical dimension is the KM4C2 Resources Center. The virtual dimension is the KM4C2 Content Management System.

- **The KM4C2 Resource Center:** The KM4C2 Resource Center is an organized physical space that will house hard copies of published multimedia materials and other knowledge products on climate change. These materials will be: acquired by DENR from commercial establishments or other agencies, national or international, involved in climate change; contributed by specialized bureaus, offices and units; and solicited from LGUs and the academe. Examples of these are books, manuals, reports, policy documents, agreements, hazard maps, posters and other reference materials. These will be catalogued and indexed for easy retrieval and circulation.

The KM4C2 will be a physical repository of climate change knowledge products organized into a library. It will provide library services to DENR and the general public on climate change acquisitions. It will occupy a wing

in one of the three floors of the new DENR Library and will be administered by the Public Affairs Office.

The KM4C2 Resource Center may also contain a live exhibit area or a semi-permanent climate change interpretive center. An environmental interpretive or interpretation center is a facility for the dissemination of knowledge of nature. Examples of such facilities are Rice World found at the International Rice Research Institute in Los Baños and the Coastal Resources Interpretive Center built by USAID at the SU Marine Laboratory in Silliman beach.

Sometimes called ecomuseums, interpretation centers use different media to enhance the understanding of nature. To aid and stimulate the discovery process and the visitor's intellectual and emotional connection to nature, the main presentation strategy tends to be user-friendly and interactive, and often use exhibits and multimedia programs (www.wikipedia.com). The KM4C2 interpretation centers may contain temporary exhibit modules. Unlike traditional museums, it will not aim to collect, conserve and study objects. The KM4C2 interpretation center will be a specialized fixture for communicating the significance and meaning of climate change to educate and raise awareness.

- **The KM4C2 Content Management System:** The strategic framework recommends a service-oriented architecture for its systems design strategy. We will employ a *content management system* (CMS) that provides a bundle of modules and procedures to manage the collaborative workflows required by KM4C2. It should be a Web content management system (WCMS) designed to simplify the publication of web content to a KM4C2 website and mobile devices possibly utilizing a Drupal, Joomlah, or Plone (Zope) platform.

The KM4C2 WCMS will provide the following functionalities: website authoring, messaging and collaboration (e.g., email, chat, discussion boards, workgroups), and administration tools (e.g., security management, version control) to create and manage website content, inclusive of data, documents, images, audio-video, contact details. It may integrate the following modules:

Other Applications and Functionalities

An online database of the climate change content found in other database systems within DENR, local government units, the academe, and relevant international agencies will be developed. Although the actual content

(documents and other knowledge products) will not be contained in the database, it can be accessed and possibly downloaded directly through a link. KM4C2's metadata system should adhere closely to Dublin Core Metadata standards.

- **Documents Management:** For documents, maps and rich media that are actually housed in the KM4C2 server, a documents management module will be developed as part of the WCMS. This may contain documents explorer, photo galleries, audio-video tagging protocols, etc.
- **Learning Management System:** Another proposed module for the WCMS is online eLearning platform that provides open and distance training programs on climate change for DENR personnel and other stakeholders.
- **Links to Social Media:** The WCMS should incorporate social networking into its services by linking users to KM4C2 Facebook, Twitter and YouTube accounts. For instance, KM4C2 may register a YouTube account on indigenous knowledge and practices to adapt to or mitigate climate change. A Twitter account on climate proofing tips may be initiated, harvesting best practice and lessons learned from the World Wide Web. KM4C2 CoCs can actively engage in Facebook group discussion forums.
- **Suite of Mobile Apps:** The content management system may incorporate a service for mobile devices. Environmental advocacy has achieved much in the past two decades. For instance, there is a greater awareness today that global warming is indeed occurring and that adjuncts to this are extreme weather patterns. The challenge that face now is translating this awareness to action, i.e., climate change adaptation and mitigation, as well as, sustaining the gains made in climate change campaigns particularly among the next generation who will become future leaders, decisions makers and policy makers. KM4C2 should tap the so-called new media: and mobile devices such as hand phones, netbooks, tablets and pods. The spread of new media has been viral. In Philippines alone, Nokia, BlackBerry and iPhone users have achieved a critical mass. A message carried by applications on the BB platform and iPhone platforms has the potential of reaching millions considering that the country has a population of 90 million. Furthermore, the mobile device is now the medium of choice among Filipino youth and young professionals. It has become the universally

accepted medium for knowledge sharing and reuse. A suite of mobile phone applications including wikis, games, social networking, messaging and music can become a viral medium for the climate change message.

Content

To populate the content of both physical and virtual KM4C2, the working group members were asked to scan then list existing knowledge resources that may be contributed by their respective agencies. Similarly, possible service contributions to the KM4C2 initiative were elicited.

- **DENR Units/Offices:** The DENR offices represented in this resource scanning are: the National Water Resources Board; the Management Information Systems Division; the Mines and Geosciences Bureau; the Ecosystems Research Development Bureau; the Protected Areas and Wildlife Bureau; the Foreign Assisted and Special Projects Office; the River Basin Control Office; the Planning Division; the Land Management Bureau; the National Mapping and Resource Information Authority; the Laguna Lake Development Authority; the Center for Land Administration and Management, Philippines; Field Operations; the Central Office; and the Public Affairs Office.
- **Resource Contributions:** The members of the KM4C2 working group were asked to individually identify their agency's possible contributions to the KM4C2 initiative in terms of: CMS modules and content (virtual); KM4C2 Resource Center (physical); and the KM4C2 Program (services).

Potential CMS Module contributions include a library system, the ERDIS and the ETGIS. Virtual content contributions range from digitized documents, publications, hazard maps, proceedings, newsbriefs, abstracts, and expertise for CoPs. Physical content contributions encompass library acquisitions, publications, maps, compilation of policies, laws, implementing rules and regulations, lists, equipment for the interpretive center, exhibits and others. Lastly, service contributions include security management, data warehousing, CMS development, library services, and metadata/ content provision.

Table 2 gives a matrix of virtual, physical and service contributions from the offices and units represented.

Table 2. Content and service contributions

Unit/Office	Virtual Modules and Content Contributions	Physical Content Contributions	Service Contributions
DENR Central Office	Library System	Library Acquisitions • Laws compilation • Journals • Pamphlets • Books	Library Services: Cataloging, indexing (Virtual/Physical)
ERDB	program wherein documents could be classified and entered	Publications (Canopy, RISE, Manuals, Annual Reports)	
FASPO	Publications (Canopy, RISE, Manuals, Sylvatrop Annual Reports, Compendia)		• Data/Content provider on FAPs matters (Virtual) • Projects outputs/ knowledge products (Virtual)
LLDA	Proceedings	• GHG emissions • Inventory Maps (LdBR) • Lessons learned from methane avoidance (sub-project: LISCOP Project) • GHG emissions inventory for LdBR Laguna de Bay Community Carbon Finance Project (Climate Change doc) • Thematic Maps of LdBR • Laguna de Bay Atlas	• Research and Writing (Physical) • Research skills (Physical) • Photo and Video documentation (Virtual)
LMB	Newsbriefs	• Compilation/Lists of Policies for Land Administration and Management • Lists of titled and untitled lots in the Philippines • LMB Key Services • Manual/ Publications on different kinds of land acquisition • IRR for issuance of Free Patents to residential lands	Data Provider (Virtual/ Physical) • Reference copy of Technical Description Plan • Status of Lots • Status of Friar/ Public Land Application
MGB	Abstracts of Research Results	• Geohazard maps on rain-induced landslides and flood assessment, 1:50,000 scale (available – 1:10,000 ongoing) • (Lands Geology) • Coastal geohazard assessment - ongoing (Marine Geology)	Digitization of maps in ArcGIS format; other formats may follow (Virtual)
MISD	Information Systems: ERDIS, ETGIS		• Provide Data Security (Virtual/Physical) • Creation of website using CMS such as Joomlah (Physical) • Provide CMS webhosting (Physical) • Data warehousing (Physical) • Provide FTP accounts for warehousing (Virtual)

continued on following page

Table 2. Continued

Unit/Office	Virtual Modules and Content Contributions	Physical Content Contributions	Service Contributions
-NAMRIA	ENR research specialists: forest, coastal zone/ freshwater, grasslands, degraded areas, uplands	• 2-mutidisciplinary vessels (scientific research & studies-related to CC e.g. Temperature collection, etc. • Sea-level monitoring stations • Hazard and vulnerability maps • Maritime publications • Topographic base maps • Nautical charts • IEC materials on climate change (technical publications, brochures, primers, AVPs)	
NWRB	Project Completion Reports	• Publications/ Manuals • Existing water and related laws, rules and regulations • Water resources maps	GIS services (Virtual/ Physical)
PAWB	Lessons learned from implementing projects	Publications	Content Provider (Virtual)
PLANNING	Coastal Resources Management		Data Provider
RBCO	MPAs (status)	• Integrated River Basin Master Plan • IEC materials and exhibit materials • River Basin/Watershed thematic maps • River Rehabilitation Technology • Application Manual	Technical assistance • Facilitation for stakeholder consultation • GIS mapping application

KM Strategic Framework

The Asian Institute of Development Studies (2013) as well as Flor (2013) observed that the Philippine Climate Change Commission runs on a skeletal Secretariat and a small information and knowledge team. Hence, a KM strategy that is multi-sectoral in scope but operationally less complicated is suggested. As to the matter of infrastructure, current trends in information technology will enable significant reductions in hardware requirements as described in succeeding sections. The proposed knowledge management strategic framework will adopt the vision, mission and goal statements of KM4C2 with slight modifications. However, its strategic thrusts would be trimmed down to three: systems development; content development; and capacity development. These three thrusts will be complementing each other operationally.

Vision Statement

The Philippine Knowledge Management Strategy envisions a comprehensive knowledge management system that leverages all existing knowledge resources on climate change adaptation and mitigation across sectors.

Mission Statement

The mission of the KM Strategy is to initiate and consummate a program that would establish, maintain and provide support services for an operational and functional climate change knowledge management system across sectors.

Goal Statement

The goal of the KM strategy is to contribute to the attainment of climate change resilience by 2016 through nationwide access to and sharing of knowledge resources across sectors.

Strategic Thrusts

Systems Development

The Philippine Climate Change Knowledge Management System will be designed and developed. It is proposed that it runs on a Drupal platform, specifically Open Atrium or DRAKE (Drupal Rapid Knowledge Edition). The component associated with this systems development strategy is the CCC Content Management System (CMS).

Content Development

The content that would populate this CMS will be developed by a network of KM focal persons from the different sectoral agencies. Taking the cue from KM4C2, this network will be known as the climate change community of practice (CoP) or the climate change community of champions (CoC). The KM program component associated to this content development strategy is the KM Networking component.

Table 3. KM strategic framework

Vision Statement	We envision a comprehensive knowledge management system that leverages all existing knowledge resources on climate change adaptation and across sectors.	
Mission Statement	Our mission is to initiate and consummate a program that would establish, maintain and provide support services for an operational and functional climate change knowledge management system across sectors.	
Goal Statement	Our goal is to contribute to the attainment of *climate change resiliency* by 2016 through nationwide access to and sharing of knowledge resources across sectors.	
Strategic Thrusts	**Strategies**	**Program Components**
Systems Development	Employing Open Atrium or DRAKE (Drupal Rapid Knowledge Edition) Platform	Content Management System
Content Development	Organizing a multisectoral community of practice and community of champions to populate KM System content	Networking
Capacity Development	Training, coaching and mentoring of multisectoral CoP and CoC members	Training

Capacity Development

The members of the CoP and CoC will be trained, coached and mentored on content entry and management. The KM program component associated to this capacity development strategy is the KM Training component.

This strategic framework is structured in the stratframe matrix shown in Table 3.

A KM Platform

In a paper titled, *Climate Change Knowledge Management System for Online Collaboration, Information Dissemination and Resources Sharing*, Cabagay (2013) proposed a knowledge management system powered by Open Atrium, an open source software built on top of Drupal, perhaps the most powerful open source content management systems available. Cabagay aims to develop a KM system that: eliminates the hindrance of being geographically dispersed by providing an interface for a team of experts to communicate; provides a central repository for uploading unstructured data; supports the management of articles produced by experts; and provides an efficient way of disseminating the information to the public. Cabagay chose Open Atrium as the platform for his proposed KM system since it has been defined as "a collaboration platform designed to help organizations manage their communications, teams and knowledge."

Another option is DRAKE or Drupal Rapid Knowledge Edition. Like Open Atrium, DRAKE is available at no cost to developers. It has been described as: user friendly and transparent; stable and safe employing PHP and SQL; and scalable and flexible, which would be consistent with the evolutionary prototyping approach that the KM system will adopt.

The architecture for both options is quite modular. It has five main layers: the data pool; modules; blocks and menus; user permissions; and templates. Different modules (best practice, lessons learned, reports, GIS output maps, videos, etc.) can be combined and managed by the user. DRAKE knowledge resources can even be "sliced and diced."

Storage can be outsourced with any one of the major cloud services available. This presents a very economical option considering that CCC need not invest on servers that would outlive their usefulness in a matter of years. Storage rental among cloud services are quite cheap and getting much cheaper as the technology improves. Furthermore, maintenance comes as part of the package.

Establishing a knowledge management system powered by Open Atrium or DRAKE will enable the Climate Change Commission to roll out its KM services to the general public with the participation of the climate change community at the shortest amount of time and the least actual as well as transactional costs.

REFERENCES

Asian Institute of Development Studies Inc. (2013). *Training needs assessment report and capacity building strategy*. Quezon City: Philippine Climate Change Adaptation Project.

Cabagay, T. B. (2013). *Climate change knowledge management system for online data collaboration, information dissemination and resources sharing*. Los Baños: UPLB CAS Institute of Computer Science.

Flor, A. G. (2011). Knowledge management for climate change (KM4C2): Strategic and M&E plans. Quezon City: Gesellschaft für Internationale Zusammenarbeit (GIZ) and the DENR Public Affairs Office.

Flor, B. G. (2013). *Capacity Building Strategy for Stakeholders of the Philippine Climate Change Adaptation Project*. Los Baños: Asian Institute for Development Studies, Inc.

Liebmann, M. (1999). *Knowledge management. The Microsoft Whitepaper*. Seattle, WA: The Microsoft Corporation.

Chapter 8
Communication Strategy

ABSTRACT

Apart from a knowledge management strategy for the climate change community, a communication strategy should likewise be implemented. However, this would be a communication strategy like no other. This chapter provides the rationale for the design of such a strategy based on the unique requirements of the climate change community. It gives an overview of existing initiatives that may contribute to the overall strategy. It reviews the information needs of climate change stakeholders analyzed in Chapter 5 and proposed a three-pronged strategy to fulfill these needs. Finally, it describes a grassroots social mobilization program for vulnerable communities.

INTRODUCTION

Communication Environment

An analysis of the existing communication environment, which has changed much in the past decade, would provide us with an adequate appreciation of the strategic options and communication tools available to PhilCCAP, in particular, and the Climate Change Commission, in general, in the development and implementation of a communication strategy for climate change adaptation and mitigation. We begin with a discussion of current communication theory and practice or praxis.

DOI: 10.4018/978-1-5225-2767-1.ch008

Communication Praxis

Communication observers are in general agreement that the world is now in the Information or Knowledge Age where information or knowledge is a critical resource. There has been a shift in the global power dynamic favoring information and communication over the more conventional economic resources such as capital and land. The richest, most privileged people nowadays are information and knowledge workers. Thus, communication practitioners assume and perform potentially powerful and influential roles as information and knowledge workers within the context of the Information Age.

Furthermore, communication theorists and researchers have undergone a significant paradigm shift in the past two decades, moving from linear, top down models towards more cyclical, bottom up participatory approaches. The Convergence Model of Communication, that depicts communication as a process wherein the mutual understanding spheres of two communication participants converge, has replaced the traditional Source-Message-Channel-Receiver-Effect (SMCRE) Model. Participants in the communication process are no longer classified as dominant sources and passive receivers but as co-equals. The goal of communication is no longer seen as persuasion but as mutual understanding. These same theorists and researchers submit that communication campaigns should not be media centric and source oriented, and that communication undertakings should be directed at not just changing behaviors, but at transforming social norms, which determine behaviors (Flor, 2004).

There has also been a pronounced change in communication practice. At the national level, the role of communication in national agenda setting has been recognized. Laws and national policies can be influenced or triggered by media coverage. Our national experiences since 1986, 2001, 2012 and 2013 has shown that media can indeed make or break national leaders from presidents to the Chief Justice of the Supreme Court, cabinet secretaries to governors, senators to congressional representatives.

Using New Media

By new media, we refer to digital media: the Internet and the World Wide Web; mobile devices such as hand phones, netbooks and pods; and social

networks such as Facebook, Twitter and Messenger; and Web 2.0 applications such as YouTube and Wikis; cable television and digital radio.

Environmental advocacy has achieved much in the past two decades. For instance, there is a greater awareness today that global warming is indeed occurring and that adjuncts to this are extreme weather patterns. The challenge that face now is translating this awareness to action, i.e., climate change adaptation and mitigation, as well as, sustaining the gains made in climate change campaigns particularly among the next generation who will become future leaders, decisions makers and policy makers. Conventional IEC strategies and media may not suffice in addressing this challenge since behavior change does not necessarily mean normative change as stated in the section on transformation communication. The Climate Change Commission should tap the so-called new media. The spread of new media has been viral. In Philippines alone, BlackBerry and iPhone users have achieved a critical mass. A message carried by applications on the BB platform, iPhone and MyPhone platforms has the potential of reaching millions considering that the country has a population of 90 million. Furthermore, the mobile device is now the medium of choice among Filipino youth and young professionals. It has become the universally accepted medium for knowledge sharing and reuse.

Twenty years ago, it seemed impossible that ordinary people would find it a necessity to have cellular phones. However, at present, almost everyone owns a mobile phone. In the next years or so, the cost of fourth generation (4G) mobile phones (with enhanced features) will go down. As stated by Moore's Law, the speed an Intel processor doubles every 18 months. Additionally, mobile devices are advantageous because: they allow greater access and interactivity; they are non-intimidating and user-friendly; and they encourage user-generated content.

Big Media, Little Media, My Media

Additionally, national communication campaigns are no longer the exclusive purview of Big Media such as national dailies, national television and radio. Little media such as community radio stations, community newspapers, and community cable television have been more and more co-opted in national media campaigns. Nowadays, another category besides Big Media and Little Media, have gained much prominence and an increasingly significant role in national media campaigns. This category, known as My Media, involves social networking using digital media such as Facebook, Twitter and YouTube

that capitalizes on Web 2.0 or the provision for user-generated content in the World Wide Web, thus encouraging direct participation in the communication undertaking itself. One's Facebook page is actually one's published website. One's YouTube account becomes an individualized television channel, considering YouTube's slogan, "Broadcast yourself."

Networking

Another element that is assuming a dominant role in today's communication undertakings is networking. A network is a structure made up of nodes and links. Networking involves establishing links among like-minded nodes. Networks form the natural structures of living things (Ongkiko & Flor, 2003). Thus, organisms, ecosystems, communities and societies are structured as networks, or networks of networks.

Networks may be personal or social, individual or institutional, analog or digital, so long as there are nodes that are connected by links. Information travel via networks, knowledge is shared through networks. Thus, networking has become a built-in, common strategy in most IEC activities or communication campaigns.

In the environment and natural resources sector, whom do we network with? Insofar as grassroots IEC undertakings are concerned, networking is done primarily through four major nodes, the so-called Four Pillars of Governance: the local government unit (LGU); non-government organizations (NGOs); civil society; and the private sector. Civil society, itself, is composed of: the Church; media; schools; and socio-civic organizations. Although non-profit in nature, non-government organizations are differentiated from civil society groups since the former are organizations who perform services parallel to government agencies and are thus registered as such. Similarly, although privately run, NGOs differ from the private sector in the sense that the latter is profit oriented. Another phrase used for the private sector is the business sector or the corporate sector.

Indigenous and Local Communication

The significance of using indigenous and local communication can be fully appreciated with a discussion of the so-called deep ecology approach to environmental communication. The deep ecology approach in environmental communication is based on the following propositions:

1. Living systems such as organisms and ecosystems need to perform three critical functions with its environment in order to survive: exchange of materials; exchange of energy; and exchange of information. Exchange of information is communication. Thus, communication is a critical function for every living organism or ecosystem.
2. Ecosystems are and made up of natural and cultural subsystems; both have profound influences on the other.
3. We can only have lasting and sustainable impact from our environmental IEC if we tap cultural forms and strategies.

Thus, we employ indigenous media and art forms since it is consistent with the deep ecology approach by employing storytelling and tapping cultural forms. The Philippines has a wealth of these cultural forms: *alamat* or legends; folk dances; *paminipig; composo; bandillo; balitaw; sangyaw; awit/harana; zarzuela; binalaybay; pantomina* and others. To this list, we can add an array of popular media that can supplement these such as: komiks; street dancing; games; cheer dance; rap; puppet shows; concerts; and street theater (Flor & Matulac, 1993). Furthermore, we can share our stories via Facebook and YouTube bringing to bear the synergies created by social networking and My Media on our environmental and natural resources agenda.

Communication Initiatives

Much of the current communication initiatives that relate to or interfaces with the PhilCCAP agenda and CCC Programs are IEC components internally and externally funded projects or programs. Among them are:

ICRMP

The Integrated Coastal Resources Management Project is a five-year undertaking financed through a loan from the Asian Development Bank. Its expected impact is enhanced coastal resources and pursued outcomes are sustainable management of coastal resources and increased income for coastal communities. The Project is being implemented in six priority marine biodiversity corridors and ecosystems covering 80 municipalities in the provinces of Cagayan, Cebu, Davao Oriental, Masbate, Siquijor and Zambales.

ICRMP has a comprehensive Information, Education and Communication Plan at the national, regional, provincial and municipal levels. A team of IEC consultants produced this comprehensive plan covering all 80 municipalities and six provinces. The Project undertook a communication strategies workshop in May 2010. Its major approach is the use of media, i.e., print, radio and television. The ICRMP IEC Plan also incorporates community communication and participation. The difficulty now encountered is the effective implementation of the Plan.

NewCAPP

The New Conservation Areas in the Philippines Project is a five-year undertaking funded by the UNDP Global Environmental Facility (GEF). The Project aims to strengthen terrestrial management of key biodiversity areas in the Philippines. Although terrestrial in focus, the current ecosystems approach dubbed as "ridge to reef" allow ample interfacing between NewCAPP and CCC.

NewCAPP expands the concept of conservation areas to include IP managed areas and LGU/community reserves, which at times, go beyond the terrestrial-coastal dichotomy. It increases support to biodiversity areas through a governance model of protected areas through indigenous peoples tribal chieftains and councils. In NewCAPP, LGUs play a major role in the approval or disapproval of projects.

NewCAPP has recently been introduced to PAWB and its IEC strategy has been designed and developed. It espouses an evidenced-based approach. Thus, among its initial activities is the conduct of a knowledge-attitude-practice (KAP) survey on biodiversity conservation in 10 out of 12 project sites in collaboration with the National Commission on Indigenous Peoples (NCIP) and selected local government units. Additionally, NewCAPP intends to come out with the following IEC materials: *The State of Protected Areas* publication; a *Guide for Protected Areas Advocacy*, an ICCA (Indigenous Community Conservation Area) Primer, issues of *Wilderness Magazine*; and video presentations on biodiversity.

BPP

The Biodiversity Partnerships Program (BPP) is an earlier initiated UNDP-GEF undertaking. Barely two years old, it has produced non-technical

biodiversity materials. It is likewise designing and developing a Biodiversity Governance Knowledge Management System. In terms of popularization of technical information and knowledge management, BPPs communication staff are not lacking in capacity.

Collaborating with municipalities and barangays, BPP imitated a reward and incentive system for local government units. BPP intends to mainstream biodiversity concerns in production landscapes. It has conducted biological assessment in its project sites.

STREEM

Strengthening Coordination for Effective Environmental Management (STREEM) is an initiative of the Government of the Philippines (GOP), implemented by DENR through a grant from UNDP-GEF. STREEM aims to generate global environmental benefits through improved coordination in the implementation of crosscutting concerns within Multilateral Environmental Agreements (MEAs).

STREEM looks into constraints in the effective implementation of the three Rio Conventions, namely: the United Nations Convention on Biological Diversity; the United Nations Convention to Combat Desertification; and the United Nations Framework Convention on Climate Change. At the national level, STREEM utilizes existing mechanisms for effective coordination among three Focal Point Agencies (FPAs): the DENR Environmental Management Bureau; the DENR PAWB; and the Department of Agriculture Bureau of Soils and Water Management.

The lack of coordination among the focal point agencies often lead to duplication of tasks, wastage of resources, and lack of synergy. An overlay of the National Action Plans on the three Rio Conventions showed that IEC and KM are among the seven potential areas of convergence among the three MEA FPAs. Consequently, STREEM is developing a series of tools and systems designed to support coordination and reduce duplication of MEA activities at the local level. The Project is in the process of piloting these tools in the Puerto Princesa Subterranean River National Park and the surrounding areas to strengthen local capacities for coordination. Finally, based on the above, best practice and lessons learned are being documented and packaged for sharing and reuse.

ACCCoast

The Adaptation to Climate Change in Coastal Areas is funded by the Deutsche Gesellscaft fur Internationale Zusammenarbeit or GIZ. GIZ is a German Development Organization owned by the German federal government. It focuses on improved MPA governance. The Project also aims to contribute in raising the awareness of local communities on environmental issues through innovative social marketing campaigns in partnership with RARE Conservation.

RARE has a fairly established IEC protocol that may be referred to as social marketing, adopting the so-called "P" process in the conduct of information, education and communication campaigns. RARE staff are among the best trained in this approach to environmental communication and have tried and tested this process in several regions across the globe. RARE's social marketing approach includes a capacity-building component that would enable MPA stakeholders to earn formal credits or even a degree from the University of Texas in El Paso.

PAWB IEC

There are units organic within PAWB that engage actively in IEC. Among these are the Protected Areas Conservation Management (PACMAN) Division that is currently preparing a Manual for Cave Classification and the Wildlife Resources Division, which actively implement species-based special events organizing such as the Philippine Eagle Week, the Tamaraw Month, youth camps and others.

Furthermore, PAWB celebrated its Silver Anniversary in June 2012. In the past 25 years, it has designed, developed and prepared hundreds of IEC materials and implemented numerous IEC campaigns. A number of campaigns under PAWB, specifically, the coastal clean-up and river rehabilitation campaigns mobilized schools, law enforcement agencies, the military, the media and local government units. On the other hand, many of the IEC materials produced focused on individual behaviors. The majority dealt with awareness raising instead of behavioral change. A few targeted attitudinal change, which may be considered normative at the societal level. The production of several of these materials involved the participation of nongovernment organizations, donor groups and the media. Notebooks and coloring books were targeted at

the youth. The campaigns initiated may be considered process-oriented to a certain extent. Climate change and biodiversity have become part and parcel of the social agenda. Coastal clean up and river rehabilitation campaigns have led to community mobilization.

Information and Communication Needs

The benchmarking study (Flor, 2013) reproduced in Chapter 5 contained a section on information and communication needs of the climate change community represented in the academe, the youth and the agricultural sector. What follows are excerpts from the report:

Overall Knowledge Level on Climate Change of Respondents

Of the 293 respondents surveyed, results showed that most (114 or 38.9%) understands local or indigenous knowledge on climate change adaptation or can comprehend the subject.

In terms of explicit knowledge, most respondents (127 or 43.3%) also understood weather extremes; 136 or 46.4% understood weather variability; and 140 or 47.8% understood weather uncertainty. This implies that stakeholders have a good understanding of explicit knowledge on climate change since these are the most obvious and readily felt effects of climate change regardless of affiliation.

Overall Attitude Level on Climate Change of Respondents

When attitudes toward climate change adaptation were assessed, a little over the majority (150 or 51.4%) had a score of "5" or may be described as involved. This implies that respondents accepted the fact that climate change is here to stay and that they are doing something about it. Such level of attitude further implies readiness to assume a role that is expected of them as service providers. This is a good indication of resiliency.

In terms of motivations, 135 or 46.4% of the respondents' number one motivation to face climate change is human safety. The drastic effects of weather extremes, variability, and uncertainty seemed to have a great impact to ensure safety.

Overall Practice Level on Climate Change of Respondents

Practice is categorized into three stages: coping, adaptation, and mitigation. In terms of coping mechanisms, respondents were ask to rate their level of practice on various strategies. Most respondents (77 or 26.8%) had a score of "3" or interested on stockpiling, which means that respondents may adopt the strategy if more explanations are done. The same level of practice, 3, resulted in foraging for unconventional food sources (83 or 29.5%). The same is true of off farm employment (26.5%). However, in terms of knowledge sharing/information seeking/networking, relocation, and alternative house design and layout, most respondents (101, 93, 103, respectively) had a score of "4," which means that they are aware, understand, interested, and ready to adopt the strategy depending on availability of resources. This means that they have decided to adopt which is a good indication that if interventions are taught there is a high likelihood that respondents will adopt or practice the different coping mechanisms.

In terms of adaptation mechanisms' level of practice, most respondents had a score of either "3" or "4," which means that they are either interested or decided on the adaptation strategies. Specifically, they are interested in residue management, change in cropping patterns, varietal change and crop insurance. They have decided to apply early warning systems, backyard food conservation, farm waste conservation, and irrigation and water impounding practices. They are also interested in terracing/hedgerows/wind/fire breaks/buffers. This implies that respondents are familiar with adaptation practices.

In terms of mitigation practices, most respondents also had a score of "3" in organic farming (90 or 36.4%), methane capture (78 or 27.5%), tillage management (81 or 28.5%), and alternative wetting and drying irrigation (84 or 29.6%). More so, most respondents had a score of "4" in reforestation (112 or 39.4%), cover crops (94 or 33.1%), agroforestry (82 or 30%), nutrient management (94 or 33.1%), restoration of degraded areas (91 or 32%), and pasture management (79 or 27.8%). These results imply that stakeholders are interested or ready to adapt these practices given the right technology and resources.

TNA Recommendations

The TNA study forwarded a number of recommendations not limited to training and capacity development. Those related to communication were as follows:

1. Develop courses on climate change
2. Conduct of multisectoral campaigns on climate change
3. Recognize the role of communication to disseminate information internally and externally
4. Conduct information campaigns where the youth takes the lead.
5. Develop materials in various formats and dialects if possible customized for easier delivery among intended audiences.

Three-Pronged Strategy

A three-pronged approach that constitutes the proposed Communication Strategy is: knowledge products sharing and reuse; social mobilization using PAWB's *Dalaw Turo*; and social marketing.

Knowledge Products Sharing

The primary communication strategy that should be adopted is knowledge products sharing and reuse. Consistent with the knowledge management approach, CCC will document and capture best practice and lessons learned on climate change adaptation. These will be packaged into a series of print, audio and video materials for dissemination to national media, government institutions particularly the legislature and educational institutions. These materials will be packaged digitally in formats that may easily be accommodated by mass media, community media and new media.

Table 1. Knowledge products utilization matrix

Knowledge Products	Utilization		
	Public Awareness	**Advocacy**	**Capacity Building**
Best Practice and Lessons Learned Series	Released to national dailies. Uploaded in CCC KM platform	Distributed to technical staff of Senate and Congress, NGOs & CSOs	Given to universities, training institutions and libraries
	Released to all radio stations through KBP. Uploaded as podcasts in KM system		Given as audio CDs to universities and training institutions
	Released to all TV stations and community cable operators. Uploaded in YouTube		Given as video CDs to universities and training institutions
Policy Briefs	Released to national dailies. Uploaded in CCC KM platform	Distributed to technical staff of Senate and Congress, NGOs & CSOs	Given to universities, training institutions and libraries

Social Mobilization Approach

Traditional media should be employed for purposes of sustainability. It can tap PAWB's main vehicle for traditional media, *Dalaw Turo*.

*Dalaw-Turo (*DT*)*, the literal translation of which is *Teaching Visits*, is an environmental outreach program initiated in the early nineties by PAWB. It educates communities on pressing environmental issues through participatory rural theater, songs, dances, games and other local and indigenous performance media. From experience, we know that *Dalaw Turo* is an approach that uses indigenous, local and popular media. It is participatory and involves multiple stakeholders. It is flexible, dynamic and context specific. Moreover, it involves both social learning and social mobilization.

The outreach program started out independently as an internally driven initiative, without the benefit of external funding and technical assistance. Yet, *Dalaw Turo* has proven to be resilient and robust, thriving in the past two decades in spite of limited resources. For participating communities, DT sessions took the form of *environmental interpretation*, an educational communication activity designed to forge emotional and intellectual connections between an audience and the messages or meanings inherent in biodiversity, protected areas and wildlife themes. Today, *Dalaw Turo's* community-based, participatory slant still carries its original resonance and DENR is now exploring the possibility of going beyond the traditional DT themes by expanding its coverage to other sectors such as forestry, mining, lands and environmental management (Flor, 2012).

For the past two decades, *Dalaw-Turo* modules have naturally been confined to messages associated with the Protected Areas, Wildlife and Coastal Zone Management Service (PAWCZMS). However, it would also be quite appropriate to the CTI CFF NPoA for the following reasons:

- Firstly, DT may actually be considered as an exemplar IEC strategy for all subsectors covered by environment and natural resources given the recent developments in information, education and communication theory and practice or praxis. *Dalaw Turo* is consistent with the pronounced changes in communication theory and practice. It is participatory, cyclical and non-linear. It is not media centric nor is it source oriented.

- Secondly, with its use of local media and indigenous art forms, *Dalaw Turo* employs Little Media. Furthermore, it can potentially benefit from My Media as will be discussed in earlier sections.
- Thirdly, *Dalaw Turo* makes full use of networking strategies with the participation of local government units, schools, non-government organizations and the private sector. [1]

From its beginnings in the nineties to its current form, *Dalaw Turo* has been evolving. For it to be mainstreamed, we need to revisit *Dalaw Turo* and perhaps level it up to the status of an IEC program for the entire ENR sector.

Dalaw-Turo is made up of several elements such as lectures, skits and games. We propose that additional elements be incorporated. These elements are: learning resources; flexible delivery systems; networks; and a program of action. As a communication strategy for biodiversity conservation and climate change adaptation, the consultant recommends the restructuring of *Dalaw Turo* with the following elements/programs/activities, some of which may be supported by CCC:

Proposed Elements

Sets of Modules

DT Modules on climate change adaptation and mitigation provides exemplars of learning resources that may be used by CCC. Please refer to APPENDIX C. *Dalaw Turo* Toolkits per ENR sub-sector may be subsequently produced featuring specialized modules (on forestry, lands, biodiversity conservation, solid waste management, etc.). A set of modules focusing on coastal and marine climate change adaptation themes packaged into such a toolkit may be financed under CCC.

Flexible Delivery Systems

DT may employ additional delivery systems. In fact, a variety of Indigenous, local and popular media can be utilized and organized into a mutually reinforcing system for DT delivery.

Networks

Thirdly, DT should tap the synergies produced by networking described in earlier sections. Three types of networks may be used for this purpose: individual; institutional; and electronic. The DT network of individuals should not only be made up of DENR IEC staff and learner-participants. As described in the Prologue, these networks should be made up of DT champions that can serve as advocates. Nodes that will make up institutional networks should come from civil society, local governments, nongovernment organizations and the private sector. Electronic networks such as Facebook, Twitter and YouTube should likewise be tapped. In other words, DT can have both Facebook and Twitter pages as well as fan networks. Video clips of DT skits may be uploaded in a DT YouTube page for sharing and reuse.

Additionally, these nodes should spread horizontally, vertically and laterally, thus leading to integrated multilevel national, regional, provincial, municipal and community networks.

A National DT Program

The way forward for DT must include the design and implementation of a multi-level, multi-tiered and multi-sectoral program with a timeframe, an identified goal, a specific purpose, planned inputs, explicit outputs, sets of activities and verifiable indicators for success.

The *Dalaw Turo* program should also contain the following features:

Competition, Recognition, and Awarding

As an incentive to DT learning communities, volunteers, partners and champions, provincial, regional and national DT competitions, recognitions and awards should be initiated. Partners will be invited to perform and interpret DT storylines. The best interpretations and performances will be recognized and awarded at the provincial level. The winners of provincial competitions will be invited to perform in regional interpretative competitions. Regional winners will compete to identify the DT national champion. Cash awards and prizes can be solicited by the DT Network from the private sector.

Documentation, Sharing and Reuse

DT interpretations and performances should be video documented. A DT YouTube account may be established wherein these video clips are uploaded for the viewing of the entire DT community. Alternatively, these videos may be mirrored in the CCC website. These videos may be used as exemplars for sharing. It may likewise be downloaded and shown to other audiences.

Levels of the Proposed DT Program

The proposed DT Program should be implemented at the following levels:

- **Community or Grassroots:** The most basic level of implementation, this level constitutes the main users of the modules.
- **Municipal:** The municipal level is for social mobilization: the process of bringing together all feasible/ practical inter-sectoral/ social allies to raise people's awareness of climate change, to assist in the delivery of resources/ services, and to strengthen community participation for sustainability and self-reliance.
- **Provincial:** This level is for provincial implementation, networking, recognition awards and resource generation.
- **Regional:** This level is for regional coordination, capacity building, documentation, sharing and monitoring & evaluation.
- **National:** The national level is for policy support, program management, national recognition, curriculum development, materials production and technical direction setting.

Activities of the DT Program

Under the proposed DT Program, the following activities may be implemented to ensure that the program is implemented locally, coordinated nationally, and shared globally.

- **Strengthen Dalaw Turo Network:** Individual, institutional and electronic DT networks should be established horizontally, laterally and vertically.

- **Advocacy of DT:** *Dalaw Turo* as a DENR IEC strategy should have its own supporters and advocates, internally within DENR and externally outside DENR.
- **Establishing and Formalizing Long-Term Partnerships:** Partnerships with local government units, nongovernment organizations, civil society and the private sector should be forged. As described earlier, civil society includes socio-civic organizations, the Church, media and the academe. DT champions from these sectors should be mobilized.
- **Provision of Institutional Endorsement:** Appropriate DENR administrative orders on *Dalaw Turo* at the national and regional levels should be drafted, circulated and implemented. This would include appropriate budgetary provisions for the program.
- **Pretest and Improve DT Modules:** The modules developed should be pretested and improved.
- **Regional Action Planning:** Regional action planning workshops should be initiated to ensure program ownership at the regional, provincial, municipal and community levels.

The elements/programs/activities enumerated above forms the structure of a revitalized *Dalaw Turo* strategy for the entire ENR sector including PAWB and the PHILCCAP. CCC may contribute substantively to PHILCCAPs DT programs by sponsoring a DT toolkit on coastal and marine climate change adaptation.

Social Marketing

Social marketing began in the eighties as an offshoot of private sector (i.e., advertising industry) involvement in health and population IEC campaigns. As in the advertising model, the thrust is behavioral and planning is top-down for the most part. It adopts the so-called "P" process in the conduct of information, education and communication campaigns.

Indicative Communication Plan

To illustrate how the proposed Communication Strategy works, an indicative communication plan was drafted. Being indicative, it cannot as of yet present specific core messages and themes, nor can it lay down a detailed schedule of activities. This indicative plan is being presented for illustration's sake.

Name of Communication Campaign

This communication campaign will be known as the National Climate Change Mitigation and Adaptation Communication Plan.

Objectives

The overall objective of the Communication Plan is to increase climate change knowledge; change attitudes from complacency to engagement; and promote mitigation and adaptation practices among stakeholders of climate change actions and the public.

Its specific objectives are as follows:

1. To supplement existing PHILCCAP and CCC communication initiatives and undertakings through:
   a. the sharing and reuse of knowledge products on climate change adaptation and mitigation; and
   b. the development of a Dalaw Turo ToolKit for Adaptation to Climate Change applied nationally.
2. To promote climate change mitigation and adaptation through a national social marketing campaign.

Target Audiences

- **Target Groups:** Strategic audiences of the Communication Plan may be clustered under internal audiences and external audiences:

Internal audiences will be the primary audience of CCC knowledge products. They will include CCC staff and CCC partners.

External audiences are primary targets of communication and media materials and secondary targets of CCC knowledge products. They include: the general public, local government officials, legislators and other policy makers, as well as nongovernment and civil society organizations.

What is the difference between NGOs and CSOs? NGOs are organizations whose core business or function is the provision of services traditionally provided by government agencies to clients associated with government agencies. NGOs are registered and recognized service providers. Civil society organizations (CSOs), on the other hand, are formal or informal entities that

Table 2. Objectives per target group

Target Audience	Relevant Component Objectives
CCC Staff and Partners	To supplement CCC's communication undertakings through the design, development, sharing and reuse of knowledge products featuring best practice, lessons learned and policy options based on CCC-funded studies and projects. To support CCC communication plans through development of a Dalaw Turo ToolKit for Adaptation to Climate Change applied nationally.
The General Public	To promote climate change mitigation and adaptation through a national social marketing campaign.
LGUs	To support CCC communication plans through development of a Dalaw Turo ToolKit for Adaptation to Climate Change applied nationally.
Legislators	To promote climate change mitigation and adaptation through a national social marketing campaign.
Nongovernment Organizations and Civil Society	To support CCC communication plans through development of a Dalaw Turo ToolKit for Adaptation to Climate Change applied nationally. To supplement CCC's communication undertakings through the design, development, sharing and reuse of knowledge products featuring best practice, lessons learned and policy options based on CCC-funded studies and projects.

provide services as adjuncts to their main functions as social institutions. Examples of CSOs are: the academe; the Church; media; and civic organizations such as women's groups, the Boy Scouts, Lions, etc. Similarly, the private sector is composed of businesses that provide incidental social services as part of their corporate social responsibility (CSR).

- **Specific Objectives for Each Target Group:** Table 2 presents the relevant communication objectives per identified target group.

Media and Other Strategic Channels

The communication media and materials proposed under the Communication Plan reflect the integrated nature of the proposed communication interventions.

We can cluster these media and materials into four: knowledge products; social mobilization toolkit; new media; and mass and community media programs

- **Knowledge Products:** Pursuant to the knowledge management strategy earlier discussed, knowledge products design, development, sharing and reuse, occupies a central role in the Integrated CCC Communication Plan. CCC will document and capture best practice and lessons learned from PhilCCAP, etc. These will be packaged into a series of print, audio and video materials for dissemination to

national media, government institutions particularly the legislature and educational institutions. These materials will be packaged digitally in formats that may be accommodated by mass media, community media and new media.

Table 3 provided a proposed matrix for knowledge products utilization. The following expands this matrix to accommodate media and materials:

- **Dalaw Turo Social Mobilization Toolkit:** The strategic communication consultant proposes the design, development, pretesting and distribution of a CCC funded *Dalaw Turo Toolkit on Climate Change Adaptation*.

The toolkit includes: a set of modules on climate change adaptation in coastal areas; instructions on how these modules are to be utilized and adapted at the community level; exemplar communication materials, suggested art forms and scripts supportive of a community-based DT production; and plans on how this can be linked to provincial, regional and national DT initiatives.

Table 3. Knowledge products sharing and reuse matrix

Knowledge Products	Media	Materials	Utilization		
			Public Awareness	Advocacy	Capacity Building
Best Practice and Lessons Learned Series	Mass media • Print • Radio • TV Community media • Community cable • Community Radio New Media • CCC website • Social media • Mobile apps	Print-Text version	• Released to national dailies. • Uploaded in CCC KM platform	Distributed to technical staff of Senate and Congress, NGOs & CSOs	Given to universities, training institutions and libraries
		Audio Version	• Released to all radio stations through KBP. • Uploaded as podcasts in KM system		Given as audio CDs to universities and training institutions
		Video version	Released to all TV stations and community cable operators. Uploaded in YouTube		Given as video CDs to universities and training institutions
Policy Briefs	• Print media • Website	Print-Text version	• Released to national dailies. • Uploaded in CCC KM platform	Distributed to technical staff of Senate and Congress, NGOs & CSOs	Given to universities, training institutions and libraries

Awaiting the release of a Department Administrative Order on Dalaw Turo, PAWB (as well as other attached agencies and bureaus of DENR) will be utilizing DT as its main internally funded social mobilization and grassroots IEC vehicle covering all themes under the biodiversity conservation subsector. In anticipation of this development, CCC should position its communication initiative to support *Dalaw Turo* as its major social mobilization intervention.

- **New Media:** CCC should tap the so-called new media: the Internet and the World Wide Web; mobile devices such as hand phones, netbooks and pods; and social networks such as Facebook, Twitter and BlackBerry Messenger; and Web 2.0 applications such as YouTube and Wikis. The spread of new media has been viral. In Philippines alone, BlackBerry and iPhone users have achieved a critical mass. A message carried by applications on the iPhone and Android platforms has the potential of reaching millions considering that the country has a population of 90 million. Furthermore, the mobile device is now the medium of choice among Filipino youth and young professionals. It has become the universally accepted medium for knowledge sharing and reuse. CCC can tap new media by:
    - Establishing a webpage
    - Forming a Facebook (FB) group
    - Opening a YouTube site for videos on MPA success stories and best practice
    - Establishing a podcast service for canned audio clips on MPA success stories and best practice
    - Opening a Twitter account.

REFERENCES

Flor, A. G. (2004). *Environmental Communication.* UP Open University.

Flor, A. G. (2012). Strategic communication planning to support the ACCCoast Project. Quezon City: Gesellschaft für Internationale Zusammenarbeit (GIZ) and DENR CMMO.

Flor, A. G., & Matulac, L. A. (1993). *Cultural dimensions of environmental IEC.* Los Baños: UPLB IESAM and Dalhousie University.

Flor, B. G. (2013). *Capacity Building Strategy for Stakeholders of the Philippine Climate Change Adaptation Project*. Los Baños: Asian Institute for Development Studies, Inc.

Ongkiko, I. V. C., & Flor, A. G. (2003). *Introduction to development communication*. Los Baños: UP Open University and SEAMEO SEARCA.

ENDNOTE

[1] A phenomenon that provides a good rationale for networking is the Network Effect or Metcalf's Law, named after the leader of the team of information technologists who developed the Ethernet or the local area network or LAN system. Metcalf argued that the value of computing resources available to any node within a local area network increases exponentially with the number of nodes. A sociologist, David Reed, extended the concept of Metcalf's Law to social networks and argued that the social capital of a well-integrated social network also increases exponentially with the number of nodes. With this, we can propose another definition of social capital - the economic value produced by individual or social networking. Networking generates synergies that add value to our communication undertakings.

Appendix

APPENDIX A

Interview Schedule for Farmer Households

Instructions to the Interviewer

1. Greet the respondent. Introduce yourself by stating your name, position, and role. *G*ive the following short explanation about PhilCCAP: "The Philippine Climate Change Adaptation Project or PhilCCAP is spearheaded by the Department of Agriculture in collaboration with the Department of Environment and Natural Resources. The 5-year project aims to establish climate change adaptation projects to address our problems on climate change. "
2. Go over the items one by one. Put a cross (X) on the chosen response (show this on the chart). Practices are measured using a five-point categorical scale with the following interpretations: 1- Unfamiliar 2-Aware 3-Interested 4-Decided 5-Adopted
    a. Unfamiliar (level 1 means the respondent does not know anything about the strategy)
    b. Aware (level 2 means the respondent knows about the strategy but does understand it)
    c. Interested (level 3 means the respondent may adopt the strategy if more explanations are done)
    d. Decided (level 4 means the respondent is aware, understands, interested and ready to adopt the strategy depending on availability of resources)
    e. Adopted (level 5 means the respondent is aware, understands, interested, decided, and implemented the strategy)

Table 1. CCA strategies

CCA Strategies	1	2	3	4	5
1. Climate Smart Field School					
Palay Check System					
Integrated farming system (multi-cropping, mono-cropping; terms used by RFUs)					
Climate change adaptation technologies/practices					
Weather index-based Insurance					
2. Decision-support system for rice and corn (IRRI)					
3. Small Automated Weather Station					
4. Weather-based Index Crop Insurance					
5. Retrofitting of irrigation systems					

3. Once, the instructions and clarifications have been addressed, start with the first item. Read the items twice. Give the respondent time to answer.

The following is a list of PhilCCAP climate change adaptation technologies. Please rate your level of practice using a five-point scale with the following descriptive categories: 1- Unfamiliar 2-Aware 3-Interested 4-Decided 5-Adopted

Please do not leave any item unanswered.

APPENDIX B

Questionnaire for Stakeholder Respondents

Dear Partners,

As you know, the Asian Institute of Developmental Studies has been engaged by the World Bank to develop a knowledge management system for climate change adaptation initiatives. In this regard, a baseline study to determine the level of knowledge of, attitudes towards, practice of stakeholders, and role and participation on climate change adaptation projects is being conducted as part of the Philippine Climate Change Adaptation Project documentation. This survey also aims to assess gaps in existing knowledge and skills of stakeholders about PhilCCAP interventions.

Appendix

Table 2. Socio-demographic profile (put an X on appropriate responses as needed)

Socio-Demographic Characteristics of Respondent					
Name:					
Gender:	Male	Female	**Ethnicity:**		**Age:**
Civil status:	Single	Married	Widow/er		Separated
Relevant Training attended	Decision Support System	Knowledge management	Irrigation systems	Climate change adaptation	
	Palay Check	Cooperatives	Agri-credit	Extension methods	
	Others:				
Office					
Current Position					
Office address					
Contact details	**Office phone:**			**Mobile number:**	
Email address:			**Skype ID:**		
Previous Position/s (for the Last 5 Years)					
Position	**Office**				

Please answer the questions honestly. We will appreciate it very much if you will answer all questions asked. There is no wrong or right answer; hence, this is not a gauge of performance or intelligence about climate change interventions.

Knowledge

Instructions: Please rate your level of knowledge using a five-point scale with the following descriptive categories: 1-Oblivious 2-Cognizant 3-Understands 4-Engaged 5-Expert

1. Oblivious (level 1 means the respondent heard about the subject but does not have personal knowledge about it).
2. Cognizant (level 2 means the respondent comprehends the subject)
3. Understands (level 3 means the respondent is in a position to talk about the subject)
4. Engaged (level 4 means the respondent has given the subject some thought and has drawn conclusions about it)
5. Expert (level 5 means the respondent has some degree of authority over the subject)

Table 3. Rating of knowledge

Topics	1	2	3	4	5
Palay check system					
Integrated farming system					
Climate Change Adaptation Practices module in CSFFS					
Weather Index Based Crop Insurance					
Small Automated Weather Stations					
Decision Support Systems					
Retrofitting of Irrigation Systems					

APPENDIX C

Seven Steps in Benchmarking Climate Change Adaptation: A Field Manual

Seven Steps In Benchmarking Climate Change Adaptation is based on Chapter 4 of the volume titled CLIMATE CHANGE ADAPTATION AMONG FARM FAMILIES AND STAKEHOLDERS: A Toolkit for Assessment and Analysis prepared by Benjamina Paula Gonzalez-Flor, Nestor T. Baguinon, Rogelio N. Concepcion, Alexander G. Flor, Consorcia E. Reaño and Eduardo C. Sison.

Benchmarking refers to the documentation and analysis of climate change responsiveness, in general, or climate change adaptation, in particular, of any given target group, organization or community for purposes of future comparison, internal or external, not within the bounds of project parameters (i.e., time, resources) and project-determined outcomes.

Benchmarking provides the current state of climate change responsiveness (including adaptation) of a subject or target group. It would be most applicable to groups highly vulnerable to climate change.

The benchmarking procedure is exploratory. It is not based on assumptions about the group, organization or community being studied. It does not test hypotheses but is descriptive in nature. However, it makes use of probing questions allowing respondents to volunteer information themselves.

In a nutshell, the benchmarking procedure begins with a Focus Group Discussion of ten to fifteen opinion leaders within a community or an

organization. It proceeds with a one-shot survey whose items are determined by the FGD responses. It generates a Climate Change Responsiveness (CCRp) Profile subjected to validation with key informant interviews. Benchmarking ends with a Climate Change Responsiveness (CCRp) Scorecard.

Step 1: Identify the Vulnerable Group to Be Benchmarked for Climate Change Responsiveness

Since climate change has a spatial dimension, subjects or target groups would have a geographic or locational attribute. Hence, subjects of the benchmarking procedure would be:

- Communities (e.g., municipalities, barangays, etc.);
- Groups living within certain geographical boundaries (e.g., Dumagats of General Nakar, IPAS stakeholders, informal settlers in Dagat-dagatan, etc.); or
- Organizations (e.g., Mothers Club of Sitio Wawa, Irrigators Association of Janiuay, SK members of Los Banos, etc.).

Step 2: Identify Participants of a Focus Group Discussion (FGD) on Climate Change Knowledge, Attitude, and Practice (KAP).

FGD participants will not be sampled but purposively identified. In a farming community, the participants should be composed of ten to fifteen LGU officials, farmer leaders, women leaders, youth leaders as well as other opinion leaders or village elders.

Convene the focus group. Explain the purpose of the discussion, i.e., to determine their community's KAP response to climate change. Facilitate the discussion using the FGD Guide Questions found in Table 4.

Document the group's responses to the FGD questions and distribute as primary reference to members of the research team. The FGD documentation will serve as a basis for modifications on a one-shot survey template for benchmarking.

Table 4. FGD benchmarking guide

Knowledge
• During the past 10 or so years, what recurring, continuous or permanent changes have you observed in temperature and rainfall? • What problems have you had with increase in types and growth of weeds and major infestations or disease outbreaks in your farm in the past ten years? • What signs in your immediate environment have you observed that will indicate possible weather in the coming days? What signs do you normally observe?
Attitude
Do you believe that your experiences are related to what is referred to as climate change? • If so, how do you feel about it? Are you affected by it? Are you resigned to it? Are you worried and apprehensive? Are you doing something about it? • What motivates you to do something about climate change? Your safety? Water sufficiency? Food security? Your property? Your livelihood?
Practice
• How do you cope to the changes to protect or improve your family, well-being, livelihood or farming activities? Do you: o Stockpile food o Forage for unconventional food sources o Engage in off farm employment o Share knowledge, seek information, network with others o Relocate o Use alternative house designs and yard layouts • In your neighborhood, which of the following initiatives are being practiced to adapt to temperature and rainfall pattern changes: o Residue management o Cropping pattern adjustments (diversification, crop rotation) o Varietal change o Crop insurance o Early warning systems o Backyard food conservation o Farm waste conservation o Irrigation water impounding o Terracing, hedgerows, wind breaks, fire breaks, buffer zones • In your neighborhood, which of the following technologies are being applied: o Organic farming o Methane capture o Cover crops o Reforestation o Agroforestry o Nutrient management o Tillage management o Restoration of degraded areas o Pasture management o Alternate wetting and drying irrigation

Step 3: From a Complete Enumeration of the Population of the Community or the Members of the Vulnerable Group, Identify the Survey Respondents

Stratified sampling design will be used for the one-shot survey. Farm households will be stratified according to elevation and size of farm. For elevation, three

strata are identified: 1) highlands or farms at areas with high elevation; 2) medium elevation and lastly, 3) the coastal farms or those located low elevation. Within each elevation, farm households will be classified into two according to the size of the farms. Within each elevation-farm size classification, a simple random sample of farms or farm households will be obtained.

Step 4: Conduct the Survey on the Identified Respondents

Benchmarking makes use of the mixed methods approach. The main QUAN strand is the one shot survey. It is also the main primary data gathering procedure.

Climate change adaptation is one of several behaviors that fall under climate change responsiveness. Climate change responsiveness may be determined by measuring knowledge gain, attitude change and practice (or behavioral change). Since benchmarks are done for future internal or external comparison purposes, we recommend the use of ordinal or ranking scales.

- **Measuring Knowledge Gain (ΔK):** Knowledge Gain (ΔK) as an element of CCRp may be measured by comparing the current degree of climate change knowledge of a community to a future degree of knowledge of the same community. In benchmarking, the current degrees of knowledge among different communities may likewise be compared with one another. A five-point scale may be employed, each point representing a "level" within the cognitive domain. These points are: *1-Obliviousness; 2-Cognizance; 3-Understanding; 4-Engagement; and 5-Expertise.* These levels are operationalized as:
  - *Oblivious* (a score of 1 means research subject has no knowledge about the subject)
  - *Cognizant* (a score of 2 means subject has heard about the subject but does not have personal knowledge about it)
  - *Understands* (score of 3 means subject comprehends the subject)
  - *Engaged* (a score of 4 means subject has given the subject some thought and has drawn conclusions or constructs about it)
  - *Expert* (a score of 5 means subject has some degree of authority over the subject because of his understanding and cognitive engagement)

Each level of knowledge corresponds to a "rank" in a hierarchy of five. These levels may be used to measure both tacit (local, indigenous, biosignals)

knowledge and explicit knowledge exemplified by climate change extremes, variability and uncertainty.

- **Measuring Attitude Change (ΔA):** Attitudes refer to the disposition or feelings (including mindsets and motivations) of respondents towards climate change knowledge, adaptation strategies, coping mechanisms and mitigation means. Mindsets range from denial, apathy, resignation, apprehension and involvement. Motivations include concerns for life (human safety), water supply (water security), sustenance (food security), dwelling (habitat security) and livelihood. Attitude change (ΔA) may be measured by assigning ranked scores for these five motivations and five mindsets. The number of motivations that a subject signifies gets an equivalent number of points. In other words, if a subject signifies all five motivations then five points are given; if a subject names three motivations, then three points are given; and so on. In terms of mindsets, the following scores are assigned per response:
    - *In Denial* (a score of 1 is given if research subject is in denial of climate change)
    - *Apathetic* (a score of 2 is given if subject accepts a fact but is apathetic about it)
    - *Resigned* (a score of 3 is given if subject accepts a fact and is resigned to its eventuality)
    - *Apprehensive* (a score of 4 is given if subject accepts a fact and is apprehensive about it)
    - *Involved* (a score of 5 is given if subject accepts a fact and does something about it)
- **Measuring Behavioral Change (ΔB):** Climate change related behaviors are classified as mitigation, adaptation and coping practices, inclusive of best practice. These practices may be measured using a five-point categorical scale with the following interpretations and scores: *1-Unfamiliar; 2-Aware; 3-Interested; 3-Decided; and 5-Adopted.*
    - *Unfamiliar* (a score of 1 means research subject does not know the practice)
    - *Aware* (a score of 2 means subject knows about the practice but does understand it)
    - *Interested* (a score of 3 means subject sees potential in the practice)
    - *Decided* (a score of 4 means subject has assessed the technology after trying)

Appendix

Table 5. Template for one shot survey instrument

FIELDS	KAP	LEVEL				
		1	2	3	4	5
KNOWLEDGE		Oblivious	Cognizant	Understands	Engaged	Expert
Tacit knowledge	Local or Indigenous knowledge					
	Bio signals					
Explicit knowledge	Weather extremes					
	Weather variability					
	Weather uncertainty					
Mindsets ATTITUDES		In Denial	Apathetic	Resigned	Apprehensive	Involved
Motivations		Livelihood	Habitat	Food	Water	Human Safety
PRACTICE		Unfamiliar	Aware	Interested	Decided	Adopted
Coping mechanisms	Stockpiling					
	Foraging for unconventional food sources					
	Off farm employment					
	Knowledge sharing/ Information seeking/Networking					
	Relocation					
	Alternative house design and yard layout					
Adaptation	Residue management					
	Change in cropping patterns					
	Varietal change					
	Crop Insurance					
	Early warning systems					
	Backyard food conservation					
	Farm waste conservation					
	Irrigation, water impounding					
	Terracing, hedgerows, wind/fire breaks, buffers					
Mitigation	Organic farming					
	Methane capture					
	Reforestation					
	Cover crops					
	Agroforestry					
	Nutrient management					
	Tillage management					
	Restoration of degraded areas					
	Pasture management					
	Alternate wetting and drying irrigation					

- *Adopted* (a score of 5 means subject is aware, interested, tried, evaluated and is practicing the technology)

A master template for the one-shot survey instrument has been developed and is found in Table 5. It may be modified based upon the responses given during the FGD. Alternatively, modifications may be based upon given standards of climate change knowledge, attitudes and coping/adaptation/ mitigation practices.

Step 5: Conduct Modal Analyses for the CCRp Profile

The ordinal or ranked measurements of knowledge, attitude and practice are based on individual responses gathered during the survey. How will the ranked data be processed to arrive at a collective picture? Statistically, the modal value of the responses should represent the general trend and will thus be employed in this analysis.

The mode is the value along the five-point scale, which appears or occurs most often in the data set. The modal values for each of the items in the survey

instrument will be identified and will represent the levels of knowledge, attitude and practice of the community, group or organization being benchmarked for climate change responsiveness. For instance, the modal value for the level of explicit knowledge on weather variability is 1 for Community A, then we can say that Community A is *Oblivious* to weather variabilities. Similarly, if the modal value for mindsets of Community B is 3, then it may be concluded that Community B is *Resigned* to climate change.

Based on a modal analysis of benchmarking data gathered through the survey, a Climate Change Responsiveness Profile may be generated. The survey responses will be subjected to modal analyses to situate the subject within the levels, which can then be shaded accordingly to generate the CCRp Profile. Table 6 shows the proposed format for a CCRp Profile.

Step 6: Validate the CCRp Profile Through Three Key Informant Interviews

The CCRp Profile will be validated through key informant interviews (KII). Three key informants will be identified for in-depth interviews and validation: a farmer leader; a housewife; and a youth leader. The KII may be supplemented by photo or video documentation (ethnovideography).

Modifications may be made on the items should two or more of the informants agree on the changes.

Step 7: Accomplish the Climate Change Responsiveness Scorecard

Once the levels indicated in the profile are vetted, scores can now be assigned to each response. The levels should be considered as a five-point ranking scale with each level corresponding to an equivalent score. Supposing the subject's knowledge on weather extremes is rated 4 then its score becomes 4.

The mean scores are computed for each domain. The mean averages are then derived resulting in an overall Climate Change Responsiveness Rating for the community, organization or group studied: five (5) considered as very high; 4 as high; 3 as moderate; 2 as low; and 1 as very low.

Appendix

Table 6. CCRp profile format

Ecosystem: Upland/Lowland/Coastal Community/group/organization: As of:						
Fields	**KAP**	**Mode**				
		1	**2**	**3**	**4**	**5**
Tacit knowledge	Local or Indigenous knowledge					
	Bio signals					
Explicit knowledge	Weather extremes					
	Weather variability					
	Weather uncertainty					
Mindsets	In Denial/Apathetic/Resigned/Apprehensive/Involved					
Motivations	Human safety/Water/Food security/Habitat/Livelihood					
Coping mechanisms	Stockpiling					
	Foraging for unconventional food sources					
	Off farm employment					
	Knowledge sharing/ Information seeking/Networking					
	Relocation					
	Alternative house design and yard layout					
Adaptation	Residue management					
	Change in cropping patterns					
	Varietal change					
	Crop Insurance					
	Early warning systems					
	Backyard food conservation					
	Farm waste conservation					
	Irrigation, water impounding					
	Terracing, hedgerows, wind/fire breaks, buffers					
Mitigation	Organic farming					
	Methane capture					
	Reforestation					
	Cover crops					
	Agroforestry					
	Nutrient management					
	Tillage management					
	Restoration of degraded areas					
	Pasture management					
	Alternate wetting and drying irrigation					

Table 7. Climate Change Responsiveness (CCRp) scorecard

Domains	Types	Response	Scale					Score		
			1	2	3	4	5			
Knowledge	Tacit knowledge	Local or Indigenous knowledge								
		Bio signals								
	Explicit knowledge	Weather extremes								
		Weather variability								
		Weather uncertainty								
Total K score										
Average K score										
Attitude	Mindsets	In Denial/Apathetic/Resigned/Apprehensive/Involved								
	Motivations	Human safety/Water/Food security/Habitat/Livelihood								
Total A score										
Average A score										
Practice	Coping mechanisms	Stockpiling								
		Foraging for unconventional food sources								
		Off farm employment								
		Knowledge sharing/ Information seeking/Networking								
		Relocation								
		Alternative house design and yard layout								
	Adaptation	Residue management								
		Change in cropping patterns								
		Varietal change								
		Crop Insurance								
		Early warning systems								
		Backyard food conservation								
		Farm waste conservation								
		Irrigation, water impounding								
		Terracing, hedgerows, wind/fire breaks, buffers								
	Mitigation	Organic farming								
		Methane capture								
		Reforestation								
		Cover crops								
		Agroforestry								
		Nutrient management								
		Tillage management								
		Restoration of degraded areas								
		Pasture management								
		Alternate wetting and drying irrigation								
Total P score										
Average P score										
Overall total										
Overall CCRp rating										

APPENDIX D

PHILCCAP CCA Assessment: A Field Manual

The manual consists of easy steps on how to collect, encode, and analyze KAP data. While qualitative data may be needed, direct observation maybe used instead.

Thus, this Field Manual will be used to measure, monitor, and analyze progress towards PhilCCAP's final outcome indicators: the adoption of coping strategies, new technologies, or improved farming practices among twenty percent (20%) of households surveyed in the targeted areas to better cope with climate variability and extremes; and participation in or knowledge of demonstration activities among thirty five percent (35%) of stakeholders surveyed in the targeted areas to reduce vulnerability or adaptive capacity.

This simple and user-friendly Field Manual comes in a handy pack for you to bring during data collection as easy reference, as the need arises. It does not, however, underestimates the capability of seasoned evaluators who have a long and rich experience in conducting research. The methods are meant to standardize procedures to ensure that results are not subjected to different interpretations.

Since this Field Manual is a work in progress given the nature of climate change, it is highly recommended that changes, suggestions, or recommendations are most welcome to improve its current form especially from those who have used it.

The Training Team

Step 1: Introducing PHILCCAP

We come from the Philippine Climate Change Adaptation Project (PhilCCAP). The project aims to develop strategies and adaptive measures to increase the country's resilience to climate change. In short, the Project wants to help how Filipino farmers (especially for rice and corn) can adapt to unpredictable climate changes through different interventions given that it is here to stay and if they don't adapt now, they may not survive the challenges of the times!

The Project in effect needs to increase farming communities' adaptive capacity by improving:

1. Farm management capability under conditions of climate risk;
2. Access to information on weather forecasting and climate patterns;
3. Access to risk management options such as weather index insurance; and
4. Strengthening ecosystems.

The Project believes that these measures can address or at least protect farming families from dangers posed by climate change. This means that if farmers can change their cultural practices (or maybe they have some alternative already), if they are knowledgeable about weather conditions (some are well-versed with biosignals already), if farmers know the value of insuring their crops, and learn new ways to strengthen environmental and ecological stability then they can continue producing their crops and in turn ensure food security for the country.

It has four components.

1. **Component 1:** Supports the integration of climate change adaptation into the agriculture and natural resources sectors and strengthens the capabilities of relevant government agencies.
2. **Component 2:** Aims to help poor rural communities adapt to the effects of climate change, by demonstrating both tangible reductions in climate-related risk and increased resilience to climate change.
3. **Component 3:** Seeks to improve the ability of end-users, especially in the agriculture and natural resources sectors, to access more reliable scientific information.
4. **Component 4:** Supports project coordination functions through the Department of Environment and Natural Resources' (DENR) Foreign Assisted and Special Projects Office (FASPO).

Your task as enumerators is under Component 2. Project evaluation is important to know how the project fared in achieving its objectives. Since the Project will be implemented within five years, the need for a scientific evaluation is in order. Evaluation broadly means measuring progress against stated objectives or targets. There are two outcome Project indicators that you need to evaluate.

You may ask what are these technologies? Well, some of these technologies can be considered indigenous knowledge while some have still to be developed and introduced as interventions under the Project. Remember that only

Project-based interventions have to be evaluated. Of course, some of you are already aware of some of these. In addition, you need to differentiate adaptation strategies from coping strategies or mitigating measures or how should you identify the 20% or 35% targets! Well, these will be elaborated on in later sections.

PhilCCAP is spearheaded by the Department of Environment and Natural Resources in collaboration with several agencies like the Department of Science and Technology, PAGASA, Philippine Crop Insurance Corporation, Climate Change Commission, World Bank, and the Department of Agriculture. Specifically, the Agricultural Training Institute of DA is mandated to conduct the baseline study and perhaps succeeding periodic evaluations since the focus of evaluation is on agricultural farm families specifically rice and corn.

Step 2: Understanding the Objectives of the Field Manual

The general objective of this Field Manual is to provide a step-by-step procedure on how to conduct baseline, midterm, and terminal evaluation studies for PhilCCAP.

Specifically, it aims to:

1. Show how to determine the number of respondents and sampling scheme to obtain valid results;
2. Explain how data collection instruments will be used;
3. Provide guidance on how data shall be collected, encoded, and analyzed; and
4. Guide enumerators on how to prepare the report.

Step 3: Appreciating the Need for Project Evaluation

Project evaluation constitutes part of the project monitoring and evaluation process. It refers to baseline, mid-term, final and ex-post measurements and analysis of CCA practice conducted within the bounds of project parameters and project-determined outcomes, in this particular case, PHILCCAP timelines, resources and final outcomes.

For now, you need to know how baseline studies are conducted. More often than not, evaluation is contracted to external evaluators. In the absence of such, internal evaluation may be resorted to using standard instruments. Therefore, you have been identified to assume this role.

Step 4: Measuring the Project Outcome Indicators

Do you remember PhilCCAP's outcome indicators? Let us look at these once again:

1. The adoption of coping strategies, new technologies, or improved farming practices among twenty percent (20%) of households surveyed in the targeted areas to better cope with climate variability and extremes; and
2. Participation in or knowledge of demonstration activities among thirty-five percent (35%) of stakeholders surveyed in the targeted areas to reduce vulnerability or adaptive capacity.

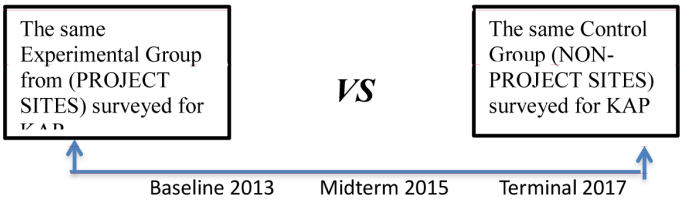
BTW, what is an indicator? An indicator is simply a set target or standard that needs to be achieved by the Project within a specific given time. In this case, you need to know if PhilCCAP had affected 20% of households surveyed in targeted areas have adopted the interventions that they have implemented. As well, you need to find out if 35% of stakeholders surveyed participated in or have demonstrated activities on reducing vulnerability or adaptive capacity among farm families. Hence, *if* 20% had indeed adopted the interventions *then* PhilCCAP was successful or have achieved its target. Similarly, *if* 35% of stakeholders were able to demonstrate the activities then PhilCCAP had achieved its target. Otherwise, they have failed. However, would you know if the objectives have been achieved ithout knowing the current state or baseline figures among farm families? That's the reason why we need to establish a baseline figure as basis to measure the change between the baseline figures and midterm and between midterm and terminal evaluations of the Project.

Of course, this is easier said than done. The method of conducting the evaluation has to be done scientifically. Thus, you need to observe the scientific process just like doing your laboratory experiments in high school or college.

Since, it is impossible to do true experiments unlike in laboratories, Quasi Experimental Design would be the best next alternative. It's the closest to an experiment but not quite so to speak. Here, respondents will be sampled out of the complete list (universe or population) of project beneficiaries from the target communities as the experimental group. A separate set of non-beneficiaries from communities having similar characteristics to the project communities will likewise be sampled as the control group. Both groups will be subjected to baseline, midterm and final evaluations. KAP changes in the experimental group will be compared to those of the control group to determine if the target communities indeed benefited from the Project. Meaning, the

Appendix

Figure 1. Measuring project outcome indicators
Terminal 2017.



same sample family- and stakeholder-respondents will be surveyed thrice in both experimental (those in the project sites) and control group (non-project sites). This is being done to determine whether the changes in KAP can be attributed to PhilCCAP interventions. In case, significant changes have been observed in control groups or non-project sites, then PhilCCAP failed. This step can be illustrated as shown in Figure 1.

In order to ensure that every farm family is given an equal chance of being chosen as respondent, stratified random sampling will be used to obtain independent samples from the two populations: farm households, which are beneficiaries of the Project under evaluation and farm households, which are not. Sample size from each will be such that 20% difference in the proportion will be declared significant with 90% probability. Control samples or samples from the non-project sites are necessary to eliminate variation resulting from factors confounded with time.

1. **The Respondents:** There are two types of respondents:
   a. **Agricultural Households:** Twenty percent of households surveyed in the targeted areas adopt coping strategies; new technologies or improved farming practices to cope better with climate variability and extremes. These include:
      i. Farmers/ fisherfolk
      ii. Rural housewives
      iii. Out-of-School Youth
   b. **Stakeholders:** Thirty-five percent of stakeholders surveyed in the targeted areas have participated in or are knowledgeable of activities demonstrated by the project to reduce vulnerability or improve adaptive capacity.
      i. Agricultural technicians
      ii. LGU extension workers
      iii. NGO staff

iv. Civil society (socio-civic organizations; the military; the Church; academe; media)

2. **Sampling Tool:** Inasmuch as rice and corn farmers are located from ridge to reef, a stratified sampling design will be used where farm households will be stratified according to elevation and size of farm. For elevation, three strata are identified: 1) highlands or farms at areas with high elevation; 2) medium elevation, and lastly, 3) the coastal farms or those located at low elevation. Within each elevation, farm households will be classified into two according to the size of the farms. Within each elevation-farm size classification, a simple random sample of farms or farm households will be obtained.

Step 5: Gathering Data and Analysing Results

- **Data Collection Instrument:** You will need to familiarize yourself with the data collection instruments. These are of two types: one for farm households and one for stakeholders. Appendix A is for farm households while Appendix B is for stakeholders. The instrument is self-explanatory and easy to follow. Follow the instructions and you will be fine.

Step 6: Preparing the Tabulated Data

The data collected, cleaned, and encoded are transformed into usable formats such as tables. Summaries of KAP data are presented using dummy tables. The tables will make the work of the Agricultural Training Institute easier who will then report to PhilCCAP. The following tables may be developed using spreadsheet (the same can be constructed using the spreadsheet used for encoding the data):

1. Table 1. Socio-demographic profile of farm households
2. Table 2. Knowledge level of farm households on CCA
3. Table 3. Attitudes of farm household towards CCA
4. Table 4. Practice level of farm households of CCA strategies
5. Table 5. List of adaptation technologies/practices
6. Table 6. Sources of information on CCA

The same tables with some modifications will be done for surveyed stakeholders.

Glossary

Affective Domain: One of three learning domains proposed by Bloom, the affective relates to attitudes. It is operationalized in this book as a climate change adaptation domain. Under this domain are attitudes inclusive of mindsets and motivations.

Agricultural Household: An extended family living in a common domicile, partially or wholly engaged in farming, fishing and/or animal husbandry, is an agricultural household.

Attitudes: Under climate change adaptation, attitudes are classified as either mindsets or motivations. Mindsets on climate change range from apathy, apprehension to engagement or resignation. Motivations for climate change adaptation include: human safety; food security; water security; habitat security; energy security; and livelihood security.

Biosignals: Tacit indigenous or local knowledge among members of agricultural households that are products of long e observation shared orally among household members across generations. They are bio-ecological footprints for observable changes in plants, livestock and other biological organisms with equivalent oral expressions/ communication of potential risks that threaten their livelihood, food needs, and health.

Climate: Atmospheric Variables consist of factors namely solar radiation, temperature, rainfall, humidity, relative humidity and expressions of wind speed and direction. Atmospheric Condition is the collective expression of atmospheric variables at any given time and place.Weather is defined as the pattern of atmospheric condition in a given place on a day-to-day basis. Climate is defined as the pattern of atmospheric condition in a given place on a year-to-year basis. Weather extremes are antithesis to the average weather

patterns hence they connote outlier maximum and minimum expressions of atmospheric conditions beyond the average in a given place. Climate extremes refer to the outlier departures from the average climatic pattern in a given place and time either at the maximum or minimum expressions and they include stochastic (or random) phenomena like deviant seasonal oscillations and typhoon intensities/magnitudes and frequencies/time intervals of El Niño/La Nina events. Weather extremes and climate extremes occur in both natural and anthropogenic climate change. Climate in a narrow sense is usually defined as the average weather, or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years.

Climate Change: Climate change as provided for by the United Nations Framework Convention on Climate Change (UNFCCC) refers to a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods.

Climate Change Adaptation: Within the context of this book, climate change adaptation pertains to behavior attributed among members of an agricultural household that allow them to adapt to climate change eventualities.

Climate Change Resiliency: Power or ability to cope with adverse climate change. This involves: responsiveness (knowledge, attitudes, practice); resources (natural, economic, livelihood); and risk management (risk avoidance/risk reduction; early warning and risk communication; and preparedness.

Climate Extremes: Climate extremes in this report considers the WMO reference to extreme weather, which includes unusual, severe or unseasonal weather at the extremes of the historical distribution—the range that has been seen in the past.

Climate Uncertainty: The term reducing uncertainty is ubiquitous within the Climate Chance Science Program (CCSP) strategic plan. Reducing uncertainties is the central theme of one of the five major CCSP goals and the foundation of one of the four core approaches to address these goals. As such, it is viewed as a litmus test for determining whether scientific knowledge is sufficient to justify particular policies and decisions.

Climate Variability: Climate variability refers to variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes, etc.) of the climate on all temporal and spatial scales beyond that of individual weather events. Variability may be due to natural internal processes within the climate system (internal variability), or to variations in natural or anthropogenic external forcing (external variability).

Cognitive Domain: A climate change adaptation domain that pertains to knowledge on climate change. These are classified as either tacit or explicit knowledge

Coping Mechanisms: Stop gap measures, generally at household levels where excess or free labor are converted into cash generating activities or income augmentation to secure food for the family, examples are off-farm employment, sari-sari stores, sharing houses with close friends, family members during unexpected disasters, etc.

Experiential Exposure: This refers to an agricultural household member's exposure to weather extremes, variabilities and uncertainties that determine his current knowledge, attitudes and practice.

Explicit Knowledge: Documented knowledge found in papers, journals, books, maps, charts, graphics, audio recording and video recordings.

Factual Exposure: This refers to an agricultural household member's exposure to climate change terminologies, details and elements.

Hazard-Related Exposure: This refers to an agricultural household member's exposure to floods, landslides, drought and fires.

Indigenous Adaptation Practices: Tacit knowledge learned from iterative impacts of climate change, generally being implemented by the farmer himself: both at the farmers or household levels.

Landscape Approach: Also referred to as the agro-ecosystem approach or "Ridge to Reef" (R2R).

Practice: For purposes of this book, CCA practice may be categorized as coping mechanisms, adaptation strategies and mitigation means.

Procedural Exposure: This refers to an agricultural household member's exposure to climate change adaptation techniques, methods and procedures.

Psychomotor Domain: This CCA domain refers to observable actions of agricultural households that allow them to adapt to climate change. It corresponds with the Practice element of KAP.

Tacit Knowledge: Undocumented knowledge that a member of an agricultural household has. These include local and indigenous knowledge, bio signals.

Nomenclature

AIDA: Awareness, Interest, Decision, Action
ATI: Agricultural Training Institute
CAS: College of Arts and Sciences
CCA: Climate Change Adaptation
CCC: Climate Change Commission
CCR: Climate Change Resilience
CCRp: Climate Change Responsiveness
CFC: Chlorofluorocarbon
CMS: Content Management System
CoC: Community of Champions
CoP: Community of Practice
DA: Department of Agriculture
DENR: Department of Environment and Natural Resources
DOST: Department of Science and Technology
DSS: Decision Support System
DT: *Dalaw Turo (a Philippine social mobilization program)*
FGD: Focus Group Discussions
GEF: Global Environmental Fund
GIZ: *Gesellschaft fur Intrnationale Zusammenarbert*
GNP: Gross National Product
IEC: Information, Education and Communication
IFS: Integrated Farming Systems
IPCC: Inter-Governmental Panel on Climate Change
IRRI: International Rice Research Institute
KAP: Knowledge, Attitudes, Practice
KII: Key Informant Interviews
KM: Knowledge Management
KM4C2: Knowledge Management for Climate Change
NCCAP: National Climate Change Action Plan

NIA: National Irrigation Administration
NGA: National Government Agencies
NGO: Non-Government Organizations
PCIC: Philippine Crop Insurance Corporation
PCS: *Palay* (paddy) Check System
PhilCCAP: Philippine Climate Change Adaptation Project
SAWS: Small Automated Weather Stations
SCCF: Special Climate Change Fund
SDG: Sustainable Development Goal
SR: Stimulus - Response
TNA: Training Needs Assessment
UPLB: University of the Philippines Los Baños
UPOU: University of the Philippines-Open University
W3C: World Wide Web Consortium
WIBCI: Weather Index Based Crop Insurance
WMO: World Meteorological Organization

Related Readings

To continue IGI Global's long-standing tradition of advancing innovation through emerging research, please find below a compiled list of recommended IGI Global book chapters and journal articles in the areas of energy planning, climate change, and efficient energy. These related readings will provide additional information and guidance to further enrich your knowledge and assist you with your own research.

Adler, M. (2015). Floods Monitoring. In C. Maftei (Ed.), *Extreme Weather and Impacts of Climate Change on Water Resources in the Dobrogea Region* (pp. 312–344). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8438-6.ch011

Afzal, S. (2016). Implementation of Flooding Free Routing in Smart Grid: VCP Routing in Smart Gird. In A. Ahmad & N. Hassan (Eds.), *Smart Grid as a Solution for Renewable and Efficient Energy* (pp. 298–322). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-0072-8.ch013

Ahmad, S., Ahmad, A., & Yaqub, R. (2016). Optimized Energy Consumption and Demand Side Management in Smart Grid. In A. Ahmad & N. Hassan (Eds.), *Smart Grid as a Solution for Renewable and Efficient Energy* (pp. 1–25). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-0072-8.ch001

Arbaiy, N., Watada, J., & Lin, P. (2016). Fuzzy Random Regression-Based Modeling in Uncertain Environment. In P. Vasant & N. Voropai (Eds.), *Sustaining Power Resources through Energy Optimization and Engineering* (pp. 127–146). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-9755-3.ch006

Arhin, A. (2016). Improving Sustainability of the Environment in a Changing Climate: Can REDD+ Rise to the Challenge? In S. Dinda (Ed.), *Handbook of Research on Climate Change Impact on Health and Environmental Sustainability* (pp. 327–346). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8814-8.ch016

Bahinipati, C. S., Patnaik, U., & Viswanathan, P. K. (2016). What Causes Economic Losses from Natural Disasters in India? In S. Dinda (Ed.), *Handbook of Research on Climate Change Impact on Health and Environmental Sustainability* (pp. 157–175). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8814-8.ch008

Banerjee, S. (2016). Social Innovation: A Theoretical Approach in Intertwining Climate Change with Social Innovation. In S. Dinda (Ed.), *Handbook of Research on Climate Change Impact on Health and Environmental Sustainability* (pp. 593–618). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8814-8.ch029

Barakabitze, A. A., Fue, K. G., Kitindi, E. J., & Sanga, C. A. (2016). Developing a Framework for Next Generation Integrated Agro Food-Advisory Systems in Developing Countries. *International Journal of Information Communication Technologies and Human Development*, *8*(4), 13–31. doi:10.4018/IJICTHD.2016100102

Basu, J. P. (2016). Coastal Poverty, Resource-Dependent Livelihood, Climate Change, and Adaptation: An Empirical Study in Indian Coastal Sunderbans. In S. Dinda (Ed.), *Handbook of Research on Climate Change Impact on Health and Environmental Sustainability* (pp. 441–454). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8814-8.ch022

Bekele, I., & Ganpat, W. (2015). Education, Extension, and Training for Climate Change. In W. Ganpat & W. Isaac (Eds.), *Impacts of Climate Change on Food Security in Small Island Developing States* (pp. 361–388). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-6501-9.ch012

Bhaskar, A., Rao, G. B., & Vencatesan, J. (2017). Characterization and Management Concerns of Water Resources around Pallikaranai Marsh, South Chennai. In P. Rao & Y. Patil (Eds.), *Reconsidering the Impact of Climate Change on Global Water Supply, Use, and Management* (pp. 102–121). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1046-8.ch007

Bhatt, R. (2017). Zero Tillage for Mitigating Global Warming Consequences and Improving Livelihoods in South Asia. In W. Ganpat & W. Isaac (Eds.), *Environmental Sustainability and Climate Change Adaptation Strategies* (pp. 126–161). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1607-1.ch005

Bit, J., & Banerjee, S. (2016). Sustainable Forest Use and India's Economic Growth: A Structural Decomposition Analysis of Direct Forest Intensity. In S. Dinda (Ed.), *Handbook of Research on Climate Change Impact on Health and Environmental Sustainability* (pp. 306–326). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8814-8.ch015

Boonkerd, K. (2017). Development and Modification of Natural Rubber for Advanced Application. In T. Kobayashi (Ed.), *Applied Environmental Materials Science for Sustainability* (pp. 44–76). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1971-3.ch003

Boonmahitthisud, A. (2017). Natural Rubber and Rubber Blend Nanocomposites: Reinforcement of Natural Rubber with Polymer-Encapsulated Inorganic Nanohybrid Particles. In T. Kobayashi (Ed.), *Applied Environmental Materials Science for Sustainability* (pp. 77–105). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1971-3.ch004

Bostanci, S. H., & Albayrak, A. N. (2017). The Role of Eco-Municipalities in Climate Change for a Sustainable Future. In W. Ganpat & W. Isaac (Eds.), *Environmental Sustainability and Climate Change Adaptation Strategies* (pp. 213–231). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1607-1.ch008

Buta, C., Omer, I., & Andronic, A. (2015). Hydrological Risk Phenomena and Flood Analysis: Study Case – Taita Catchment, Romania. In C. Maftei (Ed.), *Extreme Weather and Impacts of Climate Change on Water Resources in the Dobrogea Region* (pp. 284–311). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8438-6.ch010

Carrillo, K. L., & Kobayashi, T. (2017). Natural Material Source of Bagasse Cellulose and Their Application to Hydrogel Films. In T. Kobayashi (Ed.), *Applied Environmental Materials Science for Sustainability* (pp. 19–43). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1971-3.ch002

Cazacu, G. B. (2015). Dobrogea Geology. In C. Maftei (Ed.), *Extreme Weather and Impacts of Climate Change on Water Resources in the Dobrogea Region* (pp. 73–118). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8438-6.ch004

Chai-Ittipornwong, T. (2017). Participation Framework to Sustainability: The Undercurrents in Bottled-Water Production and Consumption. In P. Rao & Y. Patil (Eds.), *Reconsidering the Impact of Climate Change on Global Water Supply, Use, and Management* (pp. 272–293). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1046-8.ch015

Chatterjee, T., & Dinda, S. (2016). Climate Change, Human Health and Some Economic Issues. In S. Dinda (Ed.), *Handbook of Research on Climate Change Impact on Health and Environmental Sustainability* (pp. 26–41). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8814-8.ch002

Chaudhary, N., & Pisolkar, Y. (2017). Issues, Concerns, and Local Stakes: Future of Water Resources in Coastal Villages of Devbag and Tarkarli, Coastal Maharashtra, India. In P. Rao & Y. Patil (Eds.), *Reconsidering the Impact of Climate Change on Global Water Supply, Use, and Management* (pp. 50–69). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1046-8.ch004

Chelcea, S., Ionita, M., & Adler, M. (2015). Identification of Dry Periods in the Dobrogea Region. In C. Maftei (Ed.), *Extreme Weather and Impacts of Climate Change on Water Resources in the Dobrogea Region* (pp. 52–72). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8438-6.ch003

Cohen, J. E., Clarke-Harris, D. O., Khan, A., & Isaac, W. P. (2015). Sustainable Management of Invasive Species for Small Island Developing States under Changing Climates. In W. Ganpat & W. Isaac (Eds.), *Impacts of Climate Change on Food Security in Small Island Developing States* (pp. 312–360). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-6501-9.ch011

Das, S. (2016). Health Impact of Water-Related Diseases in Developing Countries on Account of Climate Change – A Systematic Review: A Study in Regard to South Asian Countries. In S. Dinda (Ed.), *Handbook of Research on Climate Change Impact on Health and Environmental Sustainability* (pp. 42–60). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8814-8.ch003

David, I., Beilicci, E., & Beilicci, R. (2015). Basics for Hydraulic Modelling of Flood Runoff Using Advanced Hydroinformatic Tools. In C. Maftei (Ed.), *Extreme Weather and Impacts of Climate Change on Water Resources in the Dobrogea Region* (pp. 205–239). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8438-6.ch008

Deenapanray, P. N., & Ramma, I. (2015). Adaptations to Climate Change and Climate Variability in the Agriculture Sector in Mauritius: Lessons from a Technical Needs Assessment. In W. Ganpat & W. Isaac (Eds.), *Impacts of Climate Change on Food Security in Small Island Developing States* (pp. 130–165). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-6501-9.ch005

Dinda, S. (2016). Adaptation to Climate Change for Sustainable Development: A Survey. In S. Dinda (Ed.), *Handbook of Research on Climate Change Impact on Health and Environmental Sustainability* (pp. 363–391). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8814-8.ch018

Dinda, S. (2016). Climate Change, Trade Competitiveness, and Opportunity for Climate Friendly Goods in SAARC and Asia Pacific Regions. In S. Dinda (Ed.), *Handbook of Research on Climate Change Impact on Health and Environmental Sustainability* (pp. 515–536). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8814-8.ch026

Dongol, D., Bollin, E., & Feldmann, T. (2016). Battery Management Based on Predictive Control and Demand-Side Management: Smart Integration of Renewable Energy Sources. In A. Ahmad & N. Hassan (Eds.), *Smart Grid as a Solution for Renewable and Efficient Energy* (pp. 149–180). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-0072-8.ch007

Drăguşin, D. (2015). Drought Effects on Groundwater in Dobrogea Plateau. In C. Maftei (Ed.), *Extreme Weather and Impacts of Climate Change on Water Resources in the Dobrogea Region* (pp. 119–144). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8438-6.ch005

Elsayed, A. M., Dakkama, H. J., Mahmoud, S., Al-Dadah, R., & Kaialy, W. (2017). Sustainable Cooling Research Using Activated Carbon Adsorbents and Their Environmental Impact. In T. Kobayashi (Ed.), *Applied Environmental Materials Science for Sustainability* (pp. 186–221). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1971-3.ch009

Emmanuel, M., Muasa, L., Chen, C., Mutisya, F., & Avtar, R. (2016). Impact of Rapid Urbanization and Climate Change on Agricultural Productivity in Africa: Climate Change Policies in the Agricultural Sector. In S. Dinda (Ed.), *Handbook of Research on Climate Change Impact on Health and Environmental Sustainability* (pp. 416–426). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8814-8.ch020

Emran, A., Rob, M. A., & Kabir, M. H. (2017). Coastline Change and Erosion-Accretion Evolution of the Sandwip Island, Bangladesh. *International Journal of Applied Geospatial Research*, *8*(2), 33–44. doi:10.4018/IJAGR.2017040103

Eudoxie, G., & Roopnarine, R. (2017). Climate Change Adaptation and Disaster Risk Management in the Caribbean. In W. Ganpat & W. Isaac (Eds.), *Environmental Sustainability and Climate Change Adaptation Strategies* (pp. 97–125). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1607-1.ch004

Eudoxie, G. D., & Wuddivira, M. (2015). Soil, Water, and Agricultural Adaptations. In W. Ganpat & W. Isaac (Eds.), *Impacts of Climate Change on Food Security in Small Island Developing States* (pp. 255–279). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-6501-9.ch009

Fernández, F. J., Jiménez, A. D., Manzano, F. S., & Márquez, J. M. (2017). An Energy Management Strategy and Fuel Cell Configuration Proposal for a Hybrid Renewable System with Hydrogen Backup. *International Journal of Energy Optimization and Engineering*, *6*(1), 1–22. doi:10.4018/IJEOE.2017010101

Fernando, Y., & Wah, W. X. (2016). Moving forward a Parsimonious Model of Eco-Innovation: Results from a Content Analysis. In S. Dinda (Ed.), *Handbook of Research on Climate Change Impact on Health and Environmental Sustainability* (pp. 619–631). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8814-8.ch030

Garrick, T. A., & Liburd, O. E. (2017). Impact of Climate Change on a Key Agricultural Pest: Thrips. In W. Ganpat & W. Isaac (Eds.), *Environmental Sustainability and Climate Change Adaptation Strategies* (pp. 232–254). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1607-1.ch009

Goundar, S., & Appana, S. (2017). Mainstreaming Development Policies for Climate Change in Fiji: A Policy Gap Analysis and the Role of ICTs. In W. Ganpat & W. Isaac (Eds.), *Environmental Sustainability and Climate Change Adaptation Strategies* (pp. 1–31). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1607-1.ch001

Gupta, A. C. (2016). Bioeconomic Fishery Management: Changing Paradigms towards Eco-System Based Management. In S. Dinda (Ed.), *Handbook of Research on Climate Change Impact on Health and Environmental Sustainability* (pp. 261–281). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8814-8.ch013

Hiremath, R., Kumar, B., Bansode, S. S., Nulkar, G., Patil, S. S., & Murali, J. (2017). Industrial Wastewater Management in the Context of Climate Change Adaptation in Selected Cities of India: A Business Approach. In P. Rao & Y. Patil (Eds.), *Reconsidering the Impact of Climate Change on Global Water Supply, Use, and Management* (pp. 294–313). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1046-8.ch016

Huyen, P. T. (2017). Clay Minerals Converted to Porous Materials and Their Application: Challenge and Perspective. In T. Kobayashi (Ed.), *Applied Environmental Materials Science for Sustainability* (pp. 141–164). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1971-3.ch007

Iese, V., Maeke, J., Holland, E., Wairiu, M., & Naidu, S. (2015). Farming Adaptations to the Impacts of Climate Change and Extreme Events in Pacific Island Countries: Case Study of Bellona Atoll, Solomon Islands. In W. Ganpat & W. Isaac (Eds.), *Impacts of Climate Change on Food Security in Small Island Developing States* (pp. 166–194). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-6501-9.ch006

Ikematsu, S., Tada, I., & Nagasaki, Y. (2017). Analysis of Lipids Produced by Microalgae Isolated from the Area around Okinawa, Japan. In T. Kobayashi (Ed.), *Applied Environmental Materials Science for Sustainability* (pp. 222–233). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1971-3.ch010

Inogwabini, B. (2017). Congo Basin's Shrinking Watersheds: Potential Consequences on Local Communities. In P. Rao & Y. Patil (Eds.), *Reconsidering the Impact of Climate Change on Global Water Supply, Use, and Management* (pp. 211–226). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1046-8.ch012

Ionita, M., & Chelcea, S. (2015). Spatio-Temporal Variability of Seasonal Drought over the Dobrogea Region. In C. Maftei (Ed.), *Extreme Weather and Impacts of Climate Change on Water Resources in the Dobrogea Region* (pp. 17–51). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8438-6.ch002

Issakhov, A. (2016). Mathematical Modelling of the Thermal Process in the Aquatic Environment with Considering the Hydrometeorological Condition at the Reservoir-Cooler by Using Parallel Technologies. In P. Vasant & N. Voropai (Eds.), *Sustaining Power Resources through Energy Optimization and Engineering* (pp. 227–243). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-9755-3.ch010

Javid, T. (2016). Geographic Information System for the Smart Grid. In A. Ahmad & N. Hassan (Eds.), *Smart Grid as a Solution for Renewable and Efficient Energy* (pp. 344–362). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-0072-8.ch015

Juma, D. W., Reuben, M., Wang, H., & Li, F. (2017). Adaptive Coevolution: Realigning the Water Governance Regime to the Changing Climate. In P. Rao & Y. Patil (Eds.), *Reconsidering the Impact of Climate Change on Global Water Supply, Use, and Management* (pp. 314–325). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1046-8.ch017

Kais, S. M. (2017). Climate Change: Vulnerability and Resilience in Commercial Shrimp Aquaculture in Bangladesh. In W. Ganpat & W. Isaac (Eds.), *Environmental Sustainability and Climate Change Adaptation Strategies* (pp. 162–187). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1607-1.ch006

Kamboj, V. K., & Bath, S. K. (2016). Scope of Biogeography-Based Optimization for Economic Load Dispatch and Multi-Objective Unit Commitment Problem. In P. Vasant & N. Voropai (Eds.), *Sustaining Power Resources through Energy Optimization and Engineering* (pp. 360–389). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-9755-3.ch015

Karmaoui, A. (2016). Environmental Vulnerability to Climate Change in Mediterranean Basin: Socio-Ecological Interactions between North and South. In S. Dinda (Ed.), *Handbook of Research on Climate Change Impact on Health and Environmental Sustainability* (pp. 105–138). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8814-8.ch006

Khai, H. V. (2016). Assessing Urban Residents' Willingness to Pay for Preserving the Biodiversity of Swamp Forest. In S. Dinda (Ed.), *Handbook of Research on Climate Change Impact on Health and Environmental Sustainability* (pp. 283–305). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8814-8.ch014

Khalid, S. (2016). Application of Adaptive Tabu Search Algorithm in Hybrid Power Filter and Shunt Active Power Filters: Application of ATS Algorithm in HPF and APF. In P. Vasant & N. Voropai (Eds.), *Sustaining Power Resources through Energy Optimization and Engineering* (pp. 276–308). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-9755-3.ch012

Khan, S. S. (2016). Modeling and Operating Strategies of Micro-Grids for Renewable Energy Communities. In A. Ahmad & N. Hassan (Eds.), *Smart Grid as a Solution for Renewable and Efficient Energy* (pp. 97–122). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-0072-8.ch005

Khanna, B. K. (2017). Indian National Strategy for Climate Change Adaptation and Mitigation. In W. Ganpat & W. Isaac (Eds.), *Environmental Sustainability and Climate Change Adaptation Strategies* (pp. 32–63). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1607-1.ch002

Khanna, B. K. (2017). Vulnerability of the Lakshadweep Coral Islands in India and Strategies for Mitigating Climate Change Impacts. In W. Ganpat & W. Isaac (Eds.), *Environmental Sustainability and Climate Change Adaptation Strategies* (pp. 64–96). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1607-1.ch003

Kobayashi, T. (2017). Introduction of Environmental Materials. In T. Kobayashi (Ed.), *Applied Environmental Materials Science for Sustainability* (pp. 1–18). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1971-3.ch001

Kumar, C. P. (2016). Impact of Climate Change on Groundwater Resources. In S. Dinda (Ed.), *Handbook of Research on Climate Change Impact on Health and Environmental Sustainability* (pp. 196–221). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8814-8.ch010

Kumar, K. V., Kumar, S. S., Selvakumar, A. I., & Kumar, R. S. (2016). Recent Techniques to Identify the Stator Fault Diagnosis in Three Phase Induction Motor. In P. Vasant & N. Voropai (Eds.), *Sustaining Power Resources through Energy Optimization and Engineering* (pp. 309–325). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-9755-3.ch013

Kumar, M. (2016). Environmental Sustainability in the Fashion Supply Chain in India. *International Journal of Social Ecology and Sustainable Development*, *7*(3), 1–33. doi:10.4018/IJSESD.2016070101

Kumar, M. (2017). Economic Evaluation of Solar Cooling Schemes. *International Journal of Energy Optimization and Engineering*, *6*(1), 23–48. doi:10.4018/IJEOE.2017010102

Kumar, R., Rao, P., & Areendran, G. (2017). Understanding Glacial Retreat in the Indian Himalaya: Historical Trends and Field Studies from a Large Glacier. In P. Rao & Y. Patil (Eds.), *Reconsidering the Impact of Climate Change on Global Water Supply, Use, and Management* (pp. 33–49). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1046-8.ch003

Kumari, S., & Patil, Y. (2017). Achieving Climate Smart Agriculture with a Sustainable Use of Water: A Conceptual Framework for Sustaining the Use of Water for Agriculture in the Era of Climate Change. In P. Rao & Y. Patil (Eds.), *Reconsidering the Impact of Climate Change on Global Water Supply, Use, and Management* (pp. 122–143). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1046-8.ch008

Kumari, S., Patil, Y., & Rao, P. (2017). An Approach to Sustainable Watershed Management: Case Studies on Enhancing Sustainability with Challenges of Water in Western Maharashtra. In P. Rao & Y. Patil (Eds.), *Reconsidering the Impact of Climate Change on Global Water Supply, Use, and Management* (pp. 252–271). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1046-8.ch014

Lallo, C. H., Smalling, S., Facey, A., & Hughes, M. (2017). The Impact of Climate Change on Small Ruminant Performance in Caribbean Communities. In W. Ganpat & W. Isaac (Eds.), *Environmental Sustainability and Climate Change Adaptation Strategies* (pp. 296–321). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1607-1.ch011

Lawrence, J., Simpson, L., & Piggott, A. (2015). Protected Agriculture: A Climate Change Adaptation for Food and Nutrition Security. In W. Ganpat & W. Isaac (Eds.), *Impacts of Climate Change on Food Security in Small Island Developing States* (pp. 196–220). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-6501-9.ch007

Li, K., & Kobayashi, T. (2017). Ionic Liquids and Poly (Ionic Liquid)s Used as Green Solvent and Ultrasound Responded Materials. In T. Kobayashi (Ed.), *Applied Environmental Materials Science for Sustainability* (pp. 327–346). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1971-3.ch015

Liapakis, A., Costopoulou, C., Tsiligiridis, T., & Sideridis, A. (2017). Studying Corporate Social Responsibility Activities in the Agri-Food Sector: The Greek Case. *International Journal of Agricultural and Environmental Information Systems*, *8*(1), 1–13. doi:10.4018/IJAEIS.2017010101

Loi, N. K., Huyen, N. T., Tu, L. H., Tram, V. N., Liem, N. D., Dat, N. L., & Minh, D. N. et al. (2017). Sustainable Land Use and Watershed Management in Response to Climate Change Impacts: Case Study in Srepok Watershed, Central Highland of Vietnam. In W. Ganpat & W. Isaac (Eds.), *Environmental Sustainability and Climate Change Adaptation Strategies* (pp. 255–295). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1607-1.ch010

Londhe, S. (2016). Impact of Climate Change on Agriculture and Food Security. *International Journal of Disease Control and Containment for Sustainability*, *1*(1), 32–46. doi:10.4018/IJDCCS.2016010103

Londhe, S. (2017). Inter Linkages of Water, Climate, and Agriculture. In P. Rao & Y. Patil (Eds.), *Reconsidering the Impact of Climate Change on Global Water Supply, Use, and Management* (pp. 166–194). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1046-8.ch010

Londhe, S. L. (2016). Climate Change and Agriculture: Impacts, Adoption, and Mitigation. In S. Dinda (Ed.), *Handbook of Research on Climate Change Impact on Health and Environmental Sustainability* (pp. 393–415). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8814-8.ch019

Maftei, C., & Papatheodorou, K. (2015). Mathematical Models Used for Hydrological Floodplain Modeling. In C. Maftei (Ed.), *Extreme Weather and Impacts of Climate Change on Water Resources in the Dobrogea Region* (pp. 240–283). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8438-6.ch009

Maharaj, R., Singh-Ackbarali, D., & Sankat, C. K. (2015). Postharvest Management Strategies. In W. Ganpat & W. Isaac (Eds.), *Impacts of Climate Change on Food Security in Small Island Developing States* (pp. 221–254). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-6501-9.ch008

Mahboob, Q. (2016). Identification of Reliability Critical Items in Large and Complex Rail Electrical Networks. In A. Ahmad & N. Hassan (Eds.), *Smart Grid as a Solution for Renewable and Efficient Energy* (pp. 226–248). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-0072-8.ch010

Mahmood, W. A., & Azarian, M. H. (2017). Inorganic-Organic Composite Materials from Liquid Natural Rubber and Epoxidised Natural Rubber Derivatives: Prospects and Applications. In T. Kobayashi (Ed.), *Applied Environmental Materials Science for Sustainability* (pp. 128–140). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1971-3.ch006

Majumder, J., Shah, P., & Kumar, S. (2016). Heat Stress Vulnerability among Indian Workmen. In S. Dinda (Ed.), *Handbook of Research on Climate Change Impact on Health and Environmental Sustainability* (pp. 61–80). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8814-8.ch004

Maximay, S. (2015). The Caribbean's Response to Climate Change Impacts. In W. Ganpat & W. Isaac (Eds.), *Impacts of Climate Change on Food Security in Small Island Developing States* (pp. 33–66). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-6501-9.ch002

Meldrum, H. M., Szymanski, D., Oches, E. A., & Davis, P. T. (2016). A Picture is Worth a Thousand Words: Commentary of Broadcast Meteorologists on the Visual Presentation of Climate Change. *International Journal of Social Ecology and Sustainable Development*, *7*(4), 1–16. doi:10.4018/IJSESD.2016100101

Mili, B., Barua, A., & Katyaini, S. (2016). Climate Change and Adaptation through the Lens of Capability Approach: A Case Study from Darjeeling, Eastern Himalaya. In S. Dinda (Ed.), *Handbook of Research on Climate Change Impact on Health and Environmental Sustainability* (pp. 455–469). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8814-8.ch023

Minea, G., Bandoc, G., & Neculau, G. (2015). Seasonal Statistical Variability of Precipitations in Dobrogea and Danube Delta. In C. Maftei (Ed.), *Extreme Weather and Impacts of Climate Change on Water Resources in the Dobrogea Region* (pp. 1–16). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8438-6.ch001

Minhas, D. M., & Hussain, S. (2016). Efficient Control Strategies to Optimize Electricity Cost and Consumer Satisfaction. In A. Ahmad & N. Hassan (Eds.), *Smart Grid as a Solution for Renewable and Efficient Energy* (pp. 69–96). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-0072-8.ch004

Mohapatra, M., & Baladhandautham, C. B. (2016). Implementation of Improved Control Strategy of DC-AC Converter using Delta-Sigma Modulator. In A. Ahmad & N. Hassan (Eds.), *Smart Grid as a Solution for Renewable and Efficient Energy* (pp. 249–272). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-0072-8.ch011

Moustache, A. M. (2015). Adaptation to Impacts of Climate Change on the Food and Nutrition Security Status of a Small Island Developing State: The Case of the Republic of Seychelles. In W. Ganpat & W. Isaac (Eds.), *Impacts of Climate Change on Food Security in Small Island Developing States* (pp. 96–129). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-6501-9.ch004

Mujere, N., & Moyce, W. (2017). Climate Change Impacts on Surface Water Quality. In W. Ganpat & W. Isaac (Eds.), *Environmental Sustainability and Climate Change Adaptation Strategies* (pp. 322–340). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1607-1.ch012

Mukherjee, S., & Chakraborty, D. (2016). Does Fiscal Policy Influence Per Capita CO2 Emission?: A Cross Country Empirical Analysis. In S. Dinda (Ed.), *Handbook of Research on Climate Change Impact on Health and Environmental Sustainability* (pp. 568–592). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8814-8.ch028

N'Yeurt, A. D., & Iese, V. (2015). Marine Plants as a Sustainable Source of Agri-Fertilizers for Small Island Developing States (SIDS). In W. Ganpat & W. Isaac (Eds.), *Impacts of Climate Change on Food Security in Small Island Developing States* (pp. 280–311). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-6501-9.ch010

Nersesian, R. L., & Strang, K. D. (2017). Feasibility Approaches to Reduce the Unreliability of Gas, Nuclear, Coal, Solar and Wind Electricity Production. *International Journal of Risk and Contingency Management*, *6*(1), 54–69. doi:10.4018/IJRCM.2017010104

Ngubevana, L. (2017). Sustainable Development Dilemmas of Biofuels Research and Production: A Snapshot in South Africa. *International Journal of Energy Optimization and Engineering*, *6*(2), 24–41. doi:10.4018/IJEOE.2017040102

Nyangon, J., Alabbas, N., & Agbemabiese, L. (2017). Entangled Systems at the Energy-Water-Food Nexus: Challenges and Opportunities. In P. Rao & Y. Patil (Eds.), *Reconsidering the Impact of Climate Change on Global Water Supply, Use, and Management* (pp. 144–165). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1046-8.ch009

Onutai, S., Jiemsirilers, S., & Kobayashi, T. (2017). Geopolymer Sourced with Fly Ash and Industrial Aluminum Waste for Sustainable Materials. In T. Kobayashi (Ed.), *Applied Environmental Materials Science for Sustainability* (pp. 165–185). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1971-3.ch008

Osmani, A. R. (2016). Greenhouse Gas Mitigation through Energy Efficiency: Perform, Achieve, and Trade (PAT) – India's Emission Trading Scheme. In S. Dinda (Ed.), *Handbook of Research on Climate Change Impact on Health and Environmental Sustainability* (pp. 537–566). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8814-8.ch027

Osmani, A. R. (2017). Tipaimukh Multipurpose Hydroelectric Project: A Policy Perspective – Indo-Bangla Priorities, Indigenous Peoples' Rights, and Environmental Concerns. In P. Rao & Y. Patil (Eds.), *Reconsidering the Impact of Climate Change on Global Water Supply, Use, and Management* (pp. 227–251). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1046-8.ch013

Ozpinar, A., & Ozil, E. (2016). Smart Grid and Demand Side Management: Application of Metaheuristic and Artificial Intelligence Algorithms. In A. Ahmad & N. Hassan (Eds.), *Smart Grid as a Solution for Renewable and Efficient Energy* (pp. 49–68). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-0072-8.ch003

Padigala, B. S. (2017). Traditional Water Management System for Climate Change Adaptation in Mountain Ecosystems. In P. Rao & Y. Patil (Eds.), *Reconsidering the Impact of Climate Change on Global Water Supply, Use, and Management* (pp. 9–32). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1046-8.ch002

Page, T. (2017). A Feasibility Study in Energy Harvesting from Piezoelectric Keyboards. *International Journal of Energy Optimization and Engineering*, *6*(2), 1–23. doi:10.4018/IJEOE.2017040101

Paul, S., & Roy, P. K. (2016). A Novel Optimization Algorithm for Transient Stability Constrained Optimal Power Flow. In P. Vasant & N. Voropai (Eds.), *Sustaining Power Resources through Energy Optimization and Engineering* (pp. 147–176). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-9755-3.ch007

Pieroni, A., & Iazeolla, G. (2016). Engineering QoS and Energy Saving in the Delivery of ICT Services. In P. Vasant & N. Voropai (Eds.), *Sustaining Power Resources through Energy Optimization and Engineering* (pp. 208–226). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-9755-3.ch009

Polprasert, J., Ongsakul, W., & Dieu, V. N. (2016). Improved Pseudo-Gradient Search Particle Swarm Optimization for Optimal Power Flow Problem. In P. Vasant & N. Voropai (Eds.), *Sustaining Power Resources through Energy Optimization and Engineering* (pp. 177–207). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-9755-3.ch008

Potiyaraj, P. (2017). Poly (Lactic Acid) Generated for Advanced Materials. In T. Kobayashi (Ed.), *Applied Environmental Materials Science for Sustainability* (pp. 106–127). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1971-3.ch005

Rale, V., & Tendulkar, P. (2017). Common Duckweeds as a Model System for Climate Change Impact Assessment. In P. Rao & Y. Patil (Eds.), *Reconsidering the Impact of Climate Change on Global Water Supply, Use, and Management* (pp. 364–372). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1046-8.ch019

Ramakrishna, A., & Bang, S. (2015). The Impacts of Climate Change on Food Security and Management in Papua New Guinea. In W. Ganpat & W. Isaac (Eds.), *Impacts of Climate Change on Food Security in Small Island Developing States* (pp. 67–95). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-6501-9.ch003

Rani, S. (2016). Assessment of Annual, Monthly, and Seasonal Trends in the Long Term Rainfall of the Garhwal Himalayas. In S. Dinda (Ed.), *Handbook of Research on Climate Change Impact on Health and Environmental Sustainability* (pp. 222–241). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8814-8.ch011

Rao, P., & Patil, Y. (2017). Recent Trends, Issues, and Challenges in Water Resource Development and Global Climate Change. In P. Rao & Y. Patil (Eds.), *Reconsidering the Impact of Climate Change on Global Water Supply, Use, and Management* (pp. 1–8). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1046-8.ch001

Ray, S. (2016). A Framework for Understanding Adaptation by Manufacturing Industries. In S. Dinda (Ed.), *Handbook of Research on Climate Change Impact on Health and Environmental Sustainability* (pp. 471–481). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8814-8.ch024

Roberts, T. G., & Rodriguez, M. T. (2015). An Overview of Climate Change and Impacts on Food Security in Small Island Developing States. In W. Ganpat & W. Isaac (Eds.), *Impacts of Climate Change on Food Security in Small Island Developing States* (pp. 1–31). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-6501-9.ch001

Roşu, L., & Macarov, L. I. (2015). Management of Drought and Floods in the Dobrogea Region. In C. Maftei (Ed.), *Extreme Weather and Impacts of Climate Change on Water Resources in the Dobrogea Region* (pp. 403–443). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8438-6.ch013

Roşu, L., & Zăgan, R. (2015). Management of Drought and Floods in Romania. In C. Maftei (Ed.), *Extreme Weather and Impacts of Climate Change on Water Resources in the Dobrogea Region* (pp. 345–402). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8438-6.ch012

Roy, J., Ghosh, D., Mukhopadhyay, K., & Ghosh, A. (2016). Exacerbating Health Risks in India due to Climate Change: Rethinking Approach to Health Service Provision. In S. Dinda (Ed.), *Handbook of Research on Climate Change Impact on Health and Environmental Sustainability* (pp. 1–25). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8814-8.ch001

Roy, P. K. (2016). A Novel Evolutionary Optimization Technique for Solving Optimal Reactive Power Dispatch Problems. In P. Vasant & N. Voropai (Eds.), *Sustaining Power Resources through Energy Optimization and Engineering* (pp. 244–275). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-9755-3.ch011

Roy, P. K., Dutta, S., & Nandi, D. (2016). Optimal Reactive Power Dispatch Incorporating TCSC-TCPS Devices Using Different Evolutionary Optimization Techniques. In P. Vasant & N. Voropai (Eds.), *Sustaining Power Resources through Energy Optimization and Engineering* (pp. 326–359). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-9755-3.ch014

Roy, P. K., & Ghosh, M. (2017). Combined Heat and Power Dispatch using Hybrid Genetic Algorithm and Biogeography-based Optimization. *International Journal of Energy Optimization and Engineering*, *6*(1), 49–65. doi:10.4018/IJEOE.2017010103

Samanta, D. (2016). Lack of Land Tenure Security as Challenges to Sustainable Development: An Assessment in the Context of Bihar, India. In S. Dinda (Ed.), *Handbook of Research on Climate Change Impact on Health and Environmental Sustainability* (pp. 348–362). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8814-8.ch017

Sasirekha, S., & Swamynathan, S. (2017). Fuzzy Rule Based Environment Monitoring System for Weather Controlled Laboratories using Arduino. *International Journal of Intelligent Information Technologies*, *13*(1), 50–66. doi:10.4018/IJIIT.2017010103

Satoh, M. (2017). Metal Ion Separation with Functional Adsorbents and Phytoremediation Used as Sustainable Technologies. In T. Kobayashi (Ed.), *Applied Environmental Materials Science for Sustainability* (pp. 284–312). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1971-3.ch013

Scorza, F. (2016). Towards Self Energy-Management and Sustainable Citizens Engagement in Local Energy Efficiency Agenda. *International Journal of Agricultural and Environmental Information Systems*, *7*(1), 44–53. doi:10.4018/IJAEIS.2016010103

Sen, S. K., & Pookayaporn, J. (2017). Role of Water-Energy-Waste Inter-Relatedness to Drive Sustainability amid Climate Concerns. In P. Rao & Y. Patil (Eds.), *Reconsidering the Impact of Climate Change on Global Water Supply, Use, and Management* (pp. 195–210). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1046-8.ch011

Senapati, S., & Gupta, V. (2016). Impacts of Climate Change on Fish Productivity: A Quantitative Measurement. In S. Dinda (Ed.), *Handbook of Research on Climate Change Impact on Health and Environmental Sustainability* (pp. 243–260). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8814-8.ch012

Senapati, S., & Gupta, V. (2016). Vulnerability to Climate Change: Issues and Challenges towards Developing Vulnerability Indicator. In S. Dinda (Ed.), *Handbook of Research on Climate Change Impact on Health and Environmental Sustainability* (pp. 82–104). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8814-8.ch005

Serban, C., & Maftei, C. (2015). Using Grid Computing and Satellite Remote Sensing in Evapotranspiration Estimation. In C. Maftei (Ed.), *Extreme Weather and Impacts of Climate Change on Water Resources in the Dobrogea Region* (pp. 145–173). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8438-6.ch006

Shanmuganathan, S., Narayanan, A., & Medagoda, N. P. (2016). Temporal Data Analysis and Mining Methods for Modelling the Climate Change Effects on Malaysia's Oil Palm Yield at Different Regional Scales. In S. Dinda (Ed.), *Handbook of Research on Climate Change Impact on Health and Environmental Sustainability* (pp. 482–513). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8814-8.ch025

Singh, R. K. (2017). Impact of Climate Change on the Retreat of Himalayan Glaciers and Its Impact on Major River Hydrology: Himalayan Glacier Hydrology. In P. Rao & Y. Patil (Eds.), *Reconsidering the Impact of Climate Change on Global Water Supply, Use, and Management* (pp. 70–83). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1046-8.ch005

Singh-Ackbarali, D., & Maharaj, R. (2017). Mini Livestock Ranching: Solution to Reducing the Carbon Footprint and Negative Environmental Impacts of Agriculture. In W. Ganpat & W. Isaac (Eds.), *Environmental Sustainability and Climate Change Adaptation Strategies* (pp. 188–212). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1607-1.ch007

Siwe, A. T., & Tembine, H. (2016). Energy Cost Saving Tips in Distributed Power Networks. In A. Ahmad & N. Hassan (Eds.), *Smart Grid as a Solution for Renewable and Efficient Energy* (pp. 26–48). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-0072-8.ch002

Srivastava, N. (2016). Climate Change Mitigation: Collective Efforts and Responsibly. In S. Dinda (Ed.), *Handbook of Research on Climate Change Impact on Health and Environmental Sustainability* (pp. 427–439). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8814-8.ch021

Stennikov, V., Barakhtenko, E., Sokolov, D., & Oshchepkova, T. (2016). Problems of Modeling and Optimization of Heat Supply Systems: New Methods and Software for Optimization of Heat Supply System Parameters. In P. Vasant & N. Voropai (Eds.), *Sustaining Power Resources through Energy Optimization and Engineering* (pp. 76–101). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-9755-3.ch004

Stennikov, V., Oshchepkova, T., & Stennikov, N. (2016). Problems of Modeling and Optimization of Heat Supply Systems: Methods to Comprehensively Solve the Problem of Heat Supply System Expansion and Reconstruction. In P. Vasant & N. Voropai (Eds.), *Sustaining Power Resources through Energy Optimization and Engineering* (pp. 26–53). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-9755-3.ch002

Stennikov, V., Penkovskii, A., & Khamisov, O. (2016). Problems of Modeling and Optimization of Heat Supply Systems: Bi-Level Optimization of the Competitive Heat Energy Market. In P. Vasant & N. Voropai (Eds.), *Sustaining Power Resources through Energy Optimization and Engineering* (pp. 54–75). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-9755-3.ch003

Stennikov, V. A., & Postnikov, I. V. (2016). Problems of Modeling and Optimization of Heat Supply Systems: Methodological Support for a Comprehensive Analysis of Fuel and Heat Supply Reliability. In P. Vasant & N. Voropai (Eds.), *Sustaining Power Resources through Energy Optimization and Engineering* (pp. 102–126). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-9755-3.ch005

Stone, R. J. (2017). Modelling the Frequency of Tropical Cyclones in the Lower Caribbean Region. In W. Ganpat & W. Isaac (Eds.), *Environmental Sustainability and Climate Change Adaptation Strategies* (pp. 341–349). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1607-1.ch013

Swain, M. (2016). Vulnerability to Local Climate Change: Farmers' Perceptions on Trends in Western Odisha, India. In S. Dinda (Ed.), *Handbook of Research on Climate Change Impact on Health and Environmental Sustainability* (pp. 139–155). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8814-8.ch007

Swain, M., & Swain, M. (2016). Evolution and Efficacy of Drought Management Policies and Programmes: The Case of Western Odisha, India. In S. Dinda (Ed.), *Handbook of Research on Climate Change Impact on Health and Environmental Sustainability* (pp. 176–194). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8814-8.ch009

Takahashi, Y. (2017). Eco-Friendly On-Site Water Analyses for Ultra-Trace Harmful Ions. In T. Kobayashi (Ed.), *Applied Environmental Materials Science for Sustainability* (pp. 313–326). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1971-3.ch014

Taokaew, S., Phisalaphong, M., & Newby, B. Z. (2017). Bacterial Cellulose: Biosyntheses, Modifications, and Applications. In T. Kobayashi (Ed.), *Applied Environmental Materials Science for Sustainability* (pp. 255–283). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1971-3.ch012

Tauch, S., Liu, W., & Pears, R. (2016). Measuring Cascading Failures in Smart Grid Networks. In A. Ahmad & N. Hassan (Eds.), *Smart Grid as a Solution for Renewable and Efficient Energy* (pp. 208–225). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-0072-8.ch009

Trang, T. T. (2017). Study on the Use of Biomass Polymer Sheets in Water/Alcohol Pervaporation as a Sustainable Source of Alcohol Energy. In T. Kobayashi (Ed.), *Applied Environmental Materials Science for Sustainability* (pp. 234–254). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1971-3.ch011

Tsiaras, S. (2017). Exploring the Impact of Tourism to the Sustainable Development of Mountain Regions: Implications of the Climatic Conditions. *International Journal of Agricultural and Environmental Information Systems*, *8*(1), 14–28. doi:10.4018/IJAEIS.2017010102

Tugjamba, N., Yembuu, B., Gantumur, A., & Getsel, U. (2016). Policy Provisions and Teachers Needs on Climate Change Education for Sustainable Development in Mongolia. *International Journal of Asian Business and Information Management*, *7*(4), 36–48. doi:10.4018/IJABIM.2016100103

Tyukhov, I., Rezk, H., & Vasant, P. (2016). Modern Optimization Algorithms and Applications in Solar Photovoltaic Engineering. In P. Vasant & N. Voropai (Eds.), *Sustaining Power Resources through Energy Optimization and Engineering* (pp. 390–445). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-9755-3.ch016

Uddin, Z., Shah, N., Ahmad, A., Mehmood, W., & Alam, F. (2016). Signal Processing Techniques in Smart Grids. In A. Ahmad & N. Hassan (Eds.), *Smart Grid as a Solution for Renewable and Efficient Energy* (pp. 273–297). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-0072-8.ch012

Ventrapragada, E. A., & Rayavarapu, N. (2017). Climate Change and Agriculture: Time for a Responsive and Responsible System of Water Management. In P. Rao & Y. Patil (Eds.), *Reconsidering the Impact of Climate Change on Global Water Supply, Use, and Management* (pp. 326–363). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-1046-8.ch018

Wang, Q., & Liu, H. (2017). Optimized Base Station Sleeping and Renewable Energy Procurement Scheme Using PSO. *International Journal of Swarm Intelligence Research*, *8*(1), 54–73. doi:10.4018/IJSIR.2017010103

Wong, J., & Lim, Y. S. (2016). Revolution of Energy Storage System in Smart Grids. In A. Ahmad & N. Hassan (Eds.), *Smart Grid as a Solution for Renewable and Efficient Energy* (pp. 181–206). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-0072-8.ch008

Wu, Y., Tan, X., Qian, L. P., Tsang, D. H., Song, W., & Yu, L. (2016). Management of Scheduling and Trading in Hybrid Energy Trading Market. In A. Ahmad & N. Hassan (Eds.), *Smart Grid as a Solution for Renewable and Efficient Energy* (pp. 123–148). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-0072-8.ch006

Xiang, M., Liu, W., Bai, Q., & Al-Anbuky, A. (2016). Dynamic Trust Elective Geo Routing to Secure Smart Grid Communication Networks. In A. Ahmad & N. Hassan (Eds.), *Smart Grid as a Solution for Renewable and Efficient Energy* (pp. 323–343). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-0072-8.ch014

Zăgan, S., & Chiţu, M. (2015). The Influence of Air Temperature on the Quality Parameters of the Black Sea Coastal Waters. In C. Maftei (Ed.), *Extreme Weather and Impacts of Climate Change on Water Resources in the Dobrogea Region* (pp. 174–204). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8438-6.ch007

Zharkov, S. (2016). Assessment and Enhancement of the Energy Supply System Efficiency with Emphasis on the Cogeneration and Renewable as Main Directions for Fuel Saving. In P. Vasant & N. Voropai (Eds.), *Sustaining Power Resources through Energy Optimization and Engineering* (pp. 1–25). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-9755-3.ch001

About the Contributors

Alexander G. Flor is UP Scientist, Full Professor and Dean of the Faculty of Information and Communication Studies, University of the Philippines (Open University). He holds the One UP Professorial Chair on Knowledge Management (KM4D), serves as Senior Research and Extension Fellow of the UP Resilience Institute, and coordinates the UPOU Doctor of Communication program. Formerly Vice Chancellor for research and development, he was the first Chair of the Commission on Higher Education-Technical Committee on Alternative Learning Systems. He was Research Fellow at the East West Center Institute of Culture and Communication, Honolulu, under the Fulbright-PAEF program (1989-1991). For the past 35 years, Professor Flor has been engaged as technical adviser to international development assistance undertakings in 16 countries.

Benjamina Gonzalez-Flor is Associate Professor of Development Communication, University of the Philippines Los Baños. She concurrently serves as Director of the UPLB Learning Resource Center and Chair of the Master of Development Communication Program of the UP Open University. Prior to joining the academe, she was chief of the Monitoring and Evaluation Division of the Commission on Higher Education under the Office of the President of the Philippines. Dr Flor has been engaged as program coordinator of the AusAID-funded Philippines-Australia Short Term Training Program and team leader in World Bank projects in Pakistan, Lao PDR and the Philippines, the most recent being the Technical Assistance for Baseline Studies under the Philippine Climate Change Adaptation Project.

Index