COMMUNICATING CLIMATE CHANGE IN THE RICE SECTOR

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with

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THE infomediary CAMPAIGN
SINCE 2012

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November 2017

Disclaimer: All positions and views expressed in this book are sole responsibilities of the authors who do not claim to represent the Philippine Rice Research Institute (PhilRice), Department of Education (DepEd), or CGIAR Research Program on Climate Change, Agriculture, and Food Security (CGIAR-CCAFS).

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Foreword

Rice agriculture is among the sectors most vulnerable to the adverse impacts of climate change.

Yet, it appears that little is written about how to communicate climate change among rice stakeholders, especially the resource-poor farmers. The necessity of communication has at some point been neglected as people would oftentimes just leave it to common sense. Over the years, as we get to know more about this phenomenon, we realize that it is highly complex, and along with it is the difficulty of effectively conveying educational messages across our stakeholders.

This book works at helping fill that gap. It is still a long shot from where it is supposed to be, but it is, nonetheless, a deliberate attempt to provide some guidance on how people involved in communicating climate change in the rice agriculture sector should tackle this important and highly complex, at times intellectual, discourse.

The necessity of communication has at some point been neglected as people would oftentimes just leave it to common sense.

The book has two parts. The first is drawn from literature review on some key principles that delve on communicating climate change. While the principles are for climate change in general, the authors situated these principles in the agriculture context. The second part is drawn from the completed project of the authors co-funded by PhilRice and the CGIAR Research Program on Climate Change, Agriculture, and Food Security on integrating climate change in high school curriculum. The project was executed with and fully supported by the Department of Education.

This book is part of the project *"Development of Agriculture TecVoc High Schools Offering Crops Production as Key Information Hubs on Climate Change-Ready Rice Production Technologies for Improved Agricultural Productivity"* funded by the DA - Bureau of Agricultural Research.

Agricultural extension workers, newbies in agricultural communication, and colleagues in the Department of Agriculture who are oftentimes tasked to talk about climate change in ordinary man's language will benefit from this book.

While the context is on rice, which is understandable owing to the credentials and exposures of the authors and the host Institute, we encourage readers to see how the principles can fit into their respective contexts.

Read on, and do give us feedback so we can enrich this initial work on climate change communication in the rice sector, Philippine setting.

SAILILA E. ABDULA
Executive Director, PhilRice

Acknowledgment

This work is a product of several months of critical reflection buffered by our half-a-decade work in rural communities in the Philippines. What we have done basically is capture those experiences and situate them in the larger literature on climate change communication.

We are very thankful for the funding provided by the DA-Bureau of Agricultural Research under the project, *"Development of Agriculture TecVoc High Schools Offering Crops Production as Key Information Hubs on Climate Change-Ready Rice Production Technologies for Improved Agricultural Productivity."* This project that matures in 2018 should give us the opportunity to sustain this discourse further as we explore the founding of climate change-ready schools in rice-farming communities.

We also thank our reviewers: Dr. Ricardo F. Orge and Mr. Ruben B. Miranda (PhilRice); Rosa Pilipinas F. Francisco (University of the Philippines Los Baños); Robert L. Domoguen (DA-Cordillera Administrative Region); Dr. Yusuf Sucol (UPLB Climate Risk Studies Center); Dr. Antonio J. Alcantara and Loucel E. Cui (UPLB School of Environmental Science and Management); Engr. Renato B. Dela Cruz (DA-Agricultural Training Institute); and Emilia B. Bordado (DA-Bicol Region). We benefited much from their admonitions especially in steering this book to a much clearer and substantive direction.

For the second part of this book, we draw quite significantly from our work with the CGIAR Research Program on Climate Change, Agriculture and Food Security; hence, we thank our colleagues at CGIAR-CCAFS for the opportunity to explore the subject matter further.

We thank the teachers whom we have always referred to in many publications as our champions in advancing knowledge on climate change-ready technologies on rice in the countryside. They always say that they learn a lot whenever they come to PhilRice for training programs. In return, we say that their contributions in their respective areas inspire creativity and enthusiasm among us.

We owe so much to the farmers we have had random conversations with during our fieldwork. Their wisdom, which is oftentimes not documented, inspired us to put everything together so we could come up with this book. We hope that we are able to give justice to their inputs in this publication.

We thank our teammate Teofilo C. Paulino for creating a database of articles that we have reviewed, which facilitated the search and retrieval process whenever we had to access them.

We also thank our colleagues at PhilRice for their stories on doing lectures on climate change, field experiences, and short and extemporaneous exchanges of ideas while on travel on how to communicate climate change among our clients.

We thank God, too, for giving us the wisdom, perseverance, and diligence to finish this work.

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Science City of Muñoz, Nueva Ecija, November 2017

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Smilingly preparing seedlings for transplanting.

Introduction

There is voluminous literature on climate change—its science, controversies, and known and calculated impacts on humanity. At some point, there is a tendency to associate or even blame all noticeable changes in our world on climate change.

While the science of climate change has been hugely (to the point of permeating fear) covered, climate change communication especially in the agriculture sector remains inadequately explored. In this book, we try to come up with ways on how to better communicate climate change in agriculture by immersing ourselves into the literature on climate change communication and seasoning it with our experiences in carrying out a climate change-related project with the CGIAR Research Program on Climate Change, Agriculture, and Food Security.

Communication-related issues on climate change abound even in most advanced countries like the United States. From confusions in terminology (for instance, greenhouse effect vs global warming vs climate change), integration issues in school curriculum to communication styles—all these accounts remain unsettled. Additionally, the literature has, at some point, practically gravitated around general climate change and mitigation issues, not much on how it relates to agriculture and on adaptation issues—which are major issues for countries like the Philippines.

This book does not pretend to be instructive. We only aim to help fuel and sustain the discourse on climate change communication in the rice agriculture sector. In whatever way, we in the agriculture sector should start talking more sensibly about how to deliver information on climate change to our stakeholders. We owe it to them.

The book is divided into two parts, the first of which has four chapters. Chapter 1 begins by presenting an overview of climate change in the Philippines and its impact on rice production. Chapter 2 speaks about the key characteristics of the likely audience of climate change communication endeavors in the context of rice farming. Chapter 3 follows with some specific recommendations on how to go about communicating climate change. We try to make sense of the concepts enumerated in the literature drawn from different disciplines such as science communication, risk communication, and psychology. Chapter 4 answers the question: what are the climate change-ready technologies available for the rice farmers? Often, it is not enough to introduce theories to farmers; they would ask for down-to-earth technology samples. Here, we present the technologies available and explain how they can be climate change-resilient.

The second part of this book, with three chapters, details our experiences in integrating Climate-Smart Agriculture for Rice (CSA4Rice) in high school curriculum. Chapter 5 exposes the perceptions and sources of information of students on climate change. Chapter 6 goes in-depth in explaining the information-seeking behavior of students on climate change and the infomediation process, or simply how the searching and sharing of information transpired. Finally, chapter 7 chronicles and documents success stories and innovations of some of the best implementers of the project, as well as immediate issues encountered and ways forward.

People who do extension work, and students and practitioners in development communication are the targets of the first part of this book. The tips it provides are designed to help satisfy some of the curiosities in communicating climate change; it even identifies concerns that might be good to prepare for in dealing with the audience at large. Chapter 4 is written particularly for extension workers as it parades a range of climate change-ready technologies and best practices available for farmers. For development communication practitioners and students, Part 1 carries inputs in the area of science and/or risk communication.

Part 2 is more for communicators who would like to do the same work with students and explore the intersections among young people, rice production, and climate change, they be from the private or public sector. It presents empirical data and an array of field-based experiences.

It helps to put forward that this is not a book about the basics of climate change. We can refer you instead to the series of reports released by the Intergovernmental Panel on Climate Change for authoritative inputs and advisories on the phenomenon. Additionally, we are aware of the ongoing intellectual battle among scientists whether what is going on is truly climate change or simply climate variability. And we are likewise informed of the controversies stemming from occurrences of floods, droughts, and other weather extremes being associated to climate change. In this book, we position ourselves on the shielded side of the strong consensus that indeed anthropogenic (human-caused) climate change is escalating (IPCC, 2014).

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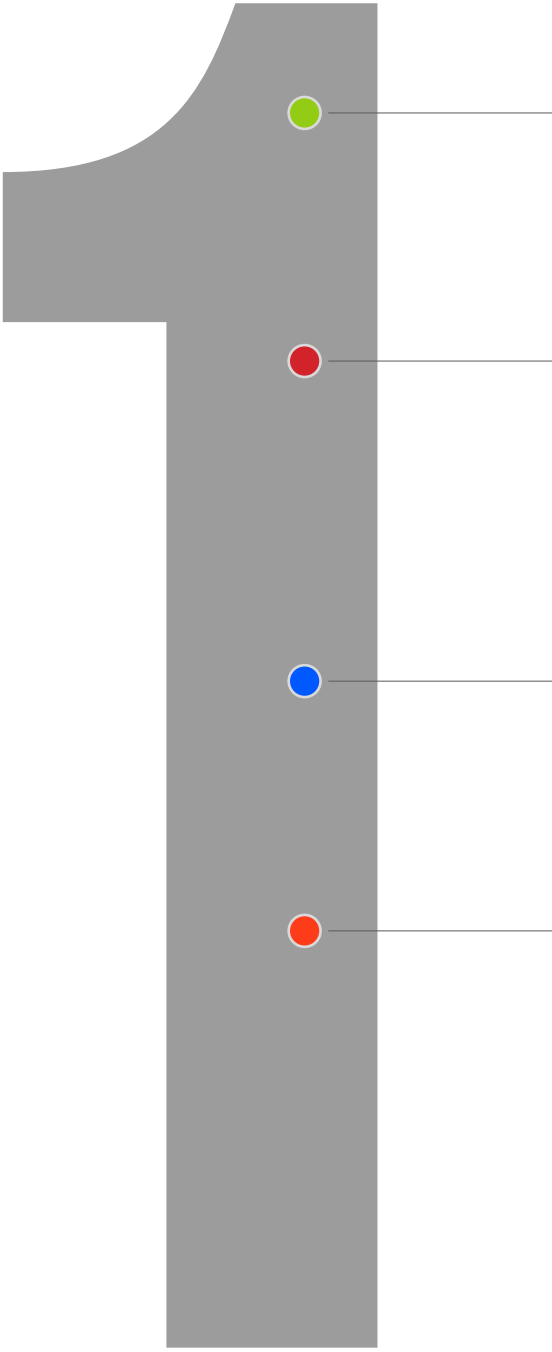
Rice seedlings mature enough
for transplanting.

PART



This part is composed of four chapters:

Chapter 1:

Climate change and rice production. This gives a brief overview of climate change and its impacts on rice production. It has some data on how badly the country has been losing from extreme weather events.

Chapter 2:

Who, by the way, is your audience? It peeks on some of the key socio-demographic characteristics of the audience. It also gives information from several research studies on the perceptions, attitudes, knowledges, adaptation mechanisms, and impacts of climate change on the rice-farming household.

Chapter 3:

Practical tips in communicating climate change. It outlines the key objectives in a climate change communication endeavor as well as some specific tips on how to communicate the climate change phenomenon in the rice-farming context.

Chapter 4:

Climate change-ready technologies at PhilRice. Resembling a catalog, it helps communicators identify technologies that would ground their authority when talking about climate change adaptation and mitigation.

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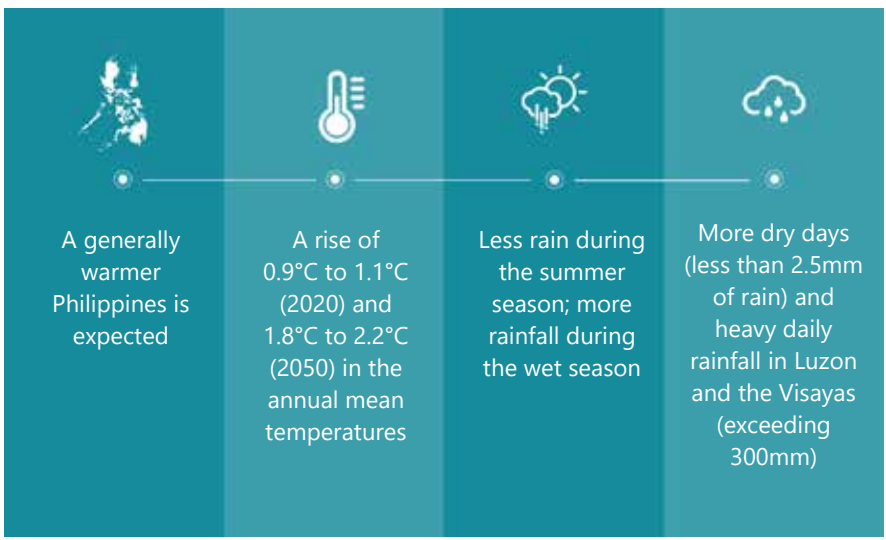
Preparing the land before transplanting.

1

CLIMATE CHANGE AND RICE PRODUCTION

It is globally recognized that climate change is making food production increasingly more difficult. This is happening at a time when world population continues to increase, and is estimated to balloon to 11 billion in year 2100. Producing more food in difficult times is indeed a complicated challenge.

The Philippine Atmospheric, Geophysical, and Astronomical Services Administration (PAGASA) notes that an average of 20 typhoons enter the Philippine Area of Responsibility yearly with some of them making highly damaging landfall. The *Climate Change in the Philippines* document released several future climate scenarios through 2050 (PAGASA, 2011):



The same document also projects temperature increases for 2020 and 2050 in all provinces given different emission scenarios. It calculates general impacts of climate change on important sectors such as health, water resources, forestry, and agriculture. For rice, the document notes the possibility of increased spikelet sterility given hotter temperatures, pest migration, and more frequent occurrence of diseases in agriculture in general. Other impacts on rice are poorer grain quality (Fitzgerald & Resurreccion, 2009), possibility of rodents infestation (Singleton, Belmain, Brown, Aplin, & Htwe, 2010), and decline in access to irrigation water, which is a major issue for rice as it needs "2-3 times more water than other cereals" (Hafeez, Bundschuh, & Mushtaq, 2014, p. 890)

A study by Buan, Maglinao, Evangelista, and Pajuelas (1996) notes that from 1968 to 1990, tropical cyclones and floods comprised 48% of the losses in rice and corn; 38% due to droughts; and 18% due to pests and diseases (p.4). In *The Philippine Strategy for Climate Change Adaptation, 2010-2022* document (DENR, 2010), it is reported that agricultural damage from worst typhoons in the country from 1990 to 2007 amounted to P95.8B. The 1991-1995 period saw the biggest losses at P28.4B, and the month of October suffered the most damage at P46.5M. Said losses were more than enough to cover some of the major government projects on education and infrastructure.

It is for this reason that PhilRice has made strong reference to climate change in its *Strategic Plan for 2017 to 2022* (PhilRice, 2016). The Institute has lined up several targets that will help the farmers continue planting rice even in most trying circumstances.

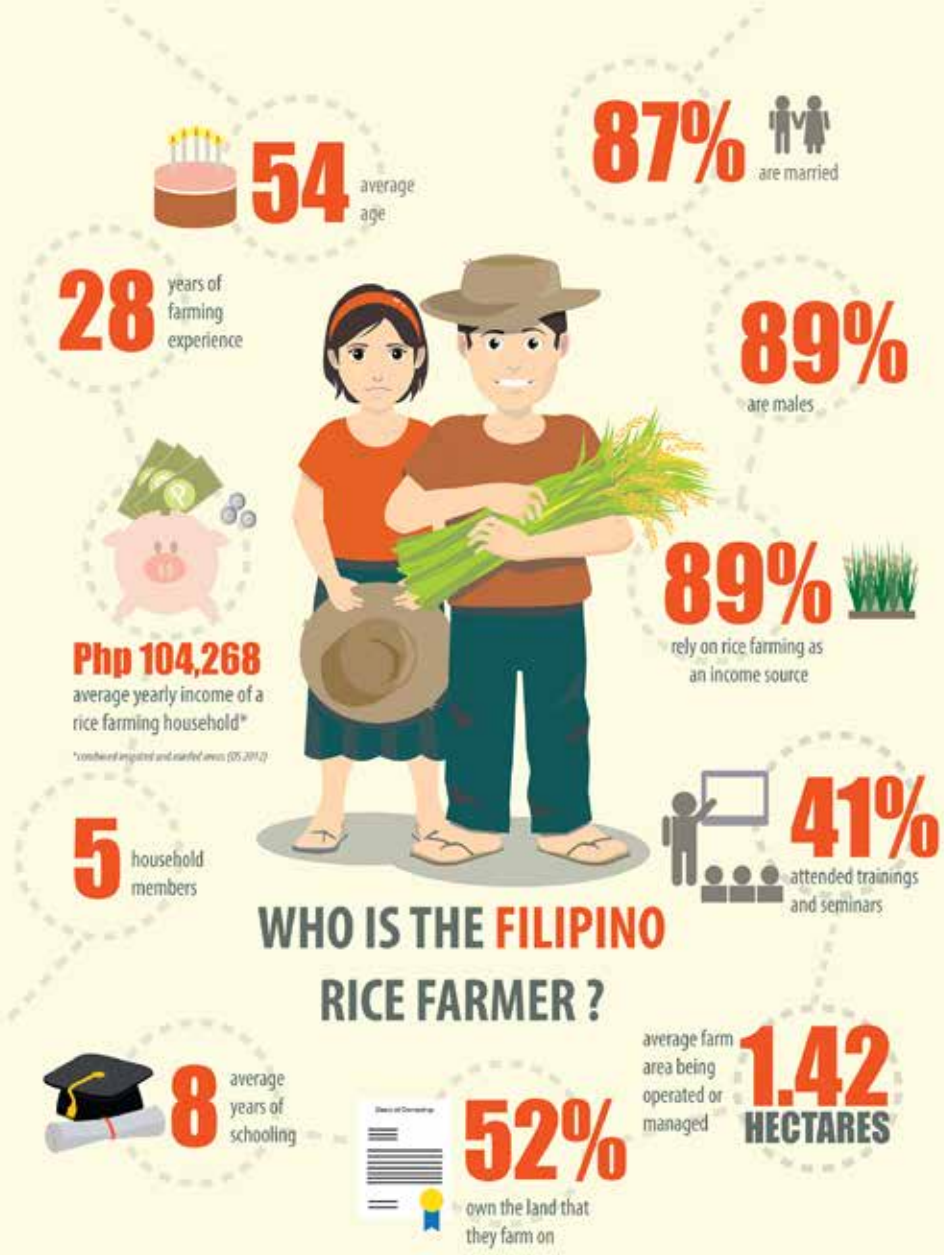
For instance, the Plan makes reference to heat tolerance research on rice anticipating temperature increases in the future. Measures to address water scarcity are also in the Plan especially those that will help farmers source water in times of drought. Development efforts of the Institute are also geared at ensuring that farmers are thoroughly informed when it comes to making decisions in relation to rice farming.

Aside from PhilRice, organized farmers would do well to look into the services being offered by other agencies such as the Agricultural Training Institute for training programs on climate change adaptation, formal and non-formal lending entities, and the Department of Agriculture itself for quick responses to climate change-related issues or emergencies.

Anilao, Iloilo
Drying rice grains for milling.

Interested parties will also benefit from the highly informative and updated website of PAGASA (http://pagasa.dost.gov.ph/). Its special section *"Climate Change in the Philippines"* offers a rich source of information such as monthly climate outlook assessment and rainfall forecast, 4-hour rainfall forecast, and farm advisories. The website also has plenty of maps that can be used in agriculture such as risk, flood, and regional severe hazard maps.

As it stands, the time is high that efforts to enhance adaptive capacities of farmers to climate change must be enhanced. Among the important initiatives along this line is improving the way climate change is being communicated to the major stakeholders. This is what we will unpack in the succeeding chapters of this book.



Characteristics of the Filipino rice farmers drawn from the 2012 Rice-Based Farm Households Survey by PhilRice and Philippine Statistics Authority.

INFOGRAPHICS BY ANDREI LANUZA (Also appeared in PhilRice Magazine, Vol. 29, No. 4, 2016)

2

WHO, BY THE WAY, IS YOUR AUDIENCE?

That our farmers are aging has been talked and written about widely, formally or informally, prompting the DA Secretary to emphasize youth engagement in agriculture in his agenda. The data above includes matters that are not often tackled in discussions about our farmers.

The 41% who had attended farmers' training programs and seminars are information seekers who invest their time and money to learn new technologies. This fact becomes clearer when matched with the data from the PhilRice Text Center, an SMS platform on rice created by the then Open Academy for Philippine Agriculture (Open Academy for Philippine Agriculture, 2009). On average, the PTC receives 300 text messages from its clients, mostly farmers asking different rice farming-related questions.

Manalo, Balmeo, Berto, and Saludez (2016) noted that teacher-child (student)-farmer interaction is also growing (more on this in the second part of the book). They attested that the farmers have been exchanging information on rice production technologies with the teachers whom PhilRice trained, especially when the teachers conduct agricultural extension events in the community. Recently, the PhilRice corporate Facebook page has increased sharply its daily reach to more than 3,900 people (S.P. Pasiona, personal communication, September 20, 2017). It is not unwise to assume that a good number of those visitors would be farmers.

Farming experience of Filipino farmers cannot be underestimated: 28 years. This guarantees that farmers whom you are likely to meet carry with them a good dose of knowledge drawn from training programs and close to three decades of actual rice farming.

Two issues of the PhilRice magazine, in 2006 and in 2015a, documented stories of what many would call as non-conventional farmers. These are professionals who have retired from their work, or newbies who dwell in the cities and would like to try on new things. Rice farming is becoming more diverse, which then requires different communication approaches.

As regards climate change, recent particular findings are worth looking into. These are from studies on perceptions, knowledges, attitudes, sources of information, adaptation mechanisms, and impacts on farmers. While we advise you to consider these findings, we would like to invite you to always remember that climate change will impact places and areas in different ways. Hence, some of these results may or may not apply in your respective areas. The strength of these studies is that they provide general information on issues, which you may have to address where appropriate.

Studies conducted in Albay (Uy, Takeuchi, & Shaw, 2011), Cagayan Valley (Evangelista, Cruz, & Lasco, 2016), Bohol (Lasco, Espaldon, & Habito, 2016), and Ifugao (Soriano, Diwa, & Herath, 2017) report that farmers have been experiencing changes in the usual weather in their areas, which are comparable with trends reported by the Intergovernmental Panel on Climate Change. These are either growing number of hotter days, more frequent weather extremes such as droughts and typhoons, and heavy rainfall. Mass media (TV in particular) serve as their main sources of information on climate change (Evangelista et al., 2016). Manalo et al. (2016) note that the PhilRice Text Center and PinoyRice also became popular sources of information on climate change in their study sites.

Adaptation is seen in quite a number of ways. Some scholars see it in terms of access to credit, applying certain practices on-field, and combining disaster risk reduction with climate change adaptation. When it comes to access to credit, neighbors (Acosta-Michlik & Espaldon, 2008) and microfinance institutions (Tatlonghari, 2014) are important sources of money. This is usually relevant to buying inputs or starting all over again after an extreme weather event that devastates crops.

At the practice level, changing varieties and adjusting cropping calendars have been reported as among the practices most employed by farmers. Manalo et al. (2016) noted that inexpensive rice production technologies easily find their way into the farmers' fields. The opposite happens for highly complex and resource-intensive technologies (employing a machine, for instance). Meanwhile, Soriano et al. (2017) in their study in Ifugao emphasize that in dealing with climate change adaptation, indigenous knowledge must have equal weight with Western Science. It should be noted that the *Climate Change Adaptation Plan* mentioned earlier also made general reference to the importance of traditional and indigenous knowledge in coping with the impacts of climate change.

A thesis by Tan (2013) problematizes different adaptation and mitigation combinations to climate change. Crop diversification, for instance, is good as it increases the income of the household. On the other hand, depending on the crop combinations, diversification may also increase greenhouse gas emissions as some crops require more fertilizer than others. She also made a point on agroforestry as one that enables farmers to adapt to and mitigate the impacts of climate change at the same time. Agroforestry is quite strong in climate change literature in the Philippines (Evangelista et al., 2016; Lasco et al., 2016).Tan stresses the need for careful thought to ensure that well-intentioned mechanisms to adapt to the impacts of climate change may serve their purpose.

In the larger scheme of things, there are also moves to integrate climate change adaptation with disaster risk reduction (Oxfam, 2010). This is where issues relating to social protection come in. This one makes sense as the impacts of climate change cut across sectors. Oftentimes, it is not just about loss of livelihood, but loss of lives as well. And for those who survive disasters, getting back to one's feet surely causes several stresses such as, for instance, a male head of a household who would engage more frequently in drinking bouts (Tatlonghari, 2014) because of his inability to provide well for the family; or some instances of death as noted in the study of Chandra, Dargusch, McNamara, Caspe, and Dalabajan (2017).

While climate change is obviously a threat to the livelihoods of farmers, adapting to it does not always follow outright. Several factors stand in the way. Acosta-Michlik and Espaldon (2008) in their study in three villages in Tanauan City in Batangas note inadequacy of financial resources and unawareness of needed information heighten the vulnerability of the locals. Same findings were reported by Uy et al. (2011) in Albay and Evangelista et al. (2016) in Cagayan Valley.

In sum, this chapter endeavors to introduce you to your potential audience. It also peeks on the complexities of climate change as regards its impacts on farmers, and, by extension, the peculiarities of communicating climate change. Skills relating to high social sensitivities are very much necessary. Climate change communication is more than just bringing in new technologies and creating beautiful powerpoint presentations. Having a deep sense of understanding of what goes on in your respective communities and knowing exactly where your audience is coming from are central to your success in this area.

Camiling, Tarlac

Deep breathing can ease rice transplanting.

3

PRACTICAL TIPS IN COMMUNICATING CLIMATE CHANGE

For a busy extension worker or any communicator for our purposes, the main question s/he will ask is: What are the key things that I should remember when talking or writing about climate change in relation to agriculture? For this chapter, we did a good search on the literature on climate change communication. We bring into the table insights from science communication, risk communication, psychology, and other disciplines. The tips are inexhaustive, but they should be able to guide randomly picked, oftentimes untrained, speakers in discussing about climate change. What we did is to make sense of the concepts available and apply them in our context in agriculture.

But before we start presenting these tips, it might be good to look into the main objectives in communicating climate change. To be sure, communication endeavors will have different purposes, but in general Moser (2010, p.38) identified three main purposes in communicating climate change: (1) inform and educate individuals; (2) achieve some type and level of social engagement and action; and (3) bring about changes in social norms and cultural values.

The purposes are interrelated such that achieving the first will lead to the second and then to the third. In relation to rice farming, the first purpose is not very difficult to understand. In the previous chapter, we learned how confusions about the science of climate change permeate on the ground. And we contend that this is not just among farmers, this also happens among teachers in developed countries. The point is there is a need for massive information dissemination on climate change. While it does not answer all adaptation-related issues, it does bring us a step closer to enhancing adaptive capacities of farmers to climate change.

The second purpose centers on pushing people to do something about the situation. After educating your audience, it is hoped that some forms of social engagement will be achieved. People need to act on climate change. In our context, the goal is enhancing adaptive capacities. The third purpose talks about having some tangible changes in the community. In the context of rice farming, this could mean putting into practice resource-conserving technologies or applying some adaptation models in the rice farm *(more on this in Chapter 3).*

Having explained the purposes, we now go to some tips in communicating climate change within the rice-farming context. For this part, we draw on tips from the principles available in the literature, and apply them in our context.

LEVEL OFF

A common mistake is to assume that our intended audience knows quite a lot about climate change (Center for Research on Environmental Decisions, 2009). Hence, there is a tendency to gloss over important terminologies and start talking about climate change as though you and your audience are on the same page. Researchers have raised the alarm that while staff members of research and other learning institutions are overly familiar with and alarmed by climate change, the same cannot be said of the people in the rural areas. Depending on where one is coming from, rural folks can be perceived to not care much about these things that people in the academe or research tend to worry so much about. It is either they do not care much about it or that they have long been coexisting with weather extremes, and have already appropriated solutions as they see fit. That said, it would be good to ask where the audience is relative to climate change. One may want to look into the knowledges, attitudes, and practices related to climate change.

READ UP ON TERMINOLOGIES

It may come as a surprise that even in most developed countries confusions on climate change terminologies abound (Herman, Feldman, & Vernaza-Hernandez, 2017; Ratinen, Viiri, & Lehesvuori, 2013). For instance, the differences between greenhouse effect vs global warming vs climate change are not always known. Often there is a tendency to use these terms interchangeably, which is inappropriate.

AVOID BLAME-IT-ALL TENDENCIES

There is a tendency for people to blame everything on climate change. For instance, it rained hard; the chance is high that someone will refer to it as caused by climate change. Additionally, there is often this feeling that climate change is something that one cannot do something about. Scholars advise that blame-it-all tendencies (Fortner, 2001; McNaught, Warrick, & Cooper, 2014) must be avoided as this usually results in people not being aware that local solutions might be available, and that consequently, this may lead people to not doing anything about the situation.

COMMUNICATE WITH CERTAINTY

Staff members of government agencies especially research institutions or the academe have the tendency to play it safely in communicating technologies. For instance, in talking about a water-saving technology, a communicator will say "this might work for you if…" We usually set plenty of conditions about a certain technology. While this is understandable and very transparent, scholars note that this discourages farmers from adopting a certain technology (Rabinovich & Morton, 2012). This is the case when communication becomes tricky as the concerned institution certainly does not want to communicate something that is not true as this will erode its credibility. On the flip side, the desire for farmers to adopt certain technologies is also high. There is really no easy answer for this. A tip would be to indicate **level of certainties**. For instance: we are 80% confident that this will work. Something to that effect. This way, you are helping your client decide on his/her decision to adopt (or not) certain technologies.

AVOID FEAR COMMUNICATION

The IPCC (2007) notes that fear does little in convincing people to adapt to climate change. Climate change communicators must bear this in mind. Fear in this context does not only refer to spoken words but also to our facial expression and gestures. Climate change is already a complex topic that adding fear becomes superfluous and unnecessary.

EDUCATE YOURSELF

The best way to communicate about the science of climate change is for you to educate yourself first. In the context of agriculture, it would do well to know the information hubs. For instance, for rice, the easiest way to get information is to text the PhilRice Text Center. Response time for this facility is 0-15 minutes during office hours. The PinoyRice, an information portal on rice, offers a rich source of information on anything that has something to do with rice (www.pinoyrice.com). In the appendices section of this book, we have listed several websites that we have reviewed. They may serve as good sources of learning materials on climate change.

Also, it would be good to brush up on new terminologies people are using like climate-smart agriculture. This usually is a high-sounding concept that one may think that this is something that has yet to be discovered. Truth is, most of the technologies that will fall under this concept are already available. It is more like a new framework so people will think along the same line when it comes to climate change. A list of climate change-ready technologies on rice is available in Chapter 4. The bottomline is to make yourself aware of these new concepts to help you in searching for more reference materials, and to provide direction in your literature search, if need be.

CLOSELY EXAMINE: YOUR BELIEFS AND IMPRESSIONS VS SCIENCE

There are instances when teachers who teach climate change have the tendency to convey their beliefs rather than talk about its science (Waters-Adams, 2006). On the flip side, owing to the inadequacy of training on environmental issues, there is a tendency to rely on materials provided by different advocacy groups, which may be less than accurate as far as science is concerned (Disinger, 2001).

On the other hand, one of the reviewers of this book raised a valid point that "Science" too can be a body of beliefs; and that there are several scientific findings that are no longer true today but some people in the community continue to believe in them. Kuhn (1996) notes that new forms of knowledge are developed using the same methods that created old forms of knowledge. Hence, this is where communication on climate change becomes tricky and complex. We submit that an answer to this tension is beyond what this book can cover.

CHECK YOUR SOURCES

This is the most exciting time for most of us as the things we need are literally just at our fingertips. It is very easy to just search from our favorite search engine, and, voila, we'll get answers in seconds (Priest, 2016). On the flip side, however, this is also the era of fake news; the era where authenticity is a serious battle. Not being deliberate in choosing materials will have gruesome consequences. A recommendation is to check the "about us" section of the website; check the English (authentic websites usually have good editors; have an overall feel of the information being presented to you.) While these are not fool-proof, these should help you survive the online environment.

GET EASY ON THE USE OF EMOTIONAL APPEAL

The Center for Research on Environmental Decisions (2009, p.42) notes on the concept of the ***finite pool of worry*** that "refers to the limited capacity people have for worrying. As worry increases about one type of risk, concern about other risks may lessen. People have a limited capacity for how many issues they can worry about at once." What it says basically is that if you overdo the emotional appeal, it may result in emotional numbing—pain, worry, or whatever it is may have less appeal and, hence, will fail to move people to action.

LISTEN INTENTLY

People usually have divergent views on climate change. While there is a strong scientific consensus on the occurrence of anthropogenic climate change, as a communicator, it is your duty to listen to all views—and see from there how negotiations can be arrived at. The key is to move people to action.

ENCOURAGE YOUR AUDIENCE TO SEE AND LEAD THEIR FUTURE

How do your audiences see their future? What is the chance that they can be visionary leaders as we face the challenges of climate change? Scenario-building exercises may prove useful.

COMMUNICATE TO HELP "WALK THE TALK"

The success of any communication endeavor is to see changes in the audience's behavior. In the agricultural context, you may expect to see improvements in the way adaptation or mitigation mechanisms are being observed. It may take a while and you may not see it outright—but do give it a try!

RIGHT MESSAGE TO THE RIGHT PEOPLE

In one of our seminars in Ilocos Norte, we noticed that farmers were not showing much interest in controlled irrigation. It is a technology that guides farmers when to irrigate their fields; hence, it avoids wasteful use of water. During that farmers' forum we showed them a template powerpoint about climate change-ready rice production technologies. Admittedly, this is oftentimes the case for busy staff members. A powerpoint that contains everything one has to know about a certain topic is handy.

We later found that the farmers were not interested simply because they did not have enough water to begin with. Their area had experienced long drought spells in the past, and they occasionally experience it up to now. That was basic information that we missed—and we thought we were making so much sense! Two lessons: know a bit about the area and the people who will listen to your presentation; and always review your presentation template for things that may do well to be left at the background.

Another example is about yields of rice varieties. One time we uploaded a story in PhilRice Online about the characteristics of a new upland rice variety. Among breeders, the yield was actually high, if not impressive. Upland varieties, in general, have low yields—the national average is only 2t/ha. For us writers, we thought it was a breakthrough; hence, we wrote about it. A day later one of our frequent online visitors sent us an email saying that we may need to review the yield data published online as that, to him, was absurdly low. The farmer was farming in an irrigated lowland where national average is 6t/ha. Given where he's coming from, the upland yield will obviously pale in comparison with that of irrigated lowland. The article did not excite him (probably even depressed him), but it sure would invite some interest among upland farmers.

SOME KEY CONCEPTS TO TAKE NOTE OF

"Mental models represent a person's thought process for how something works. They help shape risk perceptions, actions, and behavior; influence what people pay attention to in complicated situations; and define how people approach and solve problems. Mental models serve as the framework into which people fit new information [CRED, 2009, p.40]).

A confirmation bias makes people look for information that is consistent with what they already think, want, or feel, leading them to avoid, dismiss, or forget information that will require them to change their minds, and, quite possibly, their behavior (CRED, 2009, p.4)"

The good thing about mental models, according to CRED (2009), is that they are not static. They can change through time if misconceptions are addressed through proper education.)

PhilRice CES

Hands-on exercises on machine operations are part of the training of the project's partner-teachers.

4

CLIMATE CHANGE-READY TECHNOLOGIES AT PHILRICE

In this chapter, we will introduce to you some PhilRice technologies or technologies developed by other entities and are being promoted by PhilRice that are climate change-ready; they enhance the adaptive capacities of farmers to the climate change. They can either help farmers survive during weather extremes such as droughts or typhoons, or provide additional sources of income for farmers. Given that rice production also contributes to greenhouse gas emissions, we also present here technologies that can reduce GHGs.

This part provides only brief descriptions of these technologies. Concrete how-to's or far more comprehensive information are available from PinoyRice (www.pinoyrice.com). PinoyRice has technology bulletins and videos, fact sheets, learning handouts for all of them. For some quick information on these technologies, interested parties may please contact the PhilRice Text Center (0920-911-1398) that will link you to the experts in these strategies and/or technologies.

We do not claim ownership of these technologies/strategies. All credits go to the developers of these technologies/strategies. Likewise, our utmost apologies if we do not always refer to the original creators of these technologies, especially those developed by non-PhilRice staff members. We thank Dr. Ricardo F. Orge and Mr. Ruben B. Miranda, our colleagues at PhilRice, for their critical reviews of this chapter.

Below are some of the technologies that will help the farmers deal with onset of typhoons and/or drought. These are technologies that can help manage water and time to avoid weather extremes (typhoons, for instance).

Malonoy National High School
Dao, Capiz

Choosing the recommended varieties. Using the right varieties can enhance the adaptive capacities of farmers to climate change. There are varieties suitable for irrigated, rainfed, upland, flood-prone, and saline areas. Farmers can still plant, harvest, and earn despite weather disturbances (PhilRice, 2017 -b).

Seeding in Sultan Kudarat

Direct seeding. Through this strategy, 30% water savings is possible per hectare (Joshi et al., 2013). Irrigating and plowing are shortened. Farmers can shift to this method if rainfall is limited or there is a shortage in water supply from the irrigation system. It is recommended in rainfed areas where water is insufficient or can be an alternative option instead of transplanting.

Turning rice straw/stubbles into fertilizer.
Science City of Muñoz, Nueva Ecija

Reduced Tillage Technology (RTT). A system of land preparation that does not utilize tilling machines. Harrowing tool is the only one that is used to prepare the land for planting. Rice stalk and straw are used as fertilizers. Lesser carbon dioxide and methane are emitted using RTT as compared with the conventional way of preparing the land. Savings of up to PhP3,000 and yield increase of 5-10 bags per hectare are possible through RTT (PhilRice, 2015 -b).

Training on CSA4Rice
PhilRice CES

Mechanical Transplanter. This machine requires less time and personnel complement than manual transplanting. It can finish transplanting up to 2 ha/day and ensure proper spacing per hill (PhilRice, 2008 -b).

Tarlac rice field

Dry direct seeding technology. Being practiced in the uplands, it helps address issues relating to water scarcity—a major issue especially in drought-prone areas. In this method, sufficient humidity is the only requirement for crop establishment. It utilizes early rainfall, requires less labor, and early harvest is possible—which is important to help farmers avoid typhoons especially if the forecast is given early on (PhilRice, 2015-c).

Maguling National High School
Sarangani

Controlled irrigation. This technology is particularly important in areas where water scarcity is an issue. It guides farmers on when is the best time to irrigate their ricefields. Savings of 16-35% in water use is possible while not reducing yield (PhilRice, 2000).

Low-cost drip irrigation. It is another water-regulating technology for vegetables. It is recommended for drought-prone areas because it needs less water and labor. It can be used to grow vegetables during El Niño or drought season (Domingo, 2015, September 26).


Claveria Rural Vocational School
Cagayan

Modified dapog method. In climate change, time is of the essence; hence, there is preference for ways that can shorten production time. Through this technology, lesser time is needed as the seedlings can be transplanted 10 days after sowing. In the conventional practice, 20 - 25 days are needed before the seedlings could be transplanted. Additionally, savings of up to P1,360 is possible, and 25% – 40% reduction in the total seed requirement per hectare as compared with the traditional seedbed method (PhilRice, 2009).

Harvesting in Binalonan, Pangasinan

Rice combine harvester. Major rice-producing provinces in the Philippines such as Nueva Ecija and Isabela had experienced millions of losses when typhoons came just several days prior to their scheduled harvest. Hence, this underscores the importance of rice machines that can harvest rice the fastest way possible. Among them is the rice combine harvester. It can finish harvesting a hectare of ricefield in 1 to 2 hours, needing only 3 persons. It also saves 50-70% of the total harvesting expenses (PhilRice, 2014).

Floating garden. This strategy enables farmers in frequently flooded areas to continue growing food. It uses empty paint containers or mineral water bottles as floaters, and other indigenous materials. It ensures food and nutritional security during unwanted weather conditions like instances of flooding. It also provides an alternative source of income for farmers in flood-prone areas. PhilRice trials show that vegetables can be grown using this setup such as pechay, chili, and tomatoes. Rice can also be grown in a floating garden. We have had trials in Pampanga and Zamboanga del Norte (PhilRice, 2016 -b).

In enhancing the adaptive capacities of farmers to climate change, having additional sources of income is necessary. Hence, the following technologies/strategies will help augment the income of rice-based farming households.

PhilRice's *Palayamanan* program is a climate change-ready strategy as it provides options for farmers depending on their farming conditions. It offers mixes of farming systems that will optimize farmers' income.


PhilRice CES

Palayamanan. It maximizes the use of land area and time in farming. It promotes diversified farming, which can ensure food on the table even during times of typhoons. Palayamanan has evolved over the years and now has a life of its own with plenty of variants (e.g. *Gulayan sa bilangguan)* across the country. Below are some strategies/technologies that fall under the *Palayamanan* way of life (PhilRice, 2005):


PhilRice CES

Vermicomposting. This is an ecological way of producing organic fertilizers through earthworms or African night crawlers. These earthworms help decompose all biodegradable matters such as rice straw, weeds, animal manure, and other kitchen wastes like fruit peels, etc. A vermicompost can sell for about P200-350 per sack. This will be an added source of income for rice-based farming communities.

Mushroom production. Five tons of harvested rice produce a ton of rice straw that can be converted into 25-40 kg Nitrogen (N), 3-6 kg Potassium (P), 60-80 kg Phosphorus (K), 2-5 kg S, *200-300* kg Silicon, and 2,000 kg Carbon if properly decomposed (Frediles, 2015). Rice straw can be first used as substrate in growing mushrooms, then in vermicomposting for organic fertilizer production. Burning rice straw does not help mitigate climate change. It is best used for income-generating purposes like mushroom production.

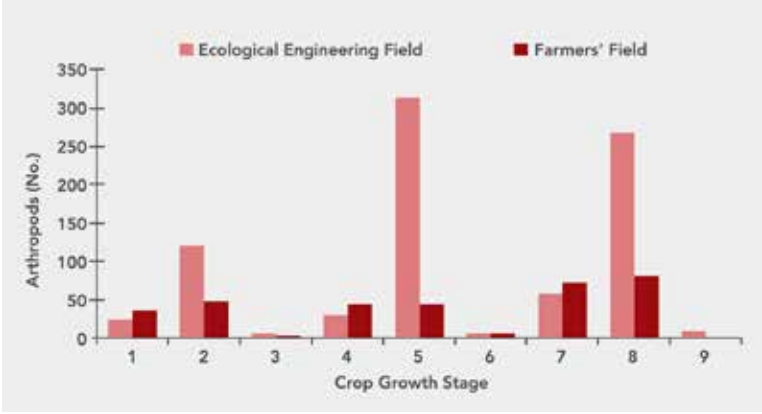
Baluan National High School
General Santos City, South Cotabato

Sorjan cropping system. A good climate change adaptation technology in both flood- and drought-prone rice areas. In flood-prone or swampy areas, the sink impounds more water and can tame the flow of water. Meanwhile, the raised beds and bunds constructed in making the sinks allow farmers to plant dryland crops like vegetables. The sink of the Sorjan system can serve as temporary rainwater-harvesting or impounding mechanism for farmers in drought-prone areas (PhilRice, 2016 -c). This system originally came from Indonesia.

(From L-R) Students Dolly Martin, Aira Mae Ceniza, Mary Grace Amoy, and Mary Joy Lanas of Bagumbayan Agro-Industrial High School in Davao Oriental mix the rice hull to facilitate easy and proper carbonization process.

Carbonized rice hull. It serves as soil conditioner and increases soil water-holding capacity. It can also be used to control golden apple snails (PhilRice, 2008 -a). In the Bagumbayan Agro-Industrial High School, Davao Oriental, one of the Infomediary Campaign sites, they sold CRH at P60-100/sack. They also used it in their vegetable garden and ornamentals to serve as soil media and to reduce rat attack.

Rice production also contributes to greenhouse gas emissions (GHGs), particularly methane. The technologies/strategies below will help in reducing GHGs.



Population of beneficial organisms in fields where ecological engineering was employed.

Ecological engineering. It is an effective way of managing pests in the ricefield by planting ornamentals near the field (about 1m). Our experiments show that this strategy can help increase the population of beneficial organisms by 40% (Frediles, 2015), reducing the need for pesticides.

(From L-R) Leo Esperanza, Mark Angelo Ramos, Arlyn Liso, Jinky Rillorta, Marjorie Dalmero, Jerry Mapanao, Rolando Agoot, Jr. of Luna National Vocational High School in Alcala, La Union

Minus-one-element technique (MOET). It is an easy and affordable way of assessing the nutrient requirements of soil in irrigated rice fields. It recommends the right amount of fertilizers needed by plants and helps prevent diseases caused by excessive fertilizer such as BLB, Blast etc. (PhilRice, 2012).

Leaf Color Chart (LCC). It is a tool to efficiently assess the timing of nitrogen application. Its use can result in savings of up to P2,000 per hectare and avoid wasteful application of N. Consequently, use of LCC can help prevent the occurrence of diseases caused by excessive nitrogen application such as Bacterial Leaf Blight and Rice Blast (PhilRice, 1997).

Luna National Vocational High School
Alcala, La Union

Beneficial microorganisms. Use of bio-fertilizer and effective microorganisms is an environment-friendly way of producing beneficial microorganisms as they hasten the decomposition of biodegradable materials. Under normal conditions and using wet substrate, the scattered rice straw in the field will take 1-2 months to decompose. Use of beneficial microorganisms reduces the process to 3-4 weeks, making the straw ready to be used as organic fertilizer (E.F. Javier, personal communication, September 18, 2017).

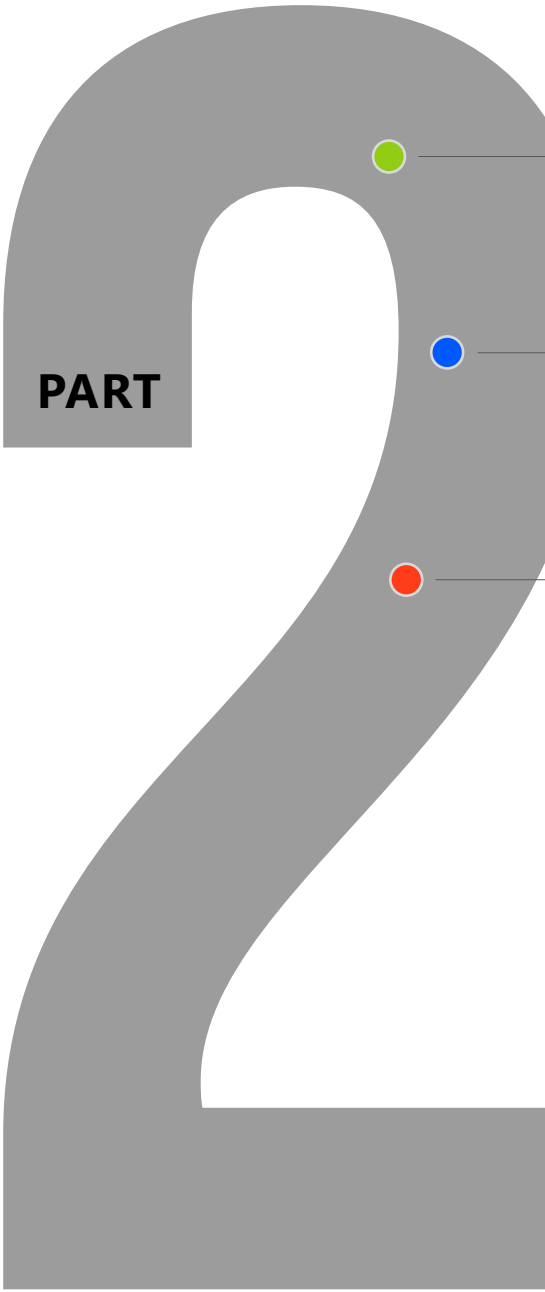
PhilRice CES

Azolla farming. Use of azolla can lessen the application of synthetic nitrogen on rice; the amount to be applied will be based on the N content analyzed in azolla (E.F. Javier, personal communication, September 18, 2017).

Rice+duck+azolla farming system. In this strategy, azolla and duck manure serve as fertilizers for the rice crop.

Ma'am Ledovina O. Manalo of Capul Agro-Industrial School in Northern Samar teaches about greenhouse effect, global warming, and climate change.

Integrating climate change discourse in agriculture lessons in high school curriculum



It is recognized that young people can significantly contribute to efforts in disseminating information on climate change. Hence, the logical move is to integrate climate change in agriculture lessons in the school curriculum.

In this part of the book, we will share our experiences in integrating climate change in agriculture lessons in the curriculum of TecVoc high schools. It was in collaboration with the CGIAR Program on Climate Change, Agriculture, and Food Security, and the Department of Education. The overarching aim was to mobilize the students to serve as information providers of climate change-ready technologies on rice and climate change as it impacts on rice production, to address issues on information poverty in rural areas. The project had 208 participating schools.

This part has three chapters:

- **Chapter 5. Perceptions and sources of information on climate change.** We discuss how the students view climate change and their sources of climate change information. We bring in some participatory methods in collecting data from the students.
- **Chapter 6. What, why, and how of the searching and sharing of information on CC-ready technologies.** We explain what transpires with the information once it is passed on from the teachers, to the students, and then to the farmers. We argue that while it may seem linear, the relationship is complex and at best dynamic.
- **Chapter 7. Fruits of integration, issues, and ways forward.** We reflect on the successes and pitfalls of this initiative. This is highly recommended for people who would like to replicate this in other contexts.

About the Project

The collaboration took off from the Infomediary Campaign of PhilRice, which started in 2012. The book *"Youth and agriculture: The Infomediary Campaign in the Philippines"* (Manalo et al., 2016) can be consulted for a detailed process documentation on how the Campaign was implemented. The gist of our project with CCAFS basically followed the key strategies in the Infomediary Campaign: Read, Surf, and Text—with climate change and rice production as its focus.

In the Read component, we gave publications relating to our advocacy to the participating schools. We introduced the PinoyRice, an information portal on rice, in the Surf component. The PhilRice Text Center, which is a texting facility on rice, was introduced in the Text component.

The key strategies were also the same. We had capacity enhancement programs for participating teachers to equip them with knowledge on climate change-ready technologies. Modules were developed under the project *(Climate Change 101, Climate Change mitigation strategies/technologies and Climate change adaptation strategies)*. The modules were in Filipino, presented in ready-to-teach powerpoint presentations. A teaching guide accompanied these modules. The expectation was for the teachers to teach these modules when they return to their agri-crop production/horticulture students under the Technical - Vocational Education track.

All participating schools were encouraged to put up their respective rice gardens to serve as their practicum site. In the rice gardens, climate change-ready technologies were showcased such as the use of early-maturing varieties and controlled irrigation. We had Infomediary Quiz bees to creatively gauge their learnings on rice. Teachers were also supported in conducting community activities relating to this project such as field days, farmers' fora, or agricultural extension events.

Monitoring schemes were in place. The text messages of the students to the PTC were coded for ease in retrieval for content analysis. We also did random on-site monitoring, and regularly checked our Facebook group where the teachers uploaded their activities in their respective schools.

Teachers' training on Climate Change and Rice Production at PhilRice CES, 2015

Students' training on rice seed sowing at PhilRice CES, 2014

Leyte Agro-Industrial School

Malalag National High School Sarangani

Cateel National Agricultural High School Davao Oriental

(From L-R) Students Riehll Juztin Cortez, Mary Grace Hernandez, and Marry Crist Aludo of Bagumbayan Agro-Industrial High School in Lupon, Davao Oriental conducting Agro-Ecosystem Analysis (AESA) in their school's rice garden

5

PERCEPTIONS AND SOURCES OF INFORMATION ON CLIMATE CHANGE

Perceptions

We started the project with CCAFS in 2014. Part of our work was to know the perceptions of young people on climate change. It was important as anyone who would like to engage in this work must know where the participants are coming from. The high schools we covered were Agusan Pequeño National High School (APNHS) in Agusan del Norte, Balagtas National Agricultural HS (BNAHS) in Bulacan, Cateel National Agricultural HS (CNAHS) in Davao Oriental, Dingle National HS (DNHS) in Iloilo, Ilocos Norte Agricultural College (INAC), Libon Agro-Industrial HS (LAIHS) in Albay, Malalag National HS (MNHS) in Sarangani, and Southern Samar National Comprehensive HS (SSNCHS). The students enrolled in these TechVoc schools came from predominantly rice-farming communities.

Table 1. Perceptions of the students on climate change (data collected before the onset of the project).

School	Increase in temperature (%)	Typhoon and flood	Drought	Salinity and sea-water rise	End of the world
Agusan Pequeño National High School (APNHS)	87.00%	68.00%	83.00%	31.00%	0.00%
Balagtas National Agricultural High School (BNAHS)	74.00%	47.00%	63.00%	21.00%	3.00%
Cateel National Agricultural High School (CNAHS)	94.00%	78.00%	88.00%	64.00%	8.00%
Dingle National High School (DNHS)	88.00%	56.00%	68.00%	22.00%	0.00%
Ilocos Norte Agricultural College (INAC)	96.00%	84.00%	86.00%	78.00%	8.00%
Libon Agro-Industrial High School (LAIHS)	78.00%	66.00%	68.00%	29.00%	8.00%
Malalag National High School (MNHS)	87.00%	72.00%	83.00%	41.00%	0.00%
Southern Samar National Comprehensive High School (SSNCHS)	91.00%	66.00%	77.00%	43.00%	15.00%

While it is not easy to catch trends in the data, it is good to highlight some of the findings. For instance, the most number of students who equated climate change to increase in temperature came from INAC; and, consistently, it is also second highest in the drought category. There had been several episodes of dry spells in the Ilocos Region, and, expectedly, a high percentage on drought also surfaced.

Also highlighted is the slightly high percentage on the "End-of-the-world category" as rated by Southern Samar NCHS. It should be noted that in November 2013, Eastern Samar, where the school is located, was badly hit by typhoon Yolanda, which was known as among the strongest typhoons in the world.

Increase in temperature was perceived by most students as the major impact of climate change. It should be noted that episodes of El Niño were reported in 2014. The point here is that students have the tendency to associate climate change to recent climatic events. Other scholars report of the same finding in different context (Le Dang, Li, Nuberg, & Bruwer, 2014)

Bagumbayan Agro-Industrial High School
Davao Oriental

A

B

C

Figure 1 (a-c) Group drawing exercises in the participating schools. Photos A and B (Riehll Juztin Cortez and Aira Mae Ceniza) also appeared in Manalo et al. (2016)

We had several participatory drawing sessions to investigate the students' perceptions on the impacts of climate change on rice production. The students linked occurrences of weather extremes to climate change. Photo B, for instance, is a student from Bagumbayan Agro-Industrial High School in Davao Oriental talking about the impacts of climate change on their crops.

Sources of information

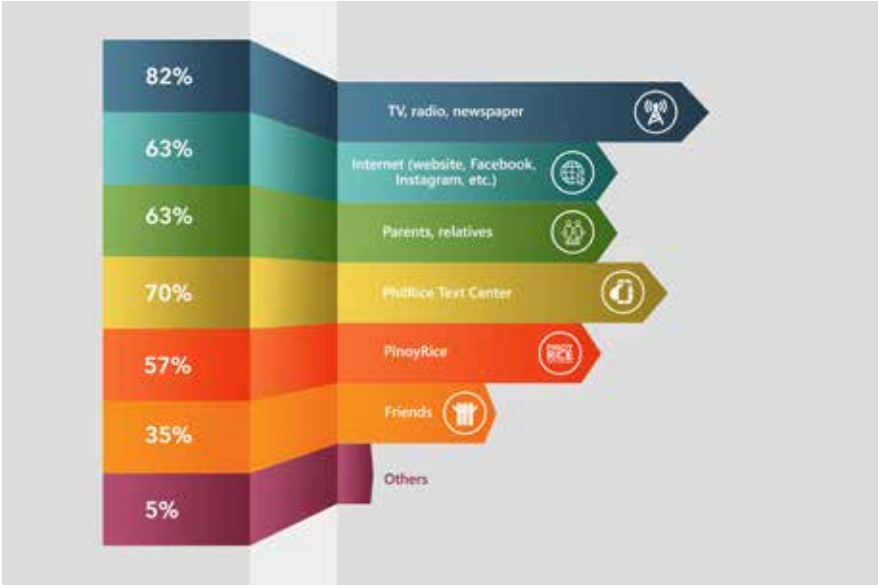


Figure 2. Sources of information on climate change in all schools (data collected after a year of work in the project sites)

At a glance, the results do not seem surprising. For instance, mass media top their information sources—something that persisted in the literature. The mass media, indeed, remain a powerful source of information.

But there are several revelations in the figure, especially in relation to the PinoyRice and PhilRice Text Center. These will pale compared with the popularity of mass media. They, however, turned out to be among the major sources of information on climate change when the teachers introduced them to the students. For the PTC, the students must have valued the ease in using the facility—with a simple text message, information on CSRA can already be generated. For PinoyRice, the wealth of information available for download must have seized their attention. **A key lesson in this figure is that if the message sources are well introduced to students, the chance is high that they will use them.**

(From L-R) Verginia Mae Condino, Aldin Alarcon, Troy Pante, and Myra Dacoco of Partido Agro- Industrial National High School in Camarines Sur

Karla Mae Ranera and Bill Jay Olaviaga of Libon Agro-Industrial High School in Albay happily show their rice seedlings ready for transplanting.

6

WHAT, WHY, AND HOW OF THE SEARCHING AND SHARING OF INFORMATION ON CLIMATE CHANGE-READY TECHNOLOGIES

In our work with CCAFS, the key aim was to mobilize the students to share information to others. Hence, this section shows how we have documented the sharing process to the farmers in the community.

The students' sending CSRA messages to the PhilRice Text Center

We wanted to know if the students were truly searching for information on CSRA, as it was a precondition to becoming full-fledged infomediaries. The data are from the database of the PTC in 2015 from the five selected schools. These schools are comparable in terms of the number of SMSs they send to the PTC: San Jose National Agricultural and Industrial High School (Region 4B), Leyte Agro-Industrial School (Region 8), Maguling National High School (Region 12), Bagumbayan Agro-Industrial High School, and Cateel National Agricultural High School (Region 11).

We analyzed 1,023 SMSs. In the PTC, the messages are coded according to the regions of origin.

Figure 3. SMSs sent by the students to the PhilRice Text Center, 2015

Region 8 was the origin of 47% of the SMSs sent, followed by Region 12 (32%). Of the 479 messages sent from Region 8, 83% were about rice varieties. At the backdrop of this data was the El Niño phenomenon in 2015 that affected more than 50 provinces, with Leyte as among the top 12 worst-hit provinces. All provinces covered in this study except Occidental Mindoro (Region 4B) were adversely affected by El Niño. Another calamity was Typhoon Hagupit that hit Region 8 in late 2014.

One important point that can be gleaned from this data is that the students searched for information at a time when the need for it was high. They could have just focused on their studies yet they chose to also send SMSs to the PTC. This relates to empathy (Ramirez, Parthasarathy, & Gordon, 2013a, 2013b) and social sensitivity (Schilderman, 2002), which are important traits of being infomediaries. The fact that they interacted with the PTC agents shows that they also exercised critical thinking, which then relates to the intellectual dimension of being infomediaries.

The point on the intellectual and affective dimensions of infomediaries is also evident in Table 2. It compares the top 5 queries sent by the students and farmers in 2015. The table shows a stark similarity of queries asked.

Table 2. Comparison between the frequently asked questions, farmers and students (infomediaries), 2015.

INFOMEDIARIES		FARMERS	
Types	%	Types	%
Varieties	54	Varieties	55
General Information	27	Pest management	9
Pest management	12	Seed availability	8
Nutrient management	2	Nutrient management	2
Crop establishment	2	General Information	2

As it stands, it is evident that the students showed social sensitivity and empathy when they performed infomediary roles. Searching for information that will positively impact on their livelihood is one laudable thing that cannot be ignored.

At this point it might help to ask: if the students do search for and share CSRA information to farmers, what types of information can they competently share? If everything is not the answer, then what are some of the specific types of information that they can transfer to others?

Taught and shared

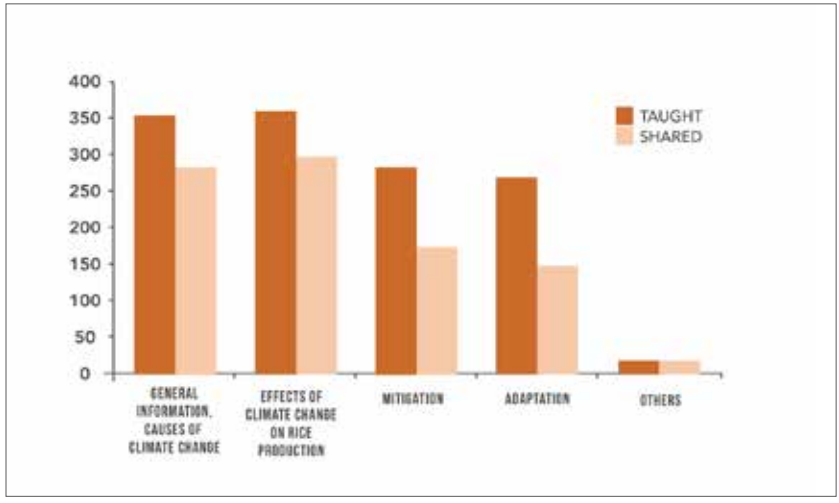


Figure 4. CSRA topics taught in classes and shared to others, all schools (Manalo et al., 2016)

The students shared more about general information, and causes and effects of CC on rice production (Manalo et al., 2016). This can be explained by the reinforcement principle as these topics are also discussed in the science subjects. Hence, the chance is high for the students to understand these concepts better. Another is these are far easier to share than mitigation and adaptation information, which require a high level of technical knowledge as these are mostly how-to's of specific technologies.

The graph, on the other hand, can change depending on the quality of teaching by the teachers. This then boils down to the need to train teachers to become the best climate change communicators (Manalo et al., 2016b). Training is not enough, however. This must be reinforced with providing farm implements and other necessary facilities so the students can better grasp the concepts being taught.

Looking at the graph from the point of view of knowledge users sees another view. At present, while there are plenty of information sources on mitigation and adaptation measures, they are hard sell; not for young people. Hence, there is a need for edutainment approaches to be in place.

Given all the possibilities, what is comforting about this figure is the fact that the information transferred was shared, at least most of it. What is probably interesting at this point is how did the sharing transpire?

Infomediation process

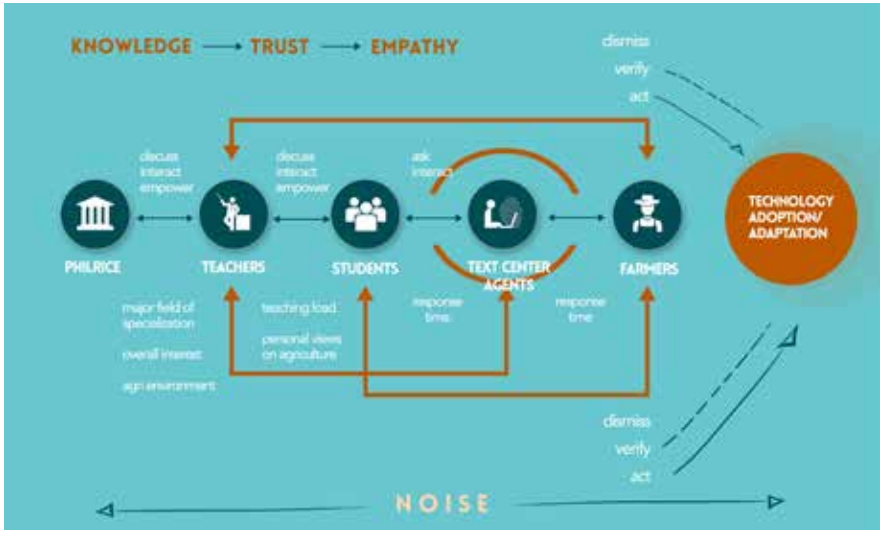


Figure 5. The infomediation framework on climate change-ready rice production technologies.

The figure above shows our conceptualization on the process of infomediation on CC-ready rice production technologies. At the center of the figure are the key players of the process. From the information source, which is PhilRice, the information is passed on to the teachers, and then to the students. In between these players, three important actions must be noted: discuss, interact, and empower. To illustrate, from PhilRice to the teachers, information is disseminated when the teachers participate in the training program where they learn about climate change and its impacts on rice production. During the training, the teachers engage in productive discussions with PhilRice experts, which, in one way or another, empower them technically. The same process can be expected when the teachers re-echo to their students what they learned from the training. The teachers introduce the PTC to the students who use the facility to know more about rice farming technologies. In the process, the students interact with PTC agents from whom they either validate their knowledge on a certain subject or ask new questions.

The students then pass on the information to farmers, mostly their own parents. The farmers either verify, dismiss, or act outright on the practices or technologies forwarded. It should be pointed out that the farmers and teachers can freely interact with one another through the farmers' forum organized by the teachers. The students and the farmers also interact freely given that they are from the same rice-farming communities.

Another key feature of this framework is its emphasis on the noise or factors that adulterate the quality of infomediation. For instance, from PhilRice to teachers, the level of competence that the teachers can acquire after the training would be strongly founded on their fields of specialization (some teachers handle subjects beyond their fields of specialization), overall environment, and the rice-farming conditions in their respective schools. From the teachers to the students, their teaching loads and biases certainly affect the quality of infomediation. The students' overall interest in agriculture and attitude also play pivotal roles. The PTC's response time is a key issue. Fast response motivates users of this facility. The success of the infomediation on CC and rice production rests upon three important criteria: knowledge, empathy, and trust. Knowledge sustains the intellectual dimension of infomediation while empathy and trust constitute its affective dimensions.

New technologies developed in PhilRice, like capillarigation, are also being taught to the teachers during their training on CSA4Rice at PhilRice CES.

7

FRUITS OF INTEGRATION, ISSUES, AND WAYS FORWARD

Fruits of integration

The one significant gratification in doing this project is it has allowed different forms of innovations to take shape. Climate change consciousness breeds ingenuity and novelty. Here, we share the various innovations our participating students and teachers did in relation to climate change in rice agriculture.

General Santos City — Students Jenny Algarme, Selwyn Luayon, Joshua Padilla, Arhon James Patricio, and Amie Lym Dedel with their adviser Edmar Juanitez of Baluan National High School present their own version of the open-type rice hull carbonizer.

Baluan National High School (BNHS), General Santos City[1]. Grade 10 students of BNHS fabricated a simple, open-type carbonizer that farming families can replicate in their own households. The students created this version after they watched a video about the technology.

The students recycled 12 pieces of 370-ml milk cans, a 16-L used can of paint or oil, and scrap metal sheets. They invested P20.00 in rivet fasteners. Here's how they did it:

1. For the chamber, they removed one of the lids of the 16-L used can of paint. On the other side, they made a hole with a diameter similar to the milk cans.

2. Using a knife, they also bored holes around the chamber, each measuring 4x4 cm. Student Padilla said that the length of carbonization depends on the size of the holes: the smaller the holes, the slower the carbonization process.

3. For the chimney, they removed both lids of all milk cans and flattened each surface. They slightly compressed one end of each can to ensure that it can be easily inserted into the other. The connected cans looked like a long cylinder, open at both ends.

4. Then, they inserted the chimney into the hole of the chamber.

5. To make the carbonizer sturdy and durable, they added braces using scrap metal sheets that hold the chimney and the chamber together. Three to four metal sheets were attached with the use of rivet fasteners.

[1]A more comprehensive story is available from Bautista (2017a). This part is also published in the Agriculture Magazine, June 2017 issue, with permission from the Manila Bulletin.

Davao Oriental — Bagumbayan Agro-Industrial High School initiates various communtiy events to showcase rice technologies to the farmers.


Troy Dino and Roy Lucero


Grade 11 Horticulture students


Diether Tanudra


Rosalina Y. Saylan

Junamie Erediano and Aljes Lucero

Bagumbayan Agro-Industrial High School (BAIHS), Davao Oriental[2]. This school has shown how to do business with rice biomass. The participating teacher taught the students about carbonized rice hull (CRH), its uses, and how to be entrepreneurial about it. The teacher initiated the fabrication of a carbonizer in their school, discussed things with the principal, and made it as an income-generating project of the school. They sold CRH at P60/sack or P5/kilo. In 2015, they earned P9,300!

[2]A more comprehensive story is available from Pasiona (2017).

Occidental Mindoro — San Jose National Agricultural and Industrial High School students actively conduct barangay-level events to disseminate information on climate change and rice production.

Shanine Carla Banao

Remelyn Baco

Evelyn Regalado, 2nd from left.

Elizabeth Pajarillo, right, during her training on CSRA at PhilRice CES (2015)

Shanine Carla Banao, Anthony Asuncion, Elhezel Roldan, and Jomar Tandog during their radio program series on ecological engineering

San Jose National Agricultural and Industrial High School (SJNAIHS), Occidental Mindoro[3]. "Students serving as actual field extensionists" was the name of the game for this participating school. Through the initiative of our partner-teacher, the students gradually developed their communication skills and shared valuable information on climate change-ready agriculture for rice not only to their farmer-parents, but also to other farmers in their community. The school is doing two kinds of outreach program for three years now.

- *Barangay-level seminar-workshop*. Since 2014, the school and the student-infomediaries annually conduct a one-day activity with the farmers in their barangay as participants. The event involves lectures on climate change and rice production using modules from PhilRice, and a workshop on livelihood activities. The school partners with the local officials in the community to provide other workshop needs especially food and venue.

- *House-to-house consultation*. The students, together with their teacher, also do household visits. They visit *sitios* on Saturdays to discuss cost-reducing and yield-enhancing technologies on rice. Some of the technologies that the farmer-parents usually show interest in include modified dapog, choice varieties, and controlled irrigation.

[3]A more comprehensive story is available from Manalo (2017).

Aklan — Infomediaries of Libacao National Forestry Vocational High School do container gardening to optimize their school's area.

Libacao National Forestry Vocational High School (LNFVHS), Aklan[4]. Addressing their lack of area for gardening, and his goal to teach climate-smart rice agriculture effectively, our partner-teacher introduced container gardening to his students:

- Each Grade 7 student was asked to bring an empty plastic container, 1 foot high and with 6-L capacity.
- The containers were filled with at least 4 kg of soil from a rice planting area.
- In every container, 4-5 rice seedlings of an upland variety were planted. After a week, they removed those that did not survive, leaving 2 to 3 seedlings in each container.
- The seedlings were transplanted using the modified dapog method; series of agro-ecosystem analyses were conducted to monitor the crop.
- Aside from rice, ornamentals and vegetables were also planted.

Pangasinan — Eastern Pangasinan Agricultural College showcases its school garden focused on means to adapt to the changing climate.

Eastern Pangasinan Agricultural College (EPAC). This school has been putting life to the lyrics of the nursery rhyme *Bahay Kubo*, and is adding rice to the list. EPAC practices crop intensification that other participating schools, even farming households, can emulate.

As they are in a rainfed area, they practice crop rotation. During the rainy season, they plant rice. They harvest rainwater channeled to their rice plots. Beside the plots are vegetables. During the dry season, they plant cash crops such as pechay and mustard.

They also dug three fishponds where they plan to grow mudfish and tilapia, beside the planting area. Each pond measures 1.5x3m and is 1m deep. Beside the fishponds are wood trellises for bitter gourd.

Sarangani Province — Students of Maguling National High School have been promoting various technologies that farmers in their community have already adopted.

Partner-teacher Ma. Elma Ampatin (right) instruct students Julius Ceasar Lumaghan (middle) and Mark Niño Lumaghan (left) on the use of the observation well

(From L-R) Sarah Mae Bangkit, Norhuda Kadir, Jamia Rajamuda, Johara Tarusan, Bashier Jailalani Jr.

Sarah Mae and Bashier Jailalani Jr. presents their ourput on AESA

Maguling National High School (MNHS), Sarangani. In a small community at the far edge of the municipality, the farmers fabricated their own version of an observation well based on what the students showed them. Our infomediaries from MNHS have been successful in bringing rice production technologies to their community.

The farmers used a kind of indigenous bamboo durable enough to withstand farm and water-related activities for a long time. The observation well is 1-foot-high, having either a narrow or a wider diameter than the PVC pipe. A 6-inch-long hot nail was used to pierce and make holes on the bamboo. Like the common observation well, the holes were also 10 cm apart.

The observation well of the students was borrowed by agriculture technicians in their community for field demonstration activities.

Capiz — Field days have been fruitful for the infomediaries of Malonoy National High School who have influenced farmers to adopt the *Palayamanan* way of life.

Malonoy National High School (MNHS), Capiz. Aiming to improve their community's productivity, the school made the *Palayamanan* System possible for adoption. The school manages both upland and lowland rice areas. It also plants vegetables such as *patola*, *upo*, amaranth, sweet potato, and water spinach along the dikes. They have an area for poultry and piggery, and raise African tilapia and mudfish. They also plant lemongrass. There is sugarcane, too!

The rice seeds they produce are usually bought by interested farmers in their area. The vegetables and other farm produce are either bought by the parents of the students or sold at the market near the school. Some of these are also cooked during feeding programs of the school.

Aside from selling raw products, our partner-teacher also taught the students how to process some of their harvest. They now produce dried fish they call as "*tilanggit*" (from *tilapia* and *danggit*) and sell it with an added value. They also produce lemongrass juice through the juicer personally made by our partner-teacher.

Due to the integrated, intensified, diversified type of farming that the school engages in, trainers from the Department of Agriculture in their community are partnering with them to use their garden as a venue for Farmers' Field School.

Challenges in teaching CSRA

Climate change as it relates to agriculture was taught among students in agri-related tracks. The first issue raised was the sustainability of the learnings acquired both by the teachers trained and the students. It was a valid point as most of the schools did not have farm machines and other implements needed to effectively carry out the tasks they have to perform. They also do not have area for practicum. For instance, in setting up the rice garden, some of them had to borrow land from farmers in their area. While that is a solution in itself, it poses sustainability issues as the schools are fully dependent on the owner-farmers.

Scheduling was another issue raised, as sometimes the practicum was scheduled when the sun was already hot and high. Hence, the students had a hard time appreciating the technologies. While some schools were able to address this issue, others reported they were in a more difficult situation.

Aside from climate change being a big issue in itself, teachers had to address other aspects relating to the attitude of students toward agriculture. They knew that students chose the agri-related track only because it is cheaper; they did not necessarily prefer it. Some FGD participants intimated that students do not always take agriculture seriously by not doing their tasks well if not monitored.

While girls are generally receptive toward CSRA-related activities, some schools restricted enrollment to agri-related tracks to boys. In certain schools we visited, 98% of the class were boys! Among the reasons cited were girls generally dislike field activities, and the lingering view that farming, at the end of the day, remains a man's enterprise. All this, as we have observed, was not the case in other schools. Additionally, the need for parental consent was raised as a protocol especially if field work is done on weekends.

The teachers and school principals pointed to the need for a module from DepEd on climate change and agriculture. While the project did produce modules, the need to have a standard module was high. Likewise, given that they implement on a competencies framework, the FGD participants noted that no competencies relating to climate-smart rice agriculture aside from machines operation were in their curriculum. If this will be addressed, integration will be far smoother.

Security and safety issues were raised as some schools had their rice gardens (practicum area) far from the campus. Sometimes students go home late to their

remote areas. Wearing of personal protective equipment (PPE) was also not strictly observed, which could prove dangerous particularly in machine operations. It was also forwarded during the FGD that each class must have a first-aid kit so they are ready for any emergency.

One major concern that needs to be addressed in relation to integrating climate-smart rice agriculture lessons in high school curriculum is the reshuffling of teachers and principals. During our engagements with them, we saw plenty of reshuffling in a span of only 2 years. Oftentimes, the expertise gained by the teacher is not transferred to others. For principals, we saw cases when a used-to-be-active school all of a sudden became lukewarm to the initiative as the new principal had other priorities. This is a huge issue as we have yet to have a critical mass of climate change communicators; hence, assigning people trained in this area to do other things will prove to be a massive loss.

Ways forward

Aside from addressing the issues raised above, other suggestions on how to successfully integrate CSRA lessons in school curriculum cropped up. The principals want to include them in the school development plan. It is a document that outlines what the school envisions to achieve over a 5-to-10-year period. This then cements CSRA as part of the school's development agenda.

In areas where CSRA proves highly relevant, it can also be included in the localized education agenda to help communities address their parochial concerns. This way, the school can draw up very concrete plans on how to create an impact on their immediate communities.

Given the scarcity of climate change communicators, the participants also highlighted the need to conduct intensive training programs for other school teachers on CSRA. Modules on science and risk communication are very much relevant. The key is to train them so they become better communicators in this area.

During our random interviews with our participating teachers, putting in place a clear incentive system (does not have to be monetary) will certainly be a big push for this initiative. This was validated when we had contests among schools that were welcomed wholeheartedly as evidenced by the level of creativity that they put into implementing the project (*please refer to the fruits of integration part for more details*).

Teachers learn how to use the mechanical transplanter during their CSA4Rice Training at PhilRice CES (2016).

RICE AND CLIMATE CHANGE POSTER-MAKING

With the theme *Climate change at pagsasaka: Kabataan may magagawa*, almost 100 entries from private and public high schools nationwide participated in our poster-making contest. The following are the top 15 entries, all untitled:

Elain Fernandez
Taguig High School, Manila

Gill Chloe Tolentino
Grace Christian College, Manila

Ainer Brean Padrigo
Tiong Se Academy, Manila

Chester Aaron Sia
St. Stephen's High School, Manila

Kurt Gabriel Sotelo
Baguio City National High School

Randolf Guinawatan
Clarin National High School, Misamis Occidental

Mark Kenneth Tabinas
Baguio City National High School

Crisol Devanadera Jr.
Malalag National High School, Sarangani

Mc Henry Narvaez
Malalag National High School, Sarangani

Rhea Mae delos Santos
Libon Agro-Industrial High School, Albay

Aira Magbanua
Batasan Hills National High School, Manila

Nazarene Torcelino
Batasan Hills National High School, Manila

Rich Mark Joshua Ramos
Ilocos Norte Agricultural College

Marx Lenin Yaneza
National Teachers College, Manila

Abigail Salen
Taguig Science High School, Manila

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Appendix

We have reviewed particular websites that have significant contents on climate change. They contain handouts, powerpoint presentations, and other learning materials on climate change. We are not, in any way, connected to the organizations hosting these websites.

Website	Description
CLEAN Climate Literacy and Energy Awareness Network: Collection of Climate and Energy Educational Resources http://cleanet.org/clean/educational_resources/index.html (CLEAN, 2017)	Recommended for educators and scientists, this web portal contains an impressive collection of climate and energy science resources.
UN CC: Learn The One UN Climate Change Learning Partnership http://www.uncclearn.org/ (UN CC: Learn, n.d.)	This website contains module guides with supporting visual aids and fact sheets suited for educators both in formal and informal education
Climate Generation https://www.climategen.org/what-we-do/education/climate-change-and-energy-curricula/ (Climate Generation, 2017)	The website has curriculum resources for Grades 3-12 such as curriculum guides, sample lessons, and online modules

Website	Description
Earth Day Network http://www.earthday.org/campaigns/ (Earth Day Network, 2017)	The website is about an environmental movement that combines different strategies such as education, public policy, and campaigns on climate change.
Cornell Climate Change http://climatechange.cornell.edu/tools-resources/ (Cornell Climate Change, 2017)	The website contains plenty of information on climate change events, initiatives, research, student courses and organizations, and public engagement at Cornell University. This is recommended for extension educators and researchers.
The Teach Earth http://serc.carleton.edu/teachearth/index.html (Teach the Earth, 2017)	This is a web portal hosted by the Science Education Resource Center based in the US. It has downloadable materials on modules on teaching climate change.
Extension https://extension.org/2016/01/24/issues-innovation-and-impact-of-wearable-technology-on-health-and-safety-in-agriculture/ (Extension, 2016)	Contains climate change research-based information focused on disaster issues, general agriculture, environment, family, and youth.
State Climate Office of North Carolina http://climate.ncsu.edu/edu/k12/.index (State Climate Office of North Carolina, 2012)	It contains basic to advanced information on climate and weather concepts suited for educators. Downloadable materials include illustrations, videos, and teaching activities

Website	Description
Prince William Network https://climatechangelive.org/index.php?pid=180 (Prince William Network, 2017)	This website presents climate change information in a fun and engaging way. It has modules specific for K-12, K-8, 2-4, and 3-12.
NASA https://climate.nasa.gov/ (NASA, 2017)	One of the key features of this website is the NASA Global Climate Change Education for K-12. It has plenty of educational materials for educators and students alike.
Climate.gov Science and information for a climate-smart nation https://www.climate.gov/teaching/professional-development	The Teaching Climate Page offers learning activities and curriculum materials, multimedia resources, and professional development opportunities such as joining virtual courses, webinars, and symposia for educators
Yale Program on Climate Change Communication http://climatecommunication.yale.edu/topic/ (Yale, 2017)	This website presents research studies on public climate change knowledge, attitudes, policy preferences and the underlying psychological, cultural, and political factors surrounding the issue.
Center for Climate Change Communication http://www.climatechangecommunication.org/resources/ (George Mason University Center for Climate Change Communication, 2016)	Communication research studies relating to climate change are presented in this website. Recommendations are directed to government agencies and civic organizations. The key aim of this website is to improve public engagement on climate change.

Website	Description
Climate Communication https://www.climatecommunication.org/resources/ (Climate Communication, 2017)	Educational resources, articles, related websites, videos, and reports on climate change are available in this website. Downloadable reports on climate change written by scientists and climate change communicators are available in this website.
Climate Visuals http://www.climatevisuals.org/about-the-project/ (Climate Outreach, 2017)	This website mainly offers images on climate research studies, which can be used by teachers in their class presentations
Climate Central [US] http://www.climatecentral.org/research (Climate Central, 2017)	This website is being maintained by scientists and journalists in reporting climate change and its impact on the public. It has some quantity-heavy research findings that are converted into graphics
What we know http://whatweknow.aaas.org/ (American Association for the Advancement of Science, 2014)	Scientists' perspectives on climate change are presented through videos and media outreach
USAID Leaf Asia http://www.leafasia.org/curriculum (USAID, n.d.)	Modules on climate change are among the major contents of this website. The modules are recommended for university professors, lecturers, teachers, and climate change training experts. User log in is required to access the contents of the website.
Inside Education http://www.insideeducation.ca/learning-resources/ (Inside Education, 2017)	Learning resources and classroom and field programs on climate change are among the key contents of this website.

Website	Description
Climate Change Education https://www.britishcouncil.vn/en/programmes/society/climate-change-education (British Council Vietnam, 2017)	Maintained by the British Council in Vietnam, this website contains educational activities on climate change for secondary high school teachers and students.
The Science Education Resource Center (SERC) http://serc.carleton.edu/index.html (Science Education Resource Center at Carleton College, 2017)	Engaging teaching activities and transformative workshops on climate change are available in this website.
Pacific Institute for Climate Solutions http://pics.uvic.ca/education (Pacific Institute for Climate Solutions, 2012)	It contains basic information on climate change adaptation and mitigation presented through animations and interactive courses.
Our Climate Our Future https://acespace.org/our-climate-our-future	Initiated by the Alliance for Climate Education based in the US, this website features an interactive video series for young people about climate change with trivia questions that are interspersed in between videos.
weADAPT https://www.weadapt.org/ (weAdapt, 2007)	This is a go-to website on climate change communication (CCC) being maintained by Stockholm Environment Institute

Website	Description
Consultative Group on International Agricultural Research Program on Climate Change, Agriculture, and Food Security https://ccafs.cgiar.org/ (CGIAR-CCAFS, 2017)	Contains plenty of research studies on climate change and agriculture from all CGIAR-CCAFS projects across the globe. It has maps, models, and plenty of publications on the subject.
Infomediary Campaign www.infomediary4d.com (PhilRice, 2017 -a)	Contains teaching materials on climate change and rice production
PinoyRice www.pinoyrice.com (PhilRice, 2017 -c)	Contains plenty of information on climate-ready technology in rice in the Philippines

Glossary

For consistency, the terminologies and their definitions are lifted from the *Climate Change Act of 2009 (pp. 3-6).*

(a) "**Adaptation**" refers to the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.

(b) "**Adaptive capacity**" refers to the ability of ecological, social or economic systems to adjust to climate change including climate variability and extremes, to moderate or offset potential damages and to take advantage of associated opportunities with changes in climate or to cope with the consequences thereof.

(c) "**Anthropogenic** causes" refer to causes resulting from human activities or produced by human beings.

(d) "**Climate Change**" refers to a change in climate that can be identified by changes in the mean and/or variability of its properties and that persists for an extended period typically decades or longer, whether due to natural variability or as a result of human activity.

(e) "**Climate Variability**" refers to the variations in the average state and in other statistics of the climate on all temporal and spatial scales beyond that of individual weather events.

(f) "**Climate Risk**" refers to the product of climate and related hazards working over the vulnerability of human and natural ecosystems.

(g) "**Disaster**" refers to a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceed the ability of the affected community or society to cope with using its own resources.

(h) "**Disaster risk reduction**" refers to the concept and practice of reducing disaster risks through systematic efforts to analyze and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events.

(i) "**Gender mainstreaming**" refers to the strategy for making women's as well as men's concerns and experiences an integral dimension of the design, implementation, monitoring, and evaluation of policies and programs in all political, economic, and societal spheres so that women and men benefit equally, and inequality is not perpetuated. It is the process of assessing the implications for women and men of any planned action, including legislation, policies, or programs in all areas and at all levels.

(j) "**Global warming**" refers to the increase in the average temperature of the Earth's near-surface air and oceans, which is associated with the increased concentration of greenhouse gases in the atmosphere.

(k) "**Greenhouse effect**" refers to the process by which the absorption of infrared radiation by the atmosphere warms the Earth.

(l) "**Greenhouse gases (GHG)**" refers to constituents of the atmosphere that contribute to the greenhouse effect including, but not limited to, carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride.

(m) "**Mainstreaming**" refers to the integration of policies and measures that address climate change into development planning and sectoral decision-making.

(n) "**Mitigation**" in the context of climate change, refers to human intervention to address anthropogenic emissions by sources and removals by sinks of all GHG, including ozone-depleting substances and their substitutes.

(o) "**Mitigation potential**" refers to the scale of GHG reductions that could be made, relative to emission baselines, for a given level of carbon price (expressed in cost per unit of carbon dioxide-equivalent emissions avoided or reduced).

(p) "**Sea level rise**" refers to an increase in sea level which may be influenced by factors such as global warming through expansion of sea water as the oceans warm and melting of ice over land and local factors like land subsidence.

(q) "**Vulnerability**" refers to the degree to which a system is susceptible, or unable to cope with, adverse effects of climate change, including climate variability and extremes.

Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity.

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