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Gender dimension of
climate change research for agriculture
Case studies in Southeast Asia

Editors
Thelma Paris
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Foreword

The integration of gender in research, planning, and implementation of agriculture and climate change interventions is very crucial in achieving outcomes on agricultural productivity, climate resiliency, and food and nutrition security in Southeast Asia. This ensures that the impacts of climate-smart agriculture (CSA) research for development (R4D) interventions equitably benefit men and women. Gender dimensions cut across all thematic areas in CCAFS SEA's R4D projects – from climate-smart agriculture, to climate risk management, low emissions development, and policies and institutions.

In line with CCAFS's gender strategy, this book on "**Gender dimension of climate change research for agriculture in Southeast Asia**" features case studies on climate change, gender roles, and adaptation strategies in the region. A lot of studies have been done on gender analysis but not so much in the context of climate change and agriculture. This publication aims to find the links between socio-economic and gender issues in the context of a changing climate.

All case studies featured in the book are driven by a common goal— to help develop and implement gender-sensitive, sustainable CSA R4D interventions in improving climate resiliency and food and nutrition security of vulnerable communities in Southeast Asia. Four of the case studies were conducted in the Climate-Smart Village sites, such as: Sri Dasgupta's study and Tran Nhat Lam Duyen et al's research in Tra Hat Village in Vietnam; Auni Haapala's study in Phailom Village in Laos; and Magnolia Rosimo's study in Guinayangan, Quezon province in the Philippines. Other case studies were conducted by Julie Basconsilio in Bulacan and Arma Bertuso in eastern Visayas in the Philippines; and Justin McKinley et al in Mekong River Delta in Vietnam.

As the book documents unique adaptation strategies practiced by men and women farmers in several countries in Southeast Asia, it provides opportunities for looking for similarities and differences among these practices. Through these, readers will see how the roles of men and women affect their climate change adaptation strategies. Moreover, this book also provides researchers the necessary information to pursue gender analysis in the context of climate change in agriculture in an under-researched area of Southeast Asia.

As CCAFS is now on its second phase, the findings from these studies will help in the outscaling of effective CSA interventions in other areas with similar conditions. We believe that research results published in the book will be essential in guiding scientists and researchers in developing and implementing R4D programs and activities that are effective, problem-based, and culturally acceptable.

Lastly, I would like to congratulate Dr. Thelma Paris, CCAFS SEA gender advisor and retired socio-economist-gender specialist of the International Rice Research Institute (IRRI), and Dr. Maria Fay Rola-Rubzen, Associate Professor, School of Agriculture and Environment, Faculty of Science, University of Western Australia (UWA), for spearheading the publication of this book. I also thank the contributing authors for the different case studies featured in this book.

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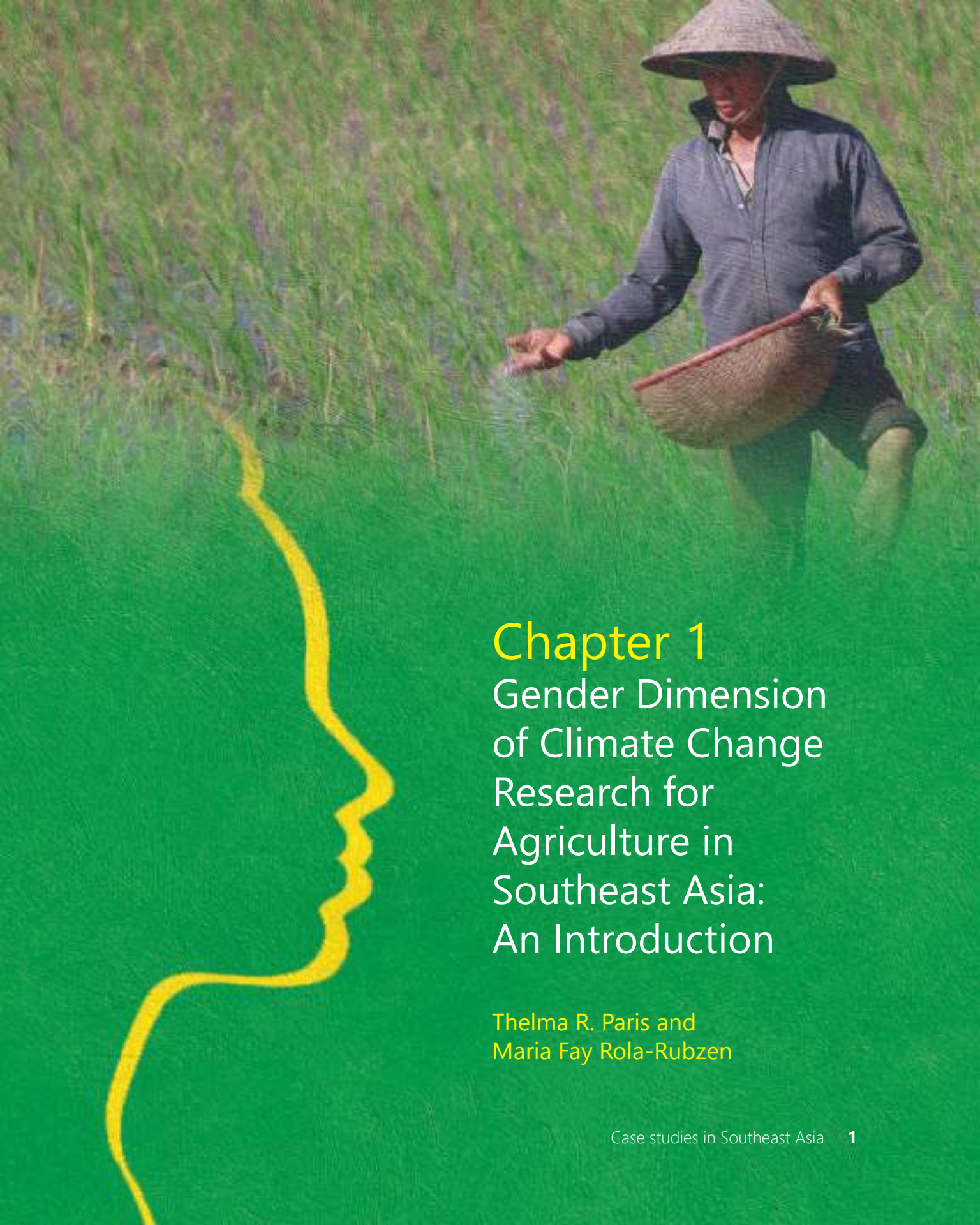
Acronyms

AMRIS	–	Angat-Maasin River Irrigation System
AWD	–	Alternate Wetting and Drying
AARIS	–	Angat Maasin Rice Irrigation System
CARD	–	Credit for Agriculture and Rural Development
CARP	–	Comprehensive Agrarian Reform Program
CBA	–	Community based adaptation
CCAFS	–	CGIAR Research Program on Climate Change, Agriculture and Food Security
CGIAR	–	Consultative Group on International Agricultural Research
CLRRI	–	Cuu Long Rice Research Institute
CBA	–	Community Based Analysis
CSA	–	Climate-Smart Agriculture
CoMSCA	–	Community Savings and Credit Association
DARD	–	Department of Agriculture and Rural Development
EV	–	Eastern Visayas
FAO	–	Food and Agriculture Organization
FGD	–	Focus Group Discussion
FLGU	–	Farmer Learning Group Unit
GSI	–	Gender Strategy Inclusion
IFAD	–	International Fund for Agricultural Development
HH	–	household
IPCC	–	Intergovernmental Panel on Climate Change
IPSARD	–	Institute of Policy and Strategy for Agriculture and Rural Development

IPM	–	Integrated Pest Management
IIRR	–	International Institute of Rural Reconstruction
IRRI	–	International Rice Research Institute
KII	–	key informant interview
LGU	–	Local Government Unit
LLL	–	Land laser leveler
MARD	–	Ministry of Agriculture and Rural Development
MAO	–	Municipal Agricultural Organization
MO	–	Market oriented
NASA	–	National Academy of Satellite Agency
QLPH	–	Quan Lo Phuang Hiep
PAGASA	–	Philippine Astronomical Administration
PhilRice	–	Philippine Rice Research Institute
PCIC	–	Philippine Crop Insurance Corporation
PIRCCA	–	Policy Information and Response Platform on Climate Change and Rice in the ASEAN and its member countries
PAR	–	Participatory Action Research
PRA	–	Participatory Rural Appraisal
PVA	–	Participatory Vulnerability Assessment
SEA	–	Southeast Asia
SHG	–	Self Help Group
SO	–	Subsistence Oriented
TOT	–	Transfer of Technology
TSPI	–	Tuloy sa Pagunlad Incorporation
VBS	–	Village Baseline Surveys



Chapter 1
Gender Dimension of Climate Change Research for Agriculture in Southeast Asia: An Introduction

Thelma R. Paris and
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Introduction

Agriculture, which consists of crop, livestock, aquaculture and agroforestry, provides the major source of livelihood and food for smallholder farmers in South East Asia (SEA). However, climate change is affecting geographical locations, agroecosystems, and rainfall patterns in the Southeast Asian region. As one of the world's most vulnerable regions to climate change, SEA is severely affected by the impacts of climate-related disasters. Being heavily reliant on agriculture, millions of people and their livelihoods are constantly at risk due to increased incidence of drought, flooding and sea level rise. In the ten-year (2005—2015) report of the Food and Agriculture Organization of the United Nations (2017), USD 14.5 billion worth of crop and livestock production loss due to natural disasters was recorded in Southeast Asia. These changes in climate adversely affect agricultural yields, biodiversity, forest harvests, and availability of clean water. With much of the population located in coastal and river deltas, millions of people in SEA are at great risks from the impacts of climate change.

The impacts associated with climate change and climate variability differ from one country to another, from one region to another, and within the same community, as the magnitude and frequency of hazards and of the existing vulnerability can have varying degrees. Generally, the poorest populations and marginal groups are impacted the most; additionally, there can be a different effect on men and women as a consequence of their social roles, inequalities in access to and control of resources, and their low participation in decision-making (Escobar Carvajal et al, 2008). Men and women face different climate change impacts because they perform different tasks, have different access to and control over assets and have different sets of knowledge and skills based on their distinct roles and responsibilities. Rural women are major contributors to the economy, both through their remunerative work on farms and through the unpaid work they traditionally render at home, at the farm and in the community. Women appear to be less adaptive because of financial or resource constraints, because of male bias in receiving information and extension services and because available adaptation strategies tend to create higher labor loads for women.

In recent years, the call for gender mainstreaming in climate change research for development programs has gained momentum. Under the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS, several research initiatives were undertaken to gain a better understanding of the connections of climate change in agriculture, gender, food security and Climate Smart Agriculture (CSA) (Kristjanson et al, 2017; Jost et al, 2015;

Twyman et al, 2014). CSA[1] options have the potential to provide benefits to women when they have access to information on CSA. Indeed, women are just as likely as men, if not more so, to adopt CSA practices (Twyman et al, 2014).

Yambrou and Nelson's (2010) work contributes to a growing body of literature on gender and climate change and draws inspiration from pioneering work in the Indian context. Gender is one of the numerous important socio-cultural dimensions typically included in climate change vulnerability assessments but it is rarely incorporated in adaptation research and planning. A major contribution of Yambrou and Nelson's research is the development of an innovative methodological model for studying gender and climate variability for use in the context of climate change. The research uses gender-sensitive qualitative and quantitative methods and gender analysis techniques to capture the voices of both men and women and quantify the degree to which men's and women's responses to climate variability differ. Their research tests the hypothesis that due to gender roles (i.e., the behaviors, tasks, and responsibilities a society defines as "male" or "female") and due also to differential gendered access to resources, men and women experience climate variability differently and, hence, cope with climate variability and changing climate patterns in diverse ways. The findings confirm that there is a strong gender dimension to the way in which climate variability is experienced and expressed by farmers in their coping strategies to ensure their livelihoods and food security. Women's and men's perceptions of and responses to impacts of drought conditions, as well as their access to resources and support, differ in important ways. These findings demonstrate that gender analysis enhances our understanding of what farmers perceive as risks and how they respond to climatic changes. Such findings are essential for informing policy decisions by ensuring that the experiences of both women and men are embedded into policy design. This has implications for future research and for incorporating gender issues into adaptation to long-term climate change.

Yambrou and Nelson (2013), in their study conducted in Andhra Pradesh, India, revealed that changes in climate over time have different impacts on men and women and these differences are linked to their gender roles. Their finding that an increase in emotional stress/anxiety was a highly ranked issue for men more so than for women is somewhat surprising as women would be expected to be more likely than men to report an increase in emotional stress. However, this finding is consistent with Tatlonghari and Paris (2013) in Luzon, Philippines wherein men were found to be more emotionally stressed than

[1]Climate-smart agriculture (CSA) is an integrated approach which uses a combination of technologies and practices to meet food security goals while adapting to, and mitigating, climate change. In practice, it means having access to agricultural technologies such as crop varieties and livestock breeds that are more adapted to a changing climate, improve water management techniques to use water more efficiently, and practicing agro-forestry, crop rotation, mulching, intercropping, integrated crop-livestock management, and improved grazing to help conserve water and carbon in the soil. CSA also focuses on better weather forecasting, early warning systems, and insurance to help farmers reduce risk. Using available technologies and practices, CSA can increase agricultural productivity, adapt to climate change, reduce greenhouse emissions from agriculture, and strengthen resilience in smallholder farming systems and livelihood (WOCAN 2012).

women due to the devastation of floods on rice. They also found that men and women adapt to flooding according to their traditional roles. Moreover due to the changing weather patterns which greatly affect their livelihoods, men and women have assumed new roles. Women tend to be more creative and more resourceful in using their social network for borrowing money, food and also other support services. Some of the strategies which women do during flooding are: stocking food before and after the flooding season; spending less on unimportant commodities; securing important assets and livestock by protecting them from floods; taking care of the nutrition and health of family members; seeking assistance from the government (relief goods) and securing loans for household needs and additional farming expenses from relatives and friends. On the other hand, men adjust rice planting ahead or delay it based on the occurrence of flooding; re-sow when seedlings are destroyed; replant when there are available seedlings for transplanting; buy seedlings from other farmers; choose varieties with high yields and tolerance to flooding; build higher dikes around the plot; secure crop insurance; store all farm machinery in secure places; delay harvesting and harvest whatever could be saved after flooding. Due to climate change, women bear the burden of allocating or stretching the limited budget for different expenditure and saving in anticipation of emergencies. Thus, they seek different sources of cash income such as fattening swine, raising poultry, growing vegetables for consumption and sale in the village, and engaging in small trade. They are increasingly becoming entrepreneurs using agricultural products. The alteration of gender roles has significant effects on the roles of men and women and on the welfare of their households. Their study highlights the importance of understanding the gendered adaptation strategies and the consequences which can provide a basis for designing long term strategies for adaption to climate variability.

The most recent literature on understanding gender dimension of agriculture and climate change in smallholder farming communities was done in Africa (Uganda and Ghana) and Bangladesh by Jost et al, (2015). These authors show that farmers in all three sites have changed agricultural practices, often at least in part because of changes they have observed in the weather, climate or environment. However, financial and food security incentives for change appear to be as important as those related to climate itself. A main challenge for the climate change research community is to move beyond the current simplistic understanding of smallholder women as a homogenous group that is inherently nature-protecting, but unable to adapt to climate change because of their overwhelming vulnerability (Arora-Jonsson, 2011 cited in Tuana 2013). They further suggest that in order to understand in-depth the gender dimension of climate change and gender, it is important to examine them within the context of climate variability, livelihoods, beliefs and social norms, and access to resources, information and services. According to Jonsson (2011 p, 746, cited in Tuana 2013), "No scientific study is ever cited to document percentages such as the assertion that 70% of all poor people are women; there is in fact little gender disaggregated

data to support the feminization of poverty hypothesis".

This signals that caution is necessary when examining evidence for gender-differentiated impacts on climate change to ensure that claims are supported by sound findings and data, and are not merely based on assumptions, projections, or speculations.

Goh's (2012) review of literature shows that increasing climate variability tends to lower agricultural production, with different impacts on women's and men's well-being and assets, including land, livestock, financial and social capital. Both women and men also spend more time and labor in agricultural production as a result of increasing climate variability, but women experience a heavier workload due to other domestic chores they have to perform. Men and women value climate impacts differently, depending on whether the impact falls within or outside their gender roles and responsibilities. Men ranked impacts that affected their agriculture and income-generating work as high impact areas while women ranked impacts related to food production and household domestic wok as high-impact areas. Studies also show that although men and women report similar impacts of climate hazards on agriculture and their homes, they valued these impacts differently depending on whether the impact falls within or outside their gender roles and responsibilities. Kristjanson et al, (2017) synthesized the initial research findings which focused on the nexus of gender, agricultural development and climate change. The study concluded that although much progress has been made in the last few years on identifying gendered research questions and developing new research approaches for addressing them, many gaps yet remain. The evidence demonstrates that men and women are exposed to different climate shocks and experience different impacts.

Research gaps

Based on the review of literature (Goh 2012) and synthesis of studies in Africa and Bangladesh (Jost et al, 2015; Kristjanson et al, 2017), the authors made several suggestions for future research on addressing gender dimension of climate change research for agriculture which can be applicable in South East Asia.

Goh (2012) suggested that a key research need is systematic and empirical studies on how climate change affects women and men, separately or jointly, in terms of their vulnerabilities, well-being and assets. Furthermore, the author suggested the need to understand the contextual factors that mediate these impacts and the ensuing responses. Thus, research on gender and climate change should examine the gender division of labor in conjunction with livelihoods within the local agricultural systems.

In terms of addressing the gender research questions identified with respect to climate risk, vulnerability context, adaptation arena, and well-being outcomes, Kristjanson et al, (2017) gave several recommendations. These include: a) conduct more in-depth research to better understand the differences not only between men and women but also among the underrepresented groups for example,

women, youth, and ethnic groups; b) use a combination of quantitative and qualitative approaches to better understand the complex nexus of gender, agricultural development and climate change and draw out patterns of gender dynamics or changing gender roles in response to climate change; c) use more participatory integrated qualitative-quantitative work, which can be linked to innovative quantitative work as well as to innovative ICT-based action research and gender-transformative approaches; d) invest in participatory action research (PAR) approaches, testing new technologies, strategies, policies, tools, and approaches and co-learning with partners on the ground. Such efforts can further enhance understanding of gender and climate change issues, while equally importantly, build capacity in local partners for climate change-appropriate gender research and development in agricultural systems and communities; e) use more 'action research' with a focus on co-learning.

On the other hand, Jost et al (2016) recommended that: a) more work should be done to move beyond the conceptualization of women as a homogenous group in Climate Smart Agriculture (CSA) programs; b) use participatory approaches in climate change adaptation research to elucidate beliefs and norms that contribute to gender dynamics; c) when conducting interviews and focus group discussions, capture the variety of voices by splitting participants into more socially differentiated groups, and allow for the probing of norms, rules and beliefs related to gender and climate change within social groups.

Lambrou and Nelson (2013) emphasized the importance of documenting men's and women's views of their own lives so that the degree to which certain issues matter more to men or women is clear. They also point to the importance of collecting data from men and women separately when conducting research on gender in agriculture and climate change so that their responses are not biased by the presence of members of the opposite sex. Often, social restrictions inhibit women from voicing out their experiences and feelings with the presence of men.

A big gap in the existing literature is the lack of research on understanding gender dimensions of agriculture and climate change in smallholder farming communities in Southeast Asia, except for a few case studies done by Tatlonghari and Paris (2013); Bagsit et al, (2014), Peralta et al, (2008) in the Philippines and Mendoza et al, (2014) in Cambodia, the Philippines and north Vietnam. Results from these studies showed that although women and men worked in complementary ways to secure their family assets, there are gender differences in their preferred adaptation and coping responses. These studies also showed that women are not only victims of climate change (as often perceived) but are also effective agents of change in relation to climate change adaptation. Thus, it is important that similar studies conducted in Africa and South Asia on gender dimensions in climate change in agriculture be conducted as well in SEA.

Social norms, gender division of labor vary across social groups, farming systems and climate change risks. Based on the review

of literature within Southeast Asia, little is known about the vulnerabilities of men and women to climate change risks, how social and gender disparities actually affect the ways in which poor men and women respond to climate change impacts on agriculture and whether there are gender disparities in the adoption of climate-smart agriculture (CSA) and practices. Moreover, there are limited examples which demonstrate that the resilience of households, communities, and food systems increase when women are given opportunities that increase their awareness, knowledge, and access to information about climate change.

The overall purpose of CCAFS is to marshal the science and expertise of CGIAR and partners to catalyze positive change towards CSA, food systems and landscapes. The main goal of CCAFS' Gender and Social Inclusion (GSI) Strategy is to promote gender equality in supporting CCAFS' work across the above arenas. CCAFS' approach to GSI aligns with the CGIAR objectives to created opportunities for women, young people and marginalized groups and to promote equitable access to resources, information and power in the agri-food systems for men and women in order to close the gender gap by 2030 (Huyer et al, 2016). In support of this goal, CCAFS has committed to undertake research that can inform, catalyze, and target CSA solutions to women and other vulnerable groups, increase the control of disadvantaged groups over productive assets and resources (e.g., climate information and novel finance) and increase participation in decision making (e.g., in local and national climate adaptation strategies). The GSI Strategy focuses on women as central to agriculture in developing countries within a broader social context. This focus is appropriate since gender equality is a key leverage point for change given women's important roles in agricultural production, food security, nutrition and livelihoods. Addressing gender equality will open spaces for addressing other social inequalities (Huyer et.al, 2016). According to Huyer (2016), while different aspects of supporting agricultural production of women and men smallholder farmers are addressed in several sites in Africa and South Asia, several common themes emerged: (a) technology is not sufficient in itself, it needs to be understood in the context of local knowledge, culture, gender relations, capacities and ecosystems; (b) technology is not gender neutral and can reinforce existing gender and power imbalances; (c) gender roles and relations are changing in response to socio-economic and environmental stresses, changing employment patterns and technology. Finally, technology to support resilience and adaptation to climate change by smallholder farmers can promote women's empowerment and the transformation of gender relations in addition to sustainably increasing agricultural production. But this will only happen if they are implemented in a framework of mutually reinforcing resources, women's control over assets, equitable decision-making between women and men, and strengthened capacity.

In November 2016, CCAFS-SEA research program under the CGIAR organized a workshop to present past and ongoing gender and climate change research activities which can be compiled into a book. The discussions concluded that there is a need to

do good gender analysis, draw patterns across research focus, identify tools, approaches and processes used for climate-risk management; focus on current state of knowledge based on experience and identify knowledge gaps; and set future directions based on gaps. This book is the product of these discussions. This book presents the gender dimensions of the relationship between agriculture and climate change. It explores whether men and women farmers in Southeast Asia experience similar or different vulnerabilities and coping mechanisms or adaptation measures in response to climate change risks. It identifies gender gaps in access to and control of resources, information, services, technologies, training, finance, etc., which enable or constrain men and women to adopt climate smart agriculture (CSA) and practices as well as presents examples of participatory action research (PAR) which incorporates a gender dimension.

This book includes farm-level micro-level studies conducted by researchers (mostly social scientists) in Southeast Asia (the Philippines, Lao-PDR, Vietnam and Cambodia) including MS and PhD students. Most of the case studies were/or are being conducted in the Climate Smart Villages (CSVs) wherein Climate Smart Agriculture (CSA) and practices are being tested using participatory action research. CCAFS-SEA works with villages referred to as Climate Smart Villages (CSVs) in focal countries (Lao PDR, Cambodia and Vietnam) to help smallholder farmers adopt innovative agricultural practices that can help them adapt to climate change and enhance food security. However, gender is considered as a defining factor of these barriers to adaptation. Critical awareness of and effective measures to address gender inequities, therefore could be a key for addressing climate change risks. (CCAFS 2014). It is hoped that through this book, scientists (biophysical and social scientists), agricultural extension workers, and policy makers will gain a profound understanding of gender roles, gendered impacts of climate change, adaptation or coping mechanisms/ strategies in response to climate change and access to climate change information, services, and resources. This knowledge will lead to further research on the most effective ways to engage men, empower women, and challenge existing gender norms.

The organization of the book

This book is divided into three themes. Theme 1 is an introductory chapter.

Paris and Rubzen (Chapter 1) discusses the significance of gender in the context of climate change in Southeast Asia and the framework for analysis. Theme 2 is on climate change and vulnerabilities which deal with gender differences in climate change perception, adaptation strategies in Vietnam and Philippines. Theme 3 focuses on capacity enhancement and perceptions of CSA practices. Theme 4 provides examples of PRA on CSA practices. Theme 5 is on Monitoring and Evaluation Frameworks on integrating gender and M & E. The specific details of each chapter are as follows:

In Chapter 2, Dasgupta analyzed the climate risks that men and women in Tra Hat Hamlet, a *climate-smart village* in the Mekong Delta, faced and their adaptation strategies

using a mix methodological approach. The study also looked into the different gender-based livelihood activities and identified the gender-based constraints that exist in accessing the resources needed to further strengthen their adaptation strategies. The results showed that in both male and female headed households, there was a perception of increasing temperature and reducing rainfall, with respondents identifying adverse impacts on the agriculture and livestock sectors. In particular, rice farming was suffering from yield losses and increased costs of inputs especially after extreme weather events. No long term adaptation strategies could be identified by the farmers but both male and female headed households have different strategies to cope with either climatic or non-climatic drivers of change. The study also found that male and female headed households engage in a portfolio of activities to diversify their livelihood. It was mainly the younger generations who either migrated or worked as seasonal hired labour outside the village. There were, however, significant differences in the levels of income earned annually by each household type based on farm size. Findings, furthermore, show that gender-based constraints in participation in trainings, accessing income generating activities and lack of knowledge and awareness still exist that may affect their adaptive capacities. The study highlights the need for further training and knowledge dissemination on adaptation strategies in agriculture and building capacities of farmers in order to reduce the vulnerabilities of farm households. The findings have implications for designing better initiatives at Tra Hat and for enhancing the involvement of men and women in the ongoing climate smart village initiative.

McKinley, Adaro, Rutsaert and Sander (Chapter 3) conducted intra-household analysis in rice farming households in three provinces in Ang Giang, Bac Lieu and Tra Vinh, south Vietnam. Results reveal that there are no gender differences between husbands and wives with regards to perceptions of climate change in the study sites. However, there are differences between husband and wives with regards to coping strategies at both the individual and household level. This study reveals that in studying climate change and gender, it is important to first examine the types of climate change risks that affect specific areas. Respondents in An Giang are more concerned about flooding while respondents in Bac Lieu and Tra Vinh provinces which are located in the coastal areas are more concerned with sea level rise and salinity intrusion. The fact that both husbands and wives have similar perceptions of climate change risks is not surprising because women are also actively engaged in rice production, postharvest and marketing. Although men are more likely to do nothing in response to climate change, women are more actively engaged in financial strategies such as taking a bank loan, using savings, or delaying a loan payment. Despite the significant contributions that women in South Vietnam make to rice production, the design and transfer of agricultural technology and extension services are performed with a male farmer in mind, thus leaving women's specific roles and needs along the rice value-chain unaddressed. Often, women are not explicitly targeted by extension programs because they

assume that women are not farmers but only housewives who help their husbands in specific farm work. Current agricultural extension workers dealing with CSA technologies and practices for rice production, such as integrated crop management, water storage and water-saving irrigation, adaptive varieties, cropping systems and changing cropping calendar, and improved livestock and poultry management, do not automatically include women as direct recipients of training programs. In order to facilitate adaptation of CSA practices by both men and women, much greater effort is needed to ensure that gender issues are addressed and integrated into the design of policies, programs, projects and other research activities.

Basconcillo (Chapter 4) carried out research in two villages in San Rafael, Bulacan which is a major rice growing area prone to frequent floods which damage rice. Results show that women and men farmers have different strategies in coping with floods. Given their gender roles and physical strengths, more men are engaged in building dikes. Significant gender-specific strategies are also seen for resowing or gap filling and acquiring loans. Farmers relied heavily on short-term risk coping strategies. Majority of respondents would customarily engage in resowing and replanting when floods or typhoons damage their crops. This substantially increases farm workload of women who have lower labor participation in rice farming activities except during harvest period. Women are not direct recipients of information. While there were many (73%) women who reported that they had access to information on farm practices and agricultural technologies, it seems that this information was accessed indirectly from their husbands who attended the meetings on behalf of the households. A low proportion of the women who had access to information said that they themselves were the direct recipients. Next to crop losses and increased workload in the farm and at home, increased indebtedness ranked third among the impacts of typhoons and flooding events on women and men farmers. The lack of access to formal credit institutions necessitated them to borrow from informal sources which required higher finance charges. Increasing prices of seeds and of other inputs further strained the household budget as the meagre incomes from the previous cropping season and from other non-agricultural sources were hardly sufficient for the household daily needs. Distress sale of rice stockpiles as a risk-coping measure. (i.e., selling rice originally allocated for consumption) put the household at risk to food insecurity. This situation could be exacerbated as they would likely have to purchase rice supply at a higher price in the future. During flood events, farmers reported decreased quality and quantity of food.

In Chapter 5, Bertuso explores the interrelationship among rootcrops production, climate change and gender. Bertuso conducted separate small group discussions with men and women and used participatory rural appraisal (PRA) tools in two selected villages representing market-oriented and subsistence oriented communities. These farming communities are engaged in mixed crop-livestock farming systems. Roots and tuber crops are important part of the mixed cropping farming system of communities in Eastern Visayas (EV), both

for market-oriented (MO) and subsistence-oriented (SO) farming. Root and tuber crops such as sweet potato, taro, cassava, yam, giant taro, cocoyam and giant swamp taro are intercropped with rice, corn, coconut, banana and vegetables. Rootcrops contribute not only to food consumption but to income as well. Although farming communities in these selected areas are highly vulnerable to typhoons and drought every year, rootcrops production enable them to be food resilient and prevent them to go deeper into poverty and food insecurity. Both men and women in MO and SO communities provide their labor in most of the crop production activities. However, in MO communities, women are more engaged in marketing than men. In the SO communities, women are more engaged in field activities in crop and livestock (pig fattening) production. Aside from providing unpaid labor in their own farms, men and women earn additional income by working as agricultural workers in other fields. In SO, more men and women are engaged in non-farm work to augment family income. The ability to spread risk through the year by diversifying the source of food and income as well as engage family members in all of these activities are crucial in enabling the people living in vulnerable areas to become more resilient than those living in areas with less diverse sources of income and food.

Tatlonghari, Paris and Villanueva (Chapter 6) pointed out that climate change is now considered as one of the major constraints to agriculture productivity particularly in rice farming in the Philippines. The adverse impacts of unpredictable extreme weather events are now being felt and confirmed to differ among men and women. Using gender-sensitive qualitative and quantitative methods, they conducted a study in Nueva Ecija, Philippines to demonstrate the vulnerabilities and adaptation of men and women farmers to devastating flooding events. Initial results of the study showed that vulnerabilities of rice farmers to extreme flooding are gendered due to their traditional roles in rice farming. The differential vulnerabilities are further aggravated by disproportionate access to resources and participation in decision-making of men and women. In coping with the devastating effects of floods, men and women assumed reverse roles. Men learned to assume reproductive roles while women are compelled to spend more time outside their homes to seek income from non-farm work. Men and women can be resilient when faced with extreme weather events. Women are deemed more resourceful in anticipating and adapting to the effects of extreme weather. However, their resilience and means to adapt to climate change will not be sustained unless they receive adequate support from the government and agricultural research institutions. This study argues that agricultural technological interventions, training programs and policies cannot be effective if women are ignored in the process.

Duyen, Sander and Wassman (Chapter 7) focused on gender issues and CSA technologies in Tra Hat, a CSV village in south Vietnam. The study found that there os no statistical significant difference between men and women in their perceptions of climate change, and constraints to adoption of CSA technologies. Among rice production activities, women participated regularly in

crop establishment and post-harvest activities while men took the lead in preparing the land, managing the crop, and operating farm machines. Generally, while women are responsible for food expense and household expenses, and children's education, men are in charge of rice production activities. Both make decisions on post harvesting, large investments, or large expenditures (e.g., purchasing large livestock, land, and machinery). The level of women participation in making decisions in rice production is lower compared with men. Moreover, an interesting finding from this study is the significant difference between men and women in their responses on crop selection, farm management, and post-harvest activities. While men dominate in decisions on selection of crop variety, women reported that they do make decision in these activities. This implies that women should be given more opportunities to gain more technical knowledge and skills which are critical in making decisions on farm-related matters. Women often have less access than men to land, production inputs, credit and education. The majority of men and women perceived a change in weather in the last ten years. Most participants reported an increase in temperature, salinity, drought and a decrease in rainfall. Based on the results of the study, it appears that there are differences between men and women in reporting adaptation strategies to climate change and factors affecting their decision of those strategies. These differences are in perceptions on acceptability of men and women on laser land leveling (LLL), nitrogen production, water management technologies for example Alternate Wet and Drying (AWD) method, integrated pest management (IPM) and change in cropping pattern. The first reason for these differences could be because some CSA technologies are relatively new to local farmers. On the other hand, the adoption of CSA technologies undertaken by respondents to adapt to or reduce effects of climate change can be learned through their roles. For IPM, the higher response of men (compared to women) can be explained by the dominance of local male farmers in the IPM trainings for Farmer Field Schools (FFS). Likewise, men are mainly responsible for most mechanized rice operations; therefore, mechanized CSA technologies are reported by men more than women. In spite of the potential of CSA technologies to improve resilience and to enhance agricultural production and rural livelihoods, farmers face several constraints in their adoption. Because there are gender gaps in access to information and technologies, the study recommends that both men and women should be provided access to climate information, training and extension materials on CSA technologies particularly for knowledge-intensive CSA technologies, especially for practices which are dominated by women such as seeds selection, gap filling, and transplanting seedlings.

Haapala's study (Chapter 8) applies a feminist approach to explore the feminine and masculine power dynamics within contemporary, technology-oriented climate change adaptation discourse. Through a case of rural Phailom community in Laos, she analyzes how three adaptation technologies related to rice cultivation are understood and negotiated by the marginalized voices at the local level. Based on this meaning-making,

her aim is to analyze how gender and wider power relations transform at the local level as adaptation technologies become part of daily life in Phailom. Theoretically, the thesis follows feminist critique on science and technology that perceives technologies as power-laden social constructions that are not objective or stable, but constantly negotiated and remade. The empirical data was collected by applying both qualitative and quantitative methods. The key data consisted of nine thematic interviews conducted with local farmers, and additional data were collected from project practitioners and farmers through interviews, household questionnaire and participatory rural appraisal methods. The findings reveal that the technified adaptation intervention becomes a setting where complex power relations between masculine and feminine, global and local, and market- and subsistence-centered worldviews become negotiated. The findings show that the adaptation project largely strengthens the existing local social hierarchies and it seems to function as a tool for marketization of rice production. In addition to these masculine impacts, the technologies however also have many emancipatory and contradictory potentials that could be better realized in Phailom. The study suggests, that the feminist non-deterministic view on technologies should be further developed and deployed to broaden the understanding of the power dynamics of technified adaptation interventions.

Tho, Chi and Duong (Chapter 9) addresses women's training needs for self-production of *Tai Nguyen* seeds in Tra Hat, CSV. This project reveals that women, and not only men, have the capacity in invigorating Tai Nguyen rice variety. After attending the training workshops, women's technical knowledge related to seed quality improved, and their knowledge is at par with trained men. As expected, trained women's knowledge scores are higher than those of untrained women. The local managers at different levels have high evaluation of women's role and they will support women's participating in terms of their guidelines and policies. The authors suggest that initially, women's participate rate in seed reinvigoration and multiplication can be around 30-40%, but to achieve gender equality in access to technical knowledge and resources, this should be increased by 20% to 50%. The authors also offer practical suggestions. For instance, to enhance men and women farmers' technical knowledge and skills on seed revival and multiplication/ production, they recommend trainings to be repeated 2-3 times with "hands-on" field experiments. Training materials should also be precise, short, and simple. To help women concentrate during training, activities should be conducted from 10am (after cooking) to 2pm instead of 8am when women are busy with other responsibilities. Local managers at different levels and extension workers should increase both women's and men's awareness on long-run benefits of rice production from reinvigorated seeds to obtain the trade name for *Tai Nguyen* variety. They also point to the need to select and train active women and men under a training of trainer (TOT) program, so farmers can teach each other in the future, and the need for socialization of the training fund where different groups contribute to the fund, for long term sustainability of the training program.

Rosimo, Dalusag, Gonsalves and Vidallo (Chapter 10) provide an understanding of the vulnerabilities through the conduct of Participatory Vulnerability Assessments (PVAs). Their study show that the impacts of climate change differ between women and men. Climate change also results to women farmers taking over additional and heavier agricultural tasks and becoming more indebted to cope with increasing crop failures or extreme weather events. Small livestock systems, a climate smart agricultural practice, present a less risk-prone livelihood venture. Small livestock production can be a diversification mechanism, reducing the risks from crop failure as it is adaptable to all ecosystems. Small livestock initiatives can benefit women as it provides them a low-labor and manageable economic option which requires a small start-up investment.

The subsequent chapters provide details of the experiences of men and women smallholder farmers as they face the daily challenges of climate change. We invite you to join us in our journey as we explore the gender dimension of climate change research for agriculture in Southeast Asia.

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Chapter 2

Gender-based Vulnerabilities and Adaptation to a Changing Climate: A Case Study in Tra Hat Hamlet, Bac Lieu Province, Vietnam

Srijita Dasgupta

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Srijita Dasgupta

Introduction

Marginalized populations, in particular women, have often been identified as a group that is very much susceptible to changing climate mainly because of their limited or restricted access to resources that limits their capacities and opportunities to empower themselves. The discourse on the gendered impacts of climate change stretches over a long period of time and several studies have set strong grounds on the necessity to focus on gender when speaking within the spectrum of differentiated climate change impacts (Denton 2002; Terry 2009; Demetriades and Esplen, 2010; Dankelman 2002; Nelson et al. 2002). Yet, gender mainstreaming and the need for women's participation is still often over looked. Women have been known to be an integral part of their families and often in maintaining both household and income generating activities. Their unique knowledge, capacities and their important but often underestimated role in agriculture is undisputable (FAO 2011).

A number of studies in the past have examined the vulnerabilities and livelihood activities that are influenced by gender roles in different regions of the world. Investigating livelihoods sheds light into differences in opportunities and vulnerabilities faced by communities (Kabeer and Tran 2000). In general, through these studies, it has been well established that female-headed households, in comparison to male-headed households are more likely to be (resource) poor because of several determinants including income, and land and property rights (Horrell and Krishnan, 2006; Quisumbing et al. 2001). For example, a study in Nigeria, Africa by Babatunde et al. (2008) found that yield, household income, off- farm income and non-labor hours were higher in male-headed households than in female-headed households. This was attributed to unequal access to resources which resulted in higher food insecurity among female-headed households. Decisions to adapt have also been found to differ between the two kinds of headships in Eastern Uganda (Nabikolo et al. 2012) though perceptions of changes in climatic conditions have not been very different, as found in another study in China (Jin et al. 2015).

Despite several such studies, Waite (2000) noted that the vulnerability dimension of gender is not well understood. Moreover, many of these studies were found to focus on the African continent, and relatively fewer papers on gender research and climate change have been conducted in Vietnam. Several of the available documents on gender issues in Vietnam have also published in the native language, limiting the dissemination of the available information to wider scientific and research bodies. In developing countries with a high population of women who are vulnerable, it is imperative that gender focus on research is strengthened to reduce

the vulnerabilities and enhance women's capacities to adapt to a changing climate.

Background

Vietnam is a highly natural disaster prone area with frequent strong and dangerous typhoons. It is reported that as many as 380 typhoons and tropical depressions hit the country between 1958 and 2007. The incidence of these events happening in all parts of the country is somewhat similar but in the southern zone, typhoons are usually followed by long days of rainfall, eventually leading to landslides and floods (NSNDPRM 2007). Floods are also a common phenomenon, as is experienced by all zones of the country. The Mekong Delta stays flooded for around 4 to 5 months a year. Droughts are the third most common natural disasters and are known to bring about severe impacts on the socio-economic conditions of the; Smajgl et al 2015) Lack of fresh water due to salt intrusion and a narrowed down river system are making it increasingly difficult to control and reduce the impacts of droughts, particularly in the agriculture sector (NSDNPRM 2007).

Vietnam stands at a crossroad of progressive economic growth while also facing risks of dampened development due to the increasing impacts of the changing climate. Much of the country's economic growth has been fostered through a focus on increasing productivity and export in the rice sector. However, with changing temperature and precipitation levels, increasing sea level rise and incidences of extreme weather events, rice yield is speculated to decrease in the south east Asian region (including Vietnam) (Redfern et al. 2012; Viet Nam News, 2017) which can be detrimental to a large proportion of the country's population dependent on the agriculture for livelihood . Therefore, climate change adaptation in rice production for people involved in this sector is a priority for the country. Gender inclusion has been an important strategy in the development process, yet women, particularly in the rural areas, still face considerable challenges in their daily lives and in accessing resources.

Based on a UN desk review on gender and climate change in agriculture in Vietnam, Tran (2008) found that there is a lack of research on the vulnerabilities, capacities and adaptation strategies that men and women use in agriculture including livestock. The rural population has been facing the challenges of the changing climate and they have an intuit ability to adapt to changes. Men and women have different strategies to reduce risks and investigating households under male and female headships help to unearth insights in their responses (Goh, 2012). Understanding their perceptions of the changes is therefore important in determining their vulnerabilities. Gender analysis has been a valuable methodology in social science research to understand the opportunities and constraints faced by men and women in agriculture and in other sectors as well (Poats 1991).

In view of these, a gender analysis had been undertaken in Tra Hat Hamlet, located in Bac Lieu province, south Vietnam to understand the vulnerabilities and adaptation processes of male and female-headed households. To the knowledge of the researcher, during the time of the study, there was no comprehensive

gender analysis conducted in Tra Hat, which highlights the importance and the need for such a study. Findings from this study will add to the existing research on this topic and will provide a good overview of the situation of male and female-headed households and support the ongoing and future initiatives being planned at Tra Hat.

Objectives and research questions

The objectives of this study are two- fold. Firstly, the study aims to analyze the climate risks that men and women face and how they are adapting to these risks. Secondly, the study assesses the different gender-based livelihood strategies in a particular agro-ecosystem (i.e., a rice-based agriculture system) and whether or not gender differences exist in accessing resources for adaptation, under projected climate stresses.

The study was guided by the following research questions.

a) What are the climate change risks that men and women face?
b) What adaptation strategies do men and women use in response to a changing climate?
c) Are there gender differences in access to resources which serve as constraints to improving their adaptation strategies?

Research methodology

Selection of study area

This study was conducted in Tra Hat village in the southern part of the Mekong Delta

Figure 2.1. Location of Tra Hat (red dot) in Bac Lieu Province (in yellow). *Source: Ngo et al. 2015*

in Vietnam (Figure 2.1). Tra Hat Village is a Climate Smart Village (CSV) under the Climate, Agriculture, Food Security (CCAFS) –SEA research program. According to Phong et al. 2015, Tra Hat's bio-physical and socioeconomic conditions represent the Mekong River Delta. Tra Hat belongs to Chau Thoi commune, Vinh Loi District, Bac Lieu Province. This region is located in the commercial rice production of Vietnam. Floods, fresh water scarcity and salinity intrusion are recognized as main climate-related problems. Being located at the tail end of Quan Lo Phung Hiep (QLPH) canal system and current lack of internal irrigation canals, Tra Hat village has limitations on farming techniques and crop diversification. Farmers in Tra Hat village consider farmland, rivers and canals as most important resources. There have been significant changes in the resources over last 10 years. Before 1995, farmlands were used for only one rice crop per year with low rice yield (3 tons/ha).

Sampling and selection method

Given that this study employs a gender lens, selection of the female-headed households (HHs) was prioritized as it was important that female-headed HHs get as much exposure as the male-headed HHs in the surveys. In Tra Hat village, there were twenty-five households with female heads (separated, divorced, widowed). Out of the twenty-five households, twenty female heads of households were available for the interviews. Thus, forty farming households, comprised of twenty male headed and female headed households were finally selected for this study.

Data collection

Quantitative methods

Household surveys were also conducted with structured questionnaires which included several open-ended and perception-based questions. The questionnaires included information on land size, income sources, gender-disaggregated data on labor use in rice production, access to resources, decision-making power.

In the household questionnaire, farmers were asked to report the main extreme weather events in the last 10 years and how these events affected rice production and livestock. A considerable amount of time was spent on revising, editing and preparing the questionnaire and several valuable inputs from experts in this field helped to shape the different sections.

Qualitative methods

Participatory Rural Appraisal (PRA) tools such as key informant interviews (KIIs), focused group discussions (FGDs), seasonal calendar and problem tree were used. Six KIIs were conducted with youth, male and female farmers. Six FGDs were conducted with separate groups of male and female farmers. The groups were separated so that women were not intimidated by the presence of men during the discussions and were more comfortable in sharing their responses. Similar topics in the FGDs were discussed with men's group in the morning and women's group in the afternoon. This was done considering the busy morning schedule of the women fulfilling both their household and childcare responsibilities. Seasonal calendars were drawn by men and women separately to present the crop and livestock production activities throughout the year in relation to the months when rainfall distribution is high and low. The gender division of labor in rice production was also discussed by asking the main question, "*In this village, who often does what specific activity*" and men and women were asked to list the sequential activities in crop, livestock and household. For each activity, a follow up question was asked. Another PRA tool used was the problem tree. Farmers were asked to identify their most important common climate risk, the root causes and their adaptation strategies.

Data analysis

All data from the household surveys were first coded and divided into different sections in MS Excel files. For data generated

through interviews, important information from the recordings was transcribed into word documents. Descriptive statistics and frequencies were constructed for the qualitative data and supported with findings from the other methods, in order to determine trends and patterns in the responses.

Results and discussions

This section presents and discusses the results collected through a triangulation of methods. The results are divided into several sub-topics corresponding to the research objectives and with the aim of answering the research questions.

Socioeconomic characteristics of the sample

Forty farming respondents (twenty male heads and twenty female heads of farming households were included in the surveys. The characteristics of the respondents are shown in Table 2.1. In 2009, the literacy rate of female and male (from 15 years old) in Bac Lieu province was 96% and 92%, respectively. In general, women are much less well educated and therefore prone to various forms of exploitation. However, an analysis of the data from the three censuses conducted from 1989 to 2009 indicates that there has been a sharp decline in the gender gap – falling from 10% in 1989 to 4.4% in 2009. This demonstrates consistent progress towards achievement on the promotion of gender equality and empowerment of women (Minh et al 20

Table 2.1. Characteristics of the sample respondents

Characteristics	MHH	FHH
Age (years)	53.3	55.9
School (years)	5.5	4.2
Farming (years)	29.8	29.5
Household Size (members)	4.7	4.3
Land owned (ha)*	1.5	1.2
Total no. of samples	20	20

Livelihood diversification

Diversifying livelihoods is a way of reducing the vulnerabilities that rural households may face from exogenous shocks or unforeseen events (Reardon et al. 1998; Block and Webb 2001). Inequality in accessing resources can further exacerbate vulnerabilities faced by households and communities and limit their possibilities to diversify livelihood and spread the potential risks (Adger 1999). Gender is important in livelihood diversification. As shown in Figure 2.2, rice farming is the major source of income of MHHs and FHHs. After rice, livestock is an important source of income for both MHHs (85%) and FHHs (75%). Pigs and poultry (chickens, ducks, geese) are commonly raised. Due to lack of grazing land, very few households raise large animals like cow and buffaloes. About half of the MHHs and 40% of FHHs with small ponds within their homestead earned income from fish sales and the rest were used for home consumption. More than half (60%) of MHHs and half (50%) of FHHs grow fruits in their homestead. Vegetables are also grown by MHHs (45%) and FHHs (35%) for the market and home consumption. Poor farmers work as seasonally hired workers during rice

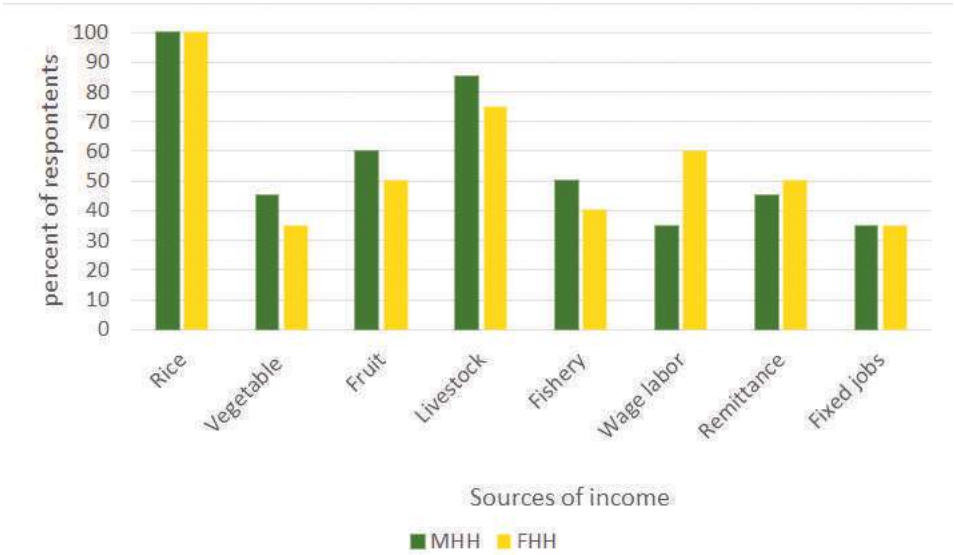

Figure 2.2. Share of various sources of income by male headed households and female headed households

planting season. Aside from agriculture (rice, fruits, vegetables and fish) a higher percentage of FHHs (60%) than MHHs (35%) obtain income by working as seasonal hired workers. Women are hired for transplanting and gap filling during peak seasons. Men are hired for land preparation, hauling and harvesting. Half of the FHHs and 40% of the MHHs receive remittances from other family members. Son and daughters are usually the migrants who send remittances back home. Younger men are engaged in construction work while younger women work in clothing factories or beauty parlors. Salaries from fixed or regular jobs which require higher education and skills comprise a low share of income of MHHs and FHHs (35%).

In summary, MHHs and FHHs are engaged in similar sources of livelihoods. However, a higher percentage of FHHs than MHHs obtain income by working as seasonal hired workers within the village. Thus, drought or floods which damage crops can result to a loss in income for FHHs who are responsible for food, income and nutrition security of their household members. Remittances from sons or daughters also help FHHs to support expenditures of family members left behind.

The seasonal agriculture calendar showing the weather, production and economic activities are illustrated in Figure 2.3. There are two main seasons in Tra Hat – the dry season from December to April and the wet season from May until November (Ngo et.al. 2015). The average monthly temperature ranges between 25.2 °C and 29 °C, with May being the hottest month and January the coolest. Rainfall during the wet seasons comprises of about 90% of the total annual precipitation. The heaviest rainfalls are usually experienced in September to November and lowest from December through April. Drought occurs during these months.

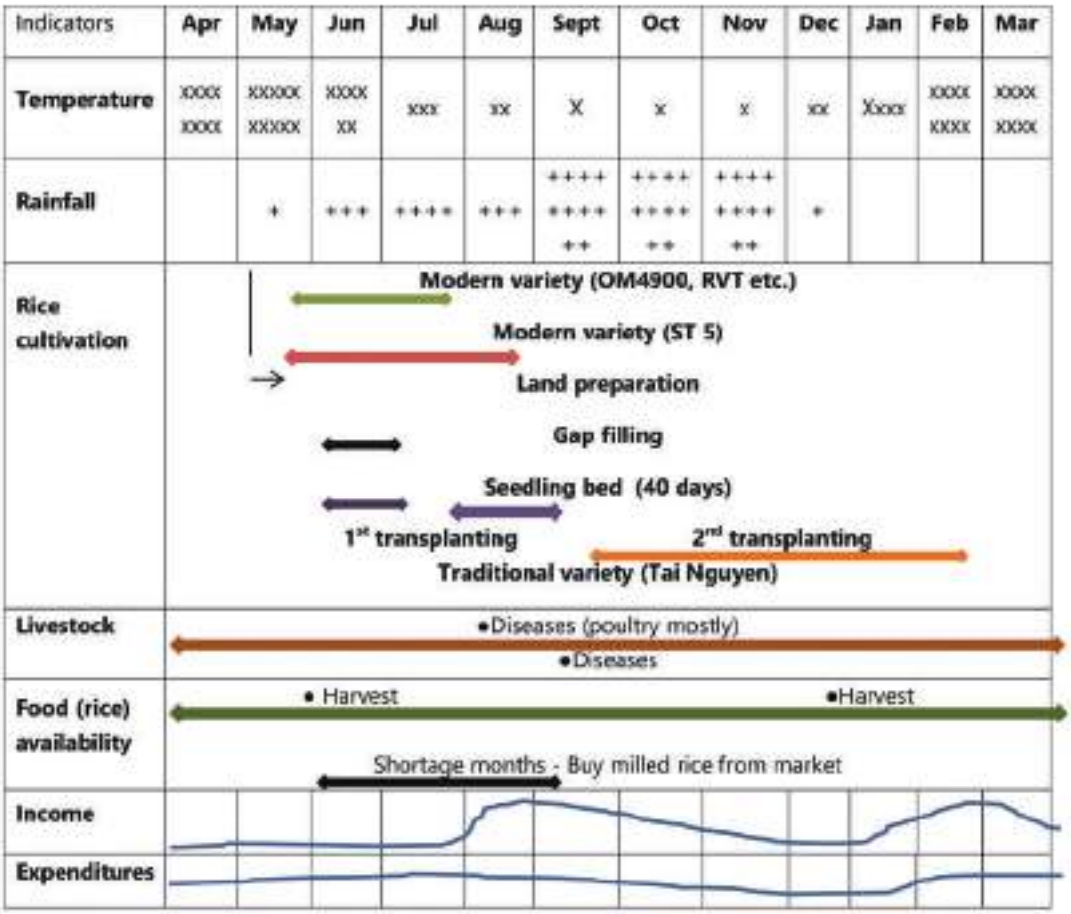

Figure 2.3. Seasonal calendar which shows the rainfall, temperature, rice cultivation, livestock disease occurrence, rice availability, income availability and expenditure

Between May and July, depending on the rain, all farmers grow modern varieties (MVs) for example OM4900, RVT, ST% and other varieties. These are short duration varieties. After harvesting MVs, farmers grow the traditional variety called Tai Nguyen from September to February.

Since rice is the major source of income, staple food and cash availability also depend on the months when farmers sell their harvests (July and November). Poor farming families are faced with food and cash shortages during specific months of the year. For example, before harvesting rice, farmers have to raise capital to purchase inputs and hire labor or machinery. Farmers are short of food (rice) supply from May to August thus, they purchase milled rice from the market. Animal (pigs and poultry) diseases often occurs in April during when temperature is high and September when floods occur. Cash is available after selling rice while expenditures are higher during the start of the cropping season when inputs have to be purchased and workers have to be hired.

Perceptions on climate change

Farmers' perceptions about changes in their surroundings can vary and they are essential indications of their adaptive capacities and the adaptation strategies they use (Dang et al, 2014). Impacts of a changing climate were being felt by the villagers and almost all the farmers (in both HH surveys and FGDs) were aware of the unusual changes in the environment.

Farmers were able to express their experiences and perceptions with regards to the changes in climate over the years. Although perceptions varied, there was a high consensus that the temperature had increased in the village in the past 10 years (Figure 2.4). Farmers also perceived that rainfall has decreased and there has been unforeseen changes in the timing and the amount of precipitation. Temperatures were reported to be higher than before in the summer months and rainfall was much lower during the wet season. Farmers also said that they experienced an increase in extreme weather events in the village, in the form of droughts, floods and cyclones. Overall, the group was under the impression that there was a change in the weather patterns and the impacts are worsening every time, making it challenging for them to adapt.

"*Rainfall is quite unpredictable now. At this time of the year (mid-April), we would usually be preparing the land for cultivating the short duration modern variety rice. But this year, I don't think we will have rain until the middle or end of May. A month delay in crop cultivation is quite long for farmers*" (F09, HH surveys).

Farmers' perceptions, in general, were similar to the Department of Agricultural Research for Development (DARD) officers' perceptions and the broader scientific research. However, it should be noted that, in addition to farmers' own experiences, the DARD in Vietnam, and recently CCAFS have been closely working with farmers in Tra Hat by communicating the imminent climate risks, and risk management and adaptation strategies. It is therefore, likely that farmers' awareness and perceptions of

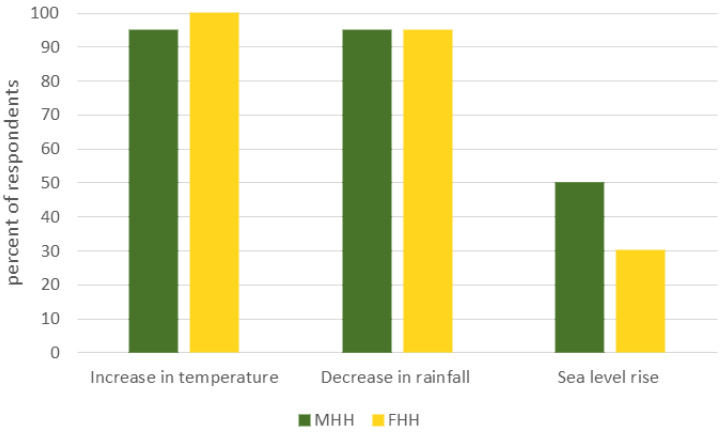

Figure 2.4. Percent of respondents with perceived changes in climate

changes in climatic conditions are a result of a combination of what they experienced and the information they gathered from different sources.

Climate change impacts

Impacts on rice production

Households identified different weather phenomena but it is important to note that there was 100% consensus that they are facing increasing incidence of yield losses and lower returns from rice. Changing climate conditions are exacerbating droughts and floods hence affecting rice-rice production systems. Due to the unpredictability of weather conditions over the last few year, rice farming has suffered from low yields or complete yield loss. Majority of the farmers recognized drought as a severe problem followed by floods. The years 2013, 2014, 2015 and 2016 (the year the study was conducted) were identified as the drought years by about 68 percent of the farmers. Yield losses during drought years happened mostly in the last stages of growing *Tai Nguyen* rice, because that was the start of the dry season. For the modern varieties, the rice plants tended to wither away in the very early phases and thus needed to be replanted. *Tai Nguyen* rice was identified as more vulnerable to damage as the planting of the modern varieties were usually timed with the arrival of the rainy season, indicating a shifting seasonal calendar. Yield loses varied between 3 percent and 100 percent. Increase in heat, dry soils and lack of water caused harm to the productivity of the crops. Farmers noted that rice plants now have poor tillering abilities and consequently, wither away quite rapidly.

Due to drought, farmers suffer from lack of irrigation water. The only source of irrigation water in the whole village is a narrow canal which is also facing pollution problems from leached fertilizers, excessive water hyacinth growth and sedimentation. According to the village leader, the water level in the canal was relatively low that year (2016) and he was expecting possible water shortages and the increased need to pump more water in the fields in the next cropping season. This is likely to increase the cost of rice production because of rising costs of diesel. The problem of yield loss as a result of drought and water shortages can be quite severe. One female-headed HH revealed, that her yield from *Tai Nguyen* rice last year was only 3 tons/ha. This is quite low compared to an expected yield of 6 to 8 tons/ha. Upon probing deeper into her case, she revealed that during the heat wave (drought) the previous year, she was unable to effectively irrigate her field which was located quite far from the water source. Pumping water from the canal was physically too strenuous for her and irrigating it twice or more increased the costs.

Rising temperatures and heat waves have also brought about the problems of pest infestation in the villages. Droughts, therefore, also increased the cost of other inputs such as fertilizers and pesticides. Apart from droughts, the impacts of floods were also documented by the villagers. The severity of impacts arising from floods depended on the elevation of the fields and farmers who had their rice fields at a higher level were less

impacted than those who owned '*deep fields*' or lands at low elevations. Water lodging in the fields resulting from floods, due to cyclones and typhoons, rotted the stems of the rice crops and resulted in yield losses. Another female-headed HH reportedly obtained low yields of 1.5 tons/ha in 2015, using the modern variety of rice. Due to continuous rainfall, the lower deep fields suffered from water lodging thus lowering yields.

The returns from rice production were quite low because of impacts from extreme weather events, increased prices of inputs and the very volatile rice prices. Based on the household surveys, calculations of costs and returns of rice production showed that several households actually had negative returns from the first cropping season in 2015. This can be attributed to the fact that the worst drought in almost 90 years in the Mekong Delta occurred in 2015. Rice yields suffered enormously in the region (United Nations, 2016). Therefore, there is a high possibility that the droughts had affected rice production in Tra Hat and resulted in the low net incomes. In the case of small farms, four out of the seven farms had negative net income. For medium sized farms, one out of four, and for large farms, four out of the 28 farms had net negative incomes

While salinity intrusion is an increasing concern in the Mekong Delta, none of the farmers mentioned facing any repercussions arising from salt water intrusion, at least not in the last 15 years. There can be two possible reasons for this; firstly, the establishment of the sluice gate that is protecting the village and secondly, the location of Tra Hat which, according to a DARD officer, is quite deep into the fresh water zone.

Impacts on livestock

Extreme weather events also affect livestock production. Since the last three or four years, death and diseases among poultry and pigs were becoming quite widespread. In the household surveys, 60 percent of the farmers reported that they faced more challenges each year in raising their livestock and the number of deaths or diseases were on the rise. Mortality was also very high among poultry.

Diseases become widespread during seasonal changes, i.e., between May and June which is a transition from dry to wet seasons and again during December and January which is the seasonal change from wet to dry. Women accounted that increased pest incidence was an emerging threat in cultivating non-rice crops. According to them, the severity was so high that they were not able to harvest the crops at all.

"*Ten years ago I owned seven big congs of land (0.91 ha) and also raised 15 pigs. In 2005, there was a very big flood that caused severe damage to my crops and killed all my pigs that were infected by diseases. I was in complete debt and to repay my loan, I had to sell six big congs of land (0.78 ha). Now I only have 0.13 ha left and survive on money my wife and son send me from the city. In these 10 years, I have not been able to recover my financial status because returns from rice are very low and with each year, heat and lack of rain are reducing the yield. If I did not have to look after my mother-in-law, I would have long left the village to work in the city*" (M05, HH survey).

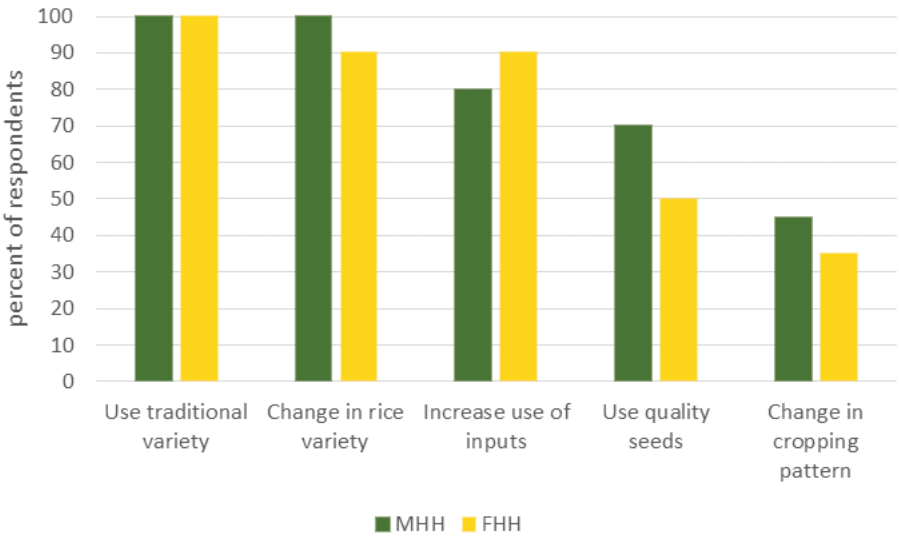

Figure 2.5. Coping strategies of rice farming households (male- and female-headed HHs)

Coping strategies to climatic variabilities

The fact that the climate is changing and that its impacts are being felt to a great extent in the village is quite evident from the surveys. Adjustment to the changing climate has been an ongoing process in ways that favorably helps them to adapt in either a reactive or anticipatory manner (Adger et.al. 2005).

On-farm strategies

Farmers were aware of the changes in the weather patterns and were concerned over what the future might hold for them while few were still not quite sure about what is needed to be done. Faith on the government was quite profound as farmers believed that the government will help them out if there are severe problems in the village, in particular, in rice production. Their belief in national policies was the result of government initiatives to introduce shrimp farming (by converting previously cultivated rice lands) in many salinity intruded areas in the Mekong Delta (FGD, key informants). They were willing to change to shrimp farming in the future in case of increased salinity in the village, but they were also worried about the risks associated with trying new technologies.

During the study, no long term adaptation strategies could be identified by the farmers and therefore, their short term *adaptation strategies* will hereafter be referred to as *coping strategies*. However, there were no discernible differences in coping strategies applied in rice farming by either male or female-headed HHs. One possible explanation for this was the fact that the villagers usually followed, learned and applied new techniques that might increase rice productivity, together with their neighbors or other farmers (FGD with male farmers). Therefore, it might be difficult to find household (either male or female)

applying explicitly different techniques on field. Applying similar strategies also reduced risks and ensured that they can access loans and other support during crisis (FGD, key informants).

Figure 2.5 shows the coping strategies in rice farming as indicated by the farmers. A majority of the households changed the rice varieties to ones that had stiffer stems and were able to withstand prolonged periods of water lodged fields. Forty-five percent of male-headed HHs and 30 percent of female-headed HHs changed their cropping patterns from three rice cropping to two rice cropping per year. Farmers also used quality seeds to ensure good yield (to compensate the losses arising from climatic conditions) and to avoid diseases and pests. *Tai Nguyen*, the traditional variety of rice which is drought tolerant, is planted by the farmers in the entire village in the second cropping season. The most common strategy, however, was the increased use of inputs to increase the yield. These included fertilizers, pesticides and number of times the rice fields were irrigated which resulted in higher costs of inputs and a consequent higher cost of rice production. Increased incidences of droughts and heat waves also put pressure on the farmers to pump more water into their fields.

Figure 2.6 shows the outcome of a PRA activity on problem identification with men and women farmers' groups. Groups were separated and were guided using pre-determined questions and other story telling techniques to help them identify the key problems they faced with agricultural activities in the previous and current years. Male and female farmers' groups interestingly identified similar problems in terms of increased heat and sporadic and untimely rainfall. The groups were then guided further to identify the different strategies they implemented to deal with the problems identified. The final stage of the PRA was for the groups to discuss what strategies they would want to implement in the future if the problems persist or intensifies. Farmers expressed concern that it is likely that the problems will continue to worsen and it is hard for them to decide on any concrete strategy or plan because they lack information and knowledge on growing any other crops other than rice especially for commercial purposes.

Individual households, however, have varied strategies (not just related to climate change) to ensure the sustainability of their livelihoods and to cope with unforeseen risks (Figure 2.7). Among the female-headed HHs, better budget management was a key strategy. Women, in general, are mainly responsible for budgeting household cash for overall expenditures and especially during the crisis months. They usually reduce the expenditures on food and clothes so as to cope with the increasing costs of inputs for agricultural activities. Borrowing money was also higher among the female-headed HHs while it was slightly lower among the male-headed HHs. For the poor and middle income farmers, selling livestock was a more feasible option. Selling livestock for income is already a livelihood activity in the village but in this case, it is a response to an unprecedented shock in order to generate cash or income.

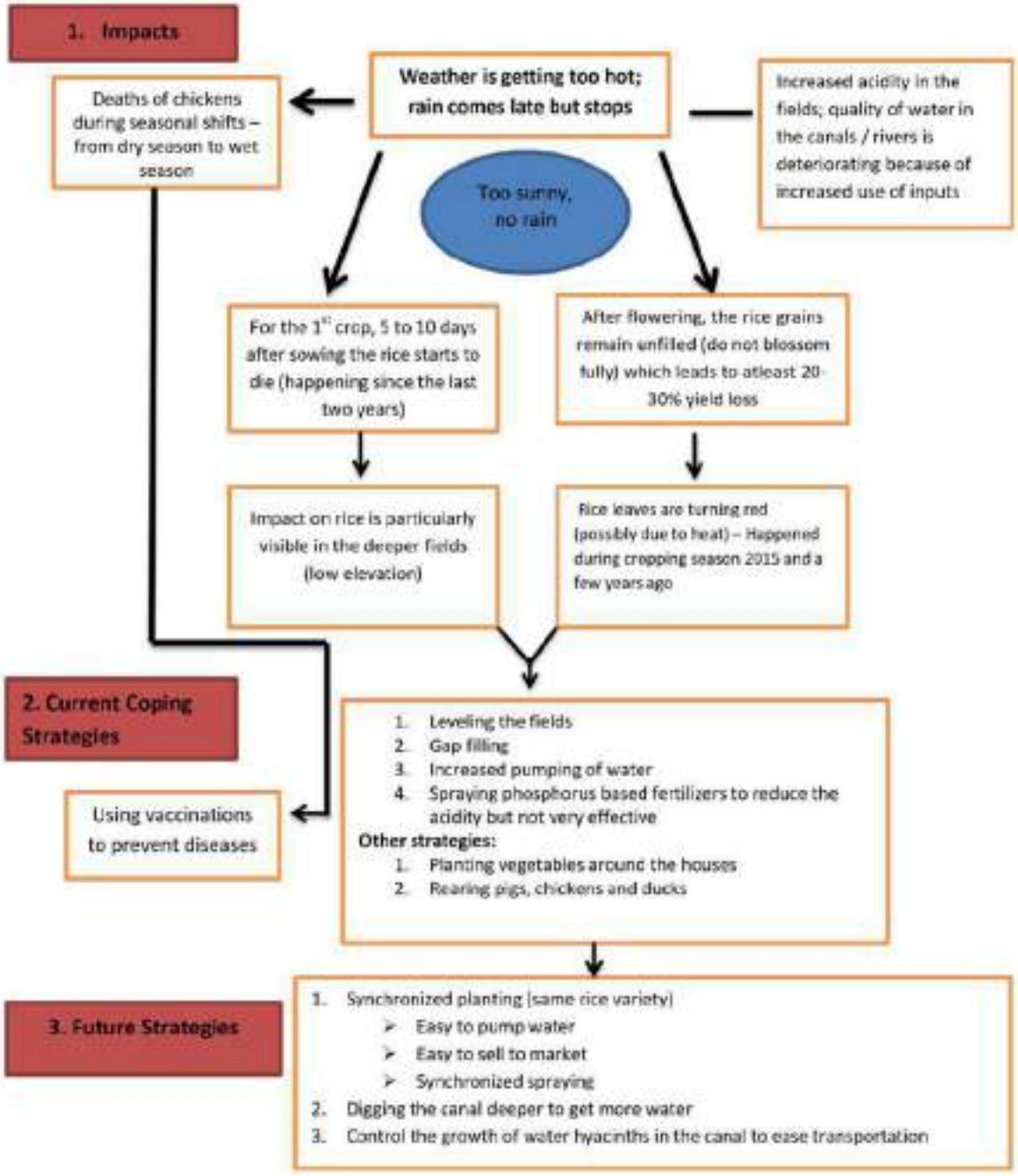

Figure 2.6. Problem identification and analysis during FGD with men and women

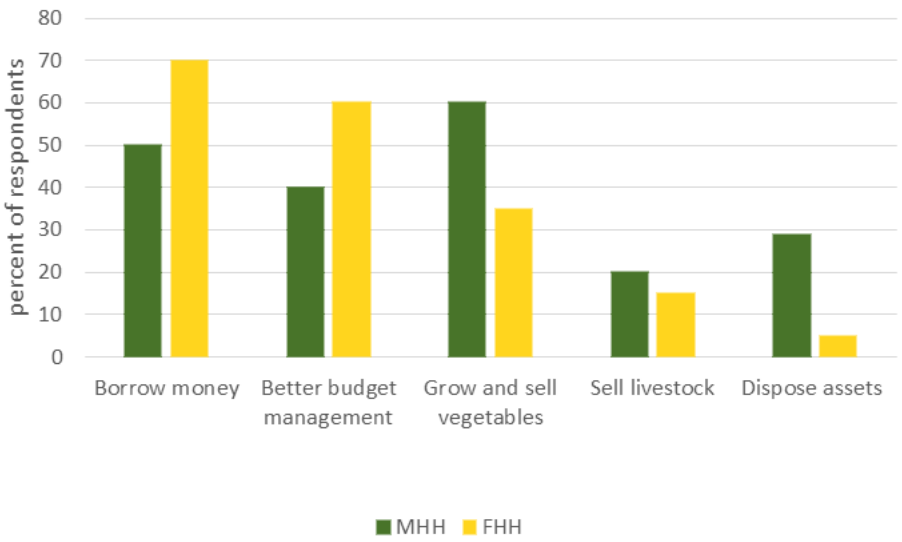

Figure 2.7. Coping strategies of male-headed and female-headed HHs

Gender division of labor and perceptions for future

Generalizations are often made that men do most of the activities in rice farming thus underestimating the significant labor contributions of women in almost all operations. Based on the results from the surveys, making a conclusive list of activities performed mainly by women (especially in agriculture) was not possible because women were an integral part of all labor requiring activities, some of which often goes unnoticed. This reiterates the many discourse on gender roles in agriculture that highlights the roles women play in agricultural activities (FAO 2011; Okali, 2011). The presence of male members in the household reduced the work load of women in the fields. In view of this, female-headed households, especially those that were not financially capable of hiring extra labor, were at a disadvantage. Female heads were burdened with twice or more of the labor tasks as they are usually the de facto manager of both households and other on-farm activities. Females residing in male-headed HHs, however said that they had more leisure time now as compared to *before*.

A focus group discussion was also held on the gender division of labor in the village in order to delve deeper into this aspect. One of the female farmers (from a male-headed HH) said,

"Men irrigate the fields mostly but it is mostly the women who carry the pipes to the fields, connect it to the machines and maneuver it through the field to the male partner so that he can pump the water" (FGD on gender division of labor, women's group).

This statement was an important indication that women provide support to their families in several forms, many of which go unnoticed and which even they themselves do not recognize. In some cases, women act as seasonal on-farm unpaid labor, meaning they are the back-up support for the family

when there is a constraint in labor availability. Therefore, women often singlehandedly are responsible for both agricultural and household chores (Boserup, 1970 as cited in Okali, 2011).

Some women also worked as seasonal agricultural labor during peak months and non-agricultural labor in the cities as house help, in beauty parlors on in sewing factories, throughout the year. While in the past, both men and women were equally involved in rice farming, the number of women going into the fields are now decreasing. Mechanization and commercialization of rice production and the reduced need for labor in the village were the key reasons attributed to this shift. Using heavy machineries can also be perceived as a male-centric job because women are 'weaker' in the physical sense. A similarity in this trend of ideology was found in the agriculture based communities in Norway where men are in charge of machineries while women are more into lenient farming techniques like livestock rearing, because of the patriarchal nature of control and thinking (Heggem, 2014).

In conclusion, there was consensus that in Tra Hat, rice farming is becoming more of a male-oriented activity while women are becoming increasingly active in rearing livestock, growing non-rice crops within their homestead area and managing the households.

By gender norms, all reproductive and household chores have always been attributed as responsibilities of women, and perhaps for this reason, women often do not perceive house chores as additional work load (Bruun 2013). Usually men are more involved during the initial stages of rice production, while women are more involved in the later stages and in managing other activities. During the survey, an important impression that came across was that women were not very much willing to give up their share of work in the house to the male members. Though they have agreed that some occasional help is always appreciated, in general, the women farmers took pride in solely controlling their households by themselves.

When asked about their perceptions of the future, the responses varied between households. Almost a quarter (22.5%) of farmers did not expect any change. Twenty percent of female-headed HHs said that role of women in rice farming will decrease in the future because of increased adoption of machineries which in turn will reduce the demand for female labor. Men will be more involved in rice farming while women will assume more managerial roles in the farm. Their work responsibilities in their homestead and in the household will remain the same. Forty percent of the male-headed HHs said that role of men in the fields will increase in the future because after each extreme weather event, they will have to spend more time in replanting and preparing the fields again. Increases in frequencies of droughts will increase the time required for irrigating the fields and applying pesticides. Fifteen percent of the female-headed HHs identified that after floods, women usually remove the rotten stems or plants or in some cases clean the dykes manually, which requires a lot of strength and time. The perceptions of the roles varied between farmers but the role of women in helping the households during crisis

cannot be undermined. A study in Philippines showed that under the prolonged impacts of natural disasters, women within a vulnerable community used their inbuilt knowledge and helped their families to effectively cope with the risks (Tatlonghari and Paris 2013). Nonetheless, extreme weather events are likely to increase women's vulnerabilities and work load due to additional roles that they have to play in sustaining their family's livelihoods and overall wellbeing (Paris 2007).

Access to resources

Land

Under the land constitution law of Vietnam, land owned by households with husband and wife still present, allows them to register the land under their names (Menon et al. 2014). Despite this, only one among the male-headed HHs, had both the husband's and wife's names on the land entitlement certificates, with majority of the households, still having the land owned by the husbands only. In the female-headed HHs, it was the women who owned the land except for three households. This is an important indication of vulnerability of females (wives) in male-headed HH. Land acts as the main form of collateral that is needed to access loans and credit services. Without land ownership certificates, women are unlikely to access credit facilities, income generating activities and can also be denied access to other resources like agricultural inputs (Menon et al. 2014).

Credit

All households had taken loans at some point for either agricultural purposes or for personal reasons. Farmers usually bought all their agricultural inputs on credit which they had to pay back during or after the rice had been harvested. There were two kinds of loans that farmers could access; formal and informal. Most farmers obtain formal loans from the Agribank which provides loans strictly for agriculture purposes, against a collateral which would usually be land. Therefore, women who do not have their names on the land title certificates are unlikely to be able to access formal credit. The other source of loan is from neighbors and relatives with or without interest rates. A higher proportion (35%) of the male-headed HHs took formal loans while a higher proportion (25%) of the female-headed HHs took informal loans. The Women's Union also helps to provide loans for women farmers mainly for the purpose of raising livestock, wherein the association acts as the guarantor for the loan. For some households, availability of rice, stored in their houses and later sold when cash is required, served as a form of security during crisis.

Markets

The villagers are dependent on the markets for their products. Due to the good infrastructure (roads and network), transporting farm products to the markets is not difficult. Mobile markets reduce women's time in going to the markets as they do not have to leave their homes to buy goods. Mobile markets sell fruits and vegetables on their motor bikes. This appeared to be a very convenient option especially for women who did not have to travel too far from their houses to buy products.

Farmers face problems in marketing rice after harvest. The usual practice is for rice farmers to contact the middlemen after each harvest and negotiate the price. After agreeing on the farm price, the middlemen go to the village and collect the rice sacks. Farmers are often unable to negotiate the prices with the middlemen, who offer them considerable lower prices for the rice varieties bought, in comparison to the sale price of the same variety in the market. To cite an example, households reported that they usually get between 6000 to 8000 VND/kg for *Tai Nguyen* rice sold to the middlemen. The same variety was sold at the markets at around 14,000 VND/kg. Collectors, who tend to participate more actively in the value chain (millers or polishing factories act as service providers for collectors), earned 10 times more than farmers in 2011 (Tran et al, 2013). Having more market power than farmers, collectors usually set low prices, particularly if there is a good crop (a surplus of paddy rice supply). Additionally, as most farmers are poor, their biggest need for cash is in the period right after the harvest. They therefore have to sell their output as quickly as possible and at any price (usually lower than the floor farm gate price, i.e. the minimum price set by the government) to settle their debts in time.

It was well articulated during the FGDs that farmers want intervention from the Department of Agriculture and Rural Development (DARD) officers and the farmers' association (FA) present in the village to help them form a strong cooperative and access the market themselves without intervention from the middlemen.

Access to information

In general, farmers lack knowledge on what more they could do to adapt to a changing climate. This finding is similar to another study in the Mekong Delta (Chi et al. 2015). They were unable to identify any other strategies beyond the rather short term coping strategies that could help them lower the impacts of droughts and in some cases floods. Diversification of livelihood activities, including migration of the younger generation to the cities were seen as effective strategies employed by households to adapt and to spread their risks. Low income from rice, which was discussed several times during the research, was an important factor to diversify their incomes. Supplementary income sources were, therefore, desired and to some extent, that also helped them reduce their vulnerability to shocks.

Access to trainings

There is gender inequality in access to training programs. Sixty male heads HHs and 35% of female heads of household reported to have ever attended agriculture-related training activities. Male heads of households were mainly trained on Integrated Pest Management (IPM). On the other hand, female heads of HHs were mainly trained on waste composting and not on agriculture-related topics. According to one female respondent, women's participation accounts for about 20% of the total attendance. There are many reasons for the low participation of women in agriculture-related training programs. The leader of the Village Women's Union said that one of the reasons for the

low participation of women is that women felt intimidated by the presence of men in meetings. In most meetings, the men dominated in the discussions and the women felt very shy to express their opinions. So they were not motivated to attend meetings or trainings be given for women-only group instead of mixed group.

Among the farmers of households that attended trainings, none of them, however, admitted that they used the techniques which were provided to them during the training activities. A female head who attended the training on information and communication technology (ICT) said that they were taught to use cell phones to contact markets and check for prices of rice and seeds but she found it very difficult to understand the concept in just two days of training.

Access to information on climate-smart agriculture

Despite Tra Hat being a CSV with several climate smart technologies being implemented already, only 50% of the FHHs and 70% of the MHHs were aware of this initiative. Information on many of the climate smart interventions and agricultural practices for adapting to climate change were also lacking within the households. Moreover, awareness of these technologies was lower among female-headed HHs than male-headed HHs. In addition, farmers had no communication and information dissemination sources from where they could receive climate-related agricultural information. There were also no early warning systems in the village that could inform people ahead in times of imminent weather risks.

Constraints to income-earning activities and aspirations for the future

During the FGDs, majority of the female who belongto MHHs or FHHs , in particular, expressed their desire to engage in income-generating activities during lean months. However, barriers such as lack of skills, age and distance from the village to the cities prevented them to undertake such initiatives. Female-headed households were also interested in earning income, but they also said that they were over burdened with many responsibilities. Moreover, there were also differences in the wages given to female and male workers, because of the cultural perception of employers that men are stronger and are more efficient. Men usually earn around 150,000 VND (US$7.5 per day) but females earn 120,000 per day (US$6 per day) for the same kind of work. Secondly, some women were not willing to travel too far away from their houses and hence preferred to get jobs inside the village. They were interested in making handicrafts and selling edible plants but they lack market information and skills in entrepreneurship. Male farmers, on the other hand, were willing to participate in future training activities mainly on rice production and latest technologies while women expressed their desire to be trained in livestock rearing. Therefore, in order to build their adaptive capacities, it is important that farmers are empowered with the knowledge, means and capacities to reduce their vulnerabilities under the projected impacts of the changing climate in the Mekong Delta.

Conclusion

The impacts of climate change are evident in the study area, with the majority of the farmers (both MHHs and FHHs) identifying unusual increase in temperature and reduction in rainfall. Droughts, floods and cyclones were the extreme weather phenomenon that are increasing in both frequency and intensity and posing substantial threats to their livelihood, which is largely dependent on agricultural activities. The different extreme weather phenomena in the village affected both the livestock and rice production. Although salinity intrusion is a major problem in the Mekong delta, this was not identified as an imminent threat in Tra Hat.

Despite identifying several climate phenomena, no long term adaptation strategies were identified by the farmers. However, both men and women employed several coping strategies to either climatic or non-climatic drivers of change. In order to spread risks and to sustain the income derived from rice, both male and female-headed HHs are also engaged in many livelihood activities.

Men and women were both involved in different operations in rice farming. Participation of male members in rice farming was found to be higher among the male-headed households, with the females more involved in livestock and other activities within their homestead area. The FHHs have greater work burden as they are engaged in both income generating livelihood activities and daily household responsibilities apart from farming.

The main gender based problems identified were women's lack of exposure to technologies through agricultural training programs as compared to men. However, men also expressed their desire to receive training on rice farming techniques in particular. A majority of the females in the male-headed households also did not have their names on the land certificates which could act as hindrance to accessing resources. Farmers also expressed concerns about being exploited by rice middlemen who generally gave them rice prices that are much lower than the actual market price of the varieties being sold. In general, both men and women lacked sources of weather-based information and awareness on climate-smart technologies and this could limit their adaptive capacities. Access to information and training, therefore, needs to be channeled to the farmers in order to reduce their vulnerability and to further help them to adapt to the changing climate.

Recommendations

Based on the findings of the study, the following recommendations are made.

1) As risks are managed at the household level, more specific vulnerability studies are needed involving more than one member (both male and female) of each household to understand the different dynamics of coping and risk reduction strategies.
2) Capacity building should be placed at the heart of interventions aimed at risk reduction. More need-based trainings on agricultural technologies and means of adaptation to the changing climate need to be organized, ensuring active participation

of both genders. Training modules also need to be designed in a way that is comprehensible and motivate farmers to apply the techniques.

3) More active engagement of the Women's Union and agriculture extension officers need to be ensured for community empowerment and constant monitoring and evaluation of any project intervention. Likewise, the Farmer's Association should become more resourceful so that farmers are able to form a strong organization, access rice markets themselves and limit interventions of the middlemen. This will foster farmers' integration into the rice value chain and allow them to benefit from higher prices of the produce. The participatory processes in the climate smart village (CSV) can facilitate these collective actions.
4) Farmers can also benefit from crop insurance facilities especially because extreme weather events are becoming more frequent and intense, causing recurrent losses in agriculture.
5) More women should be encouraged to learn and use better budget management and savings schemes and mechanisms so that they are able to tackle financial constraints during crises. In particular, women's access to resources needs to be improved and guaranteed so that they can avail formal loans when required. These can be initiated and promoted with the help of the Women's Union.
6) Information and communication technologies providing early warning systems (through different media), regular weather information and rice market conditions need to be installed so that farmers have up-to-date information.

Future research

Though this research has identified the different vulnerabilities in the male-headed and female-headed households, it is important to understand the dynamics or gender relations within households. Therefore, studies should try to understand the vulnerabilities and capacities of females residing in male-headed HHs, in particular the wives. Status of food and nutrition and security of the village should be addressed in future research. In addition, more attention should be paid on the opportunities and constraints of livestock rearing and look into their vulnerability to climate change impacts. The scope of diversifying on-farm activities also need to be researched so that sole dependency on rice-rice cropping pattern can be reduced, as it has been identified to be quite vulnerable to increased yield loss under current and projected climate impacts.

Acknowledgement

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Chapter 3
Gendered Perceptions, Impacts and Coping Strategies in Response to Climate Change: Evidence from Mekong Delta, Vietnam

Justin McKinley, Catharine Adaro, Pieter Rutsaert, Valerien Pede, and Bjoern Ole Sander

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Introduction

Climate change impacts vary because of different vulnerabilities across landscapes and populations. The poor, women, and children are among the most vulnerable to the effects of climate change, and climate change may, in fact, worsen gender inequality, create extra work for women, and exacerbate the vulnerability of women in poor households (Campbell et al. 2009). According to Jost et al. 2015, evidence from Uganda, Ghana, and Bangladesh showed that many women had considerably less access than men to critical information on weather alerts and cropping patterns. Less access to information has weakened women's capacity to respond effectively to climate variability and, consequently, women appear to be less adaptive to climate smart agriculture because of less access to resources such as financing, information, and extension services. FAO (2011) found that agricultural resources are not equally available to men and women. Globally, it is estimated that, if rural women had the same access to agricultural resources (physical, financial, educational, etc.) as men, yields could increase by 20-30% and hunger could be decreased by 12-17%. Climate change risk is also greater for women because they typically lack the necessary resources to adapt to climate change such as land rights, financial and material resources, as well as the relevant skills to adapt to climate change (Mitchell et al. 2007). Furthermore, cultural barriers can often limit women's access to the services required to adapt to climate change (Mitchell et al. 2007; Dankelman et al. 2008). The social role of women in many countries can also limit their abilities to adapt to climate change. This enhanced sensitivity to climate change is the result of women's household responsibilities such as childcare, water collection, cooking fuel collection, and an increased participation in agricultural production with less access to agricultural resources (land, extension services, and inputs) as men migrate for work outside of agriculture (Doss 2011; FAO 2011; Kakota et al. 2011; Nelson and Stathers 2009; Peterman et al. 2011). Although temporary outmigration is a common coping strategy for households affected by natural disasters and other shocks, this option is primarily open to men and to households with some labor capital and resilience (Campbell et al. 2009). Women's lack of access is alarming because, at the household level, the ability to adapt to climate change depends on control over land, financial resources, and physical assets, as well as good health and mobility (Tran Thi Van Anh et al. 2008). In addition, women are often more vulnerable than men to climate change because they have less education than men and are often refused property rights, thus making it much more difficult to access financial credit or extension agents (Gurung et al. 2006) when alternative

income is required. Women also have fewer employment opportunities away from the farm (Oxfam 2008).

The negative impacts from climate change affect rural women in particular (Goh 2012; Kakota et al. 2011; Nellemann et al. 2011). Researchers from Oxfam (2008) also found that women in villages in Ben Tre and Quang Tri provinces in Vietnam are vulnerable to climate change because of their resource dependency and limited means to adapt to climate change. Women have fewer assets to turn to during times of crop failure (Adger et al. 2007; Moser and Luers 2008).

Gender-centric development and research discussions on climate change frequently focus on rural women because they are often considered the most vulnerable group to climate change as well as being reliable agents of sound adoption practices (Dankelman 2010; Enarson and Fordham 2001; Nelson et al. 2002; Speranza et al. 2010). The increased role that rural women are playing in agricultural production could provide an opportunity to positively impact food production as well as food security, even while adapting to a changing climate (Carvajal-Escobar et al. 2008). Poor communities in Vietnam's Ban Tre and Quang Tri provinces have already shown positive signs of climate change adaptation by planting different crops and changing their cropping cycles (Oxfam 2008). Women and men, because of their respective social roles, are affected differently by the impact of climate change. Consequently, adaptation policies and measures need to be gender sensitive (Resurrección 2013).

Although there has been much discussion on governmental and organizational platforms about how differentiated vulnerabilities, such as gender, may influence adaptation, less focus has been devoted to academic research on the topic (Adger 1999; Kelkar et al. 2008; Young et al. 2009). There is still a need for a better understanding on gender perceptions and adaptation strategies toward climate-smart agriculture and food security. To understand the implications of adaptation measures for all people involved, it is necessary that all members of an adapting community be represented in climate change planning as well as in governance processes; however, women are often expected to contribute unpaid labor while being absent from the planning and governance processes (Roehr 2007). Equal involvement of men and women and their respective needs and perspectives in adaptation planning is important not only to ensure that the measures developed actually benefit those who are supposed to implement them, but also to ensure that all relevant knowledge is integrated into policy and projects to ensure success (Roehr 2007).

Understanding perceptions and adaptation strategies of rice faming households or individuals (men and women) in stress prone environments does not only provide better location specific insights but also helps generate additional information relevant to the introduction of climate smart agriculture (CSA) technologies and practices as well as gender-responsive policies. Therefore, an attempt was made in this study to identify whether there are gender differences in perceptions, access to weather-related information and coping strategies.

The study attempted to address the following questions: (i) Are there gender differences in perception about climate variability and change? (ii) What factors influence adaptation strategies pursued by farmers in response to climate variability and change? and (iii) What kind of adaptation strategies are used by farmers in the study area in response to climate variability and change?

Methodology

Selection of study areas

Vietnam is one of the vulnerable countries in SEA included in the CGIAR CCFAS-SEA research programs. The Mekong River Delta (MRD) is the most prominent irrigated rice system in Vietnam (Bong 1999). In total, the MRD is responsible for 50% of total domestic rice production (Ha 2014). A vulnerability study conducted in Southeast Asia by Yusuf and Francisco 2010, found that ten provinces in Vietnam belong to the top 25% most vulnerable regions in the study. Of these ten provinces, eight can be found in the MRD. The primary vulnerability in the MRD was found to be risk exposure (Yusuf and Fransisco 2010). Specific risks to the MRD include floods, increased water shortages in the dry season (Snidvongs and Teng 2006) as well salinity intrusion near the coastline (IPSONRE 2009).

This study, which focused on the interrelationship between climate change and gender, was conducted in seven districts located in three provinces, namely, An Giang, Bac Lieu, and Tra Vinh (Figure 3.1). The climate stresses faced by individual households vary by province. For example, An Giang and Bac Lieu are highly vulnerable to floods while Tra Vinh is least vulnerable to floods (Tri et al. 2012). An Giang is located inland, Bac Lieu province is near the coastal areas, and Tra Vinh province is more prone to sea level rise.

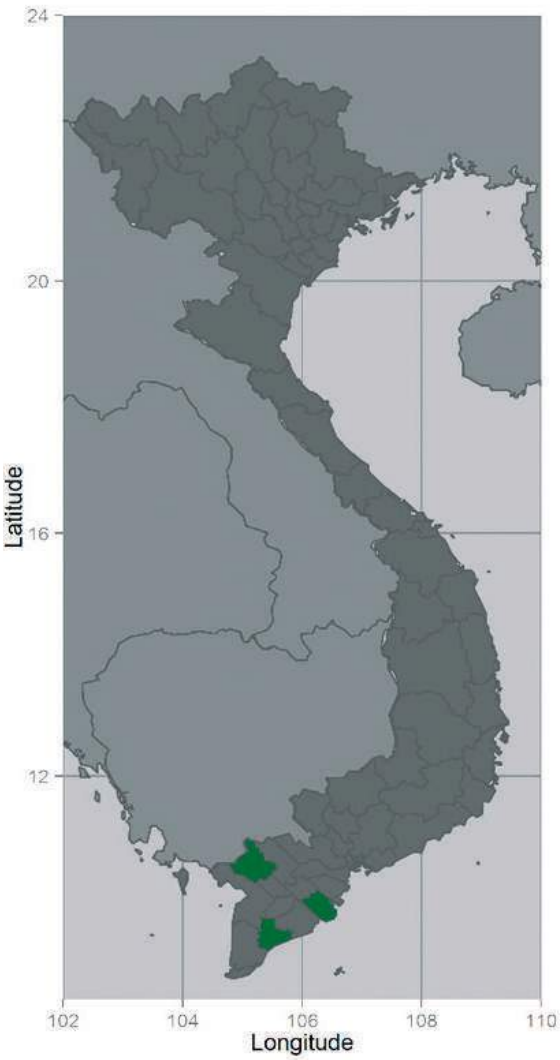

Figure 3.1. Locations of study sites

Selection of households

Once the villages were selected, a list of farmers with at least ten years of farming experience was prepared for each commune. Survey participants were then selected using stratified random sampling with equal numbers of respondents from each village. A total of 214 farming households were selected as respondents in this study. The number of households interviewed in each province were the following: An Giang (90), Bac Lieu (64), and Tra Vinh (60). Data collection during the interview was done using a structured questionnaire with several sections. In the first section, individual characteristics, farm characteristics, and household income, were gathered from both husband and wife. In the second section, the husband and wife were interviewed separately on climate change perceptions, access to climate-change information, coping strategies in response to climate change, and other climate change-related questions. The surveys were carried out by IRRI's local partner in Vietnam, the Institute of Policy and Strategy for Agriculture and Rural Development (IPSARD).

Results and discussion

The findings on the characteristics of households and respondents and the perceptions of men and women are outlined in this section.

Characteristics of respondents

The characteristics of respondents are presented in Table 3.1. On average, men are older, have more farming experience and more years in school than the women. These findings are similar to earlier studies (Khai and Yabe 2012; Khai and Yabe 2011). These findings reveal that boys had more opportunities to go to school than girls in the last 50 years or so. Nearly 80% of the respondents are from the Kinh ethnic group.

The majority of the farmers own their lands. The average farm size is 2.02 hectares. On average, 1.84 hectares are owned, and 0.18 hectare are rented. Rice is the primary crop for the surveyed farmers as total paddy production accounts for an average of 1.90 hectares of land use or about 94% of the

Table 3.1. Characteristics of respondents, selected research sites

	Husband	Spouse
Age (years)	48.92	45.10
Farming experience (years)	28.28	24.22
Years in school (years)	6.85	5.70
Ethnicity (%)		
Khmer	20.1	20.1
Kinh	79.9	79.9
Number of respondents	214	214

Source: Household surveys, 2016.

total farm size. Rice is produced during three cropping seasons: winter-Spring (WS) sowing from Nov-Dec and harvesting from Feb-April; Summer-Autumn (SA) sowing from April to June and harvesting from July to Sept and October. The prominent cropping system varies by province. Bac Lieu, where farmers adopt rice-rice-rice system, is prone to floods and salinity. Ang Giang is also prone to floods with rice-rice-rice system. In Tra Vinh, rice areas are prone to floods and salinity, and the dominant farming systems are double rice cropping and rice-shrimp system.

Household Income

Farmers diversify their sources of income in response to floods, drought or salt intrusion. As shown in Table 3.2, farming households derive their income from various sources. Rice income comprises the highest annual income from all sources in this study. Of the total farming households interviewed, 96% derive their income from rice production. The importance of rice for our sample farmers is consistent across all provinces. However, variations occur across provinces in other income sources. After rice, pigs are important in Bac Lieu (28%) followed by other crops (11%). There are more varied sources of income in Tra Vinh such as non-farm including off-farm wages, (20%), shrimp sales (17%), pig sales (15%) and sales from other crops (13%). This higher income from shrimp reveals higher profits from shrimps (commercial scale) than rice production. Income from fisheries (from the river) is more important in An Giang than the other two provinces. Raising poultry is more practiced in Bac Lieu than in Tra Vinh. Both male and female family members provide their labor in these different farm activities, depending on their gender roles, opportunity costs, and access to resources.

Table 3.2. Sources of income in An Giang, Bac Lieu and Tra Vinh*

	Ang Giang		Bac Lieu		Tra Vinh	
Source of income	% of households	Mean income	% of households	Mean Income	% of households	Mean income
Rice	99	130	95	200	93	110
Other crops	16	22	11	10	13	8
Pigs	2	8	28	20		35
Poultry	0		8	10		5
Fisheries	4	45	2	50		
Shrimp	0	0	5	100	17	155
Off-farm	22	45	6	3	20	25
Sample N	90		64		60	

Income reported in million VND 1USD =21,800 VND, July 2015
Source: Household surveys, 2016

Perceptions on changing climate variability

Climate change is experienced in the form of climate stress. Thus, the enumerators asked the husband and wife separately about their perceptions or experience on specific extreme climate variability in relation to temperature, rainfall, drought, floods, and sea level rise[2]. Perceptions on extreme climate variability are expected to vary by gender across villages in different provinces due to their varied roles and exposure to various conditions.

Change in temperature. Of the 214 households 100% of principal males and 99.53% of principal females reported that they had noticed changes in the weather in the last ten years. When asked specifically about changes in temperature, the majority of respondents, male and female alike, reported that the temperature had increased in the last ten years (Figure 3.2).

Figure 3.2 also shows respondents' perceptions of colder temperatures during the cold months and hotter temperatures during the hot months, suggesting larger variations in perceived temperature for some respondents. Furthermore, many respondents reported irregular change, or more sporadic weather patterns. All of these perceptions suggest that for at least some of the samples, temperatures appear to be more variable. Almost no respondents perceive a decrease in temperature or no change at all. When asked what were the most significant perceived changes in temperature trends, both males and females reported that increases in temperature were the most significant changes, with 131 male responses(61.21%) and 112 female responses (52.33%) reported, respectively.

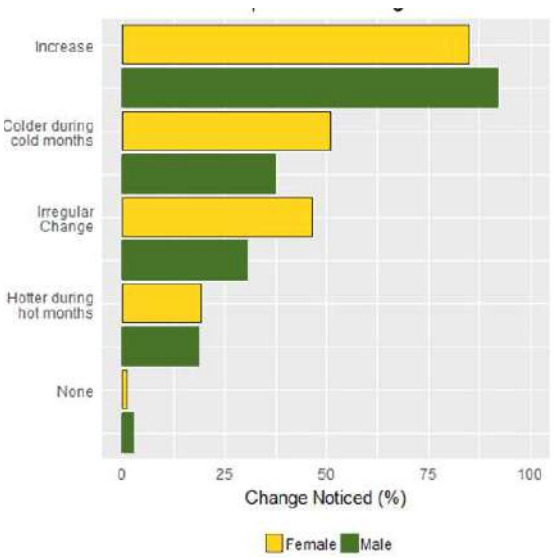

Figure 3.2. Perceived changes in temperature in the last ten years, all provinces.

Change in rainfall. As shown in Figure 3.3, slightly more women than men perceived that the most significant change in precipitation was low rainfall. The months of December through March have the lowest levels of rainfall in the MRD. Severe drought was most commonly reported as the most significant change, albeit by less than half of the respondents (42.52% men and 30.84% women). The responses reveal that both men and women perceive low rainfall and severe drought as the most important rainfall and drought changes that they have observed and experienced over the past ten years.

[2]Sea level rise is an increase in global mean sea level as a result of an increase in the volume of water in the world's oceans. Sea level rise is usually attributed to global climate change by thermal expansion of the water in the oceans and by melting of ice sheets and glaciers on land.

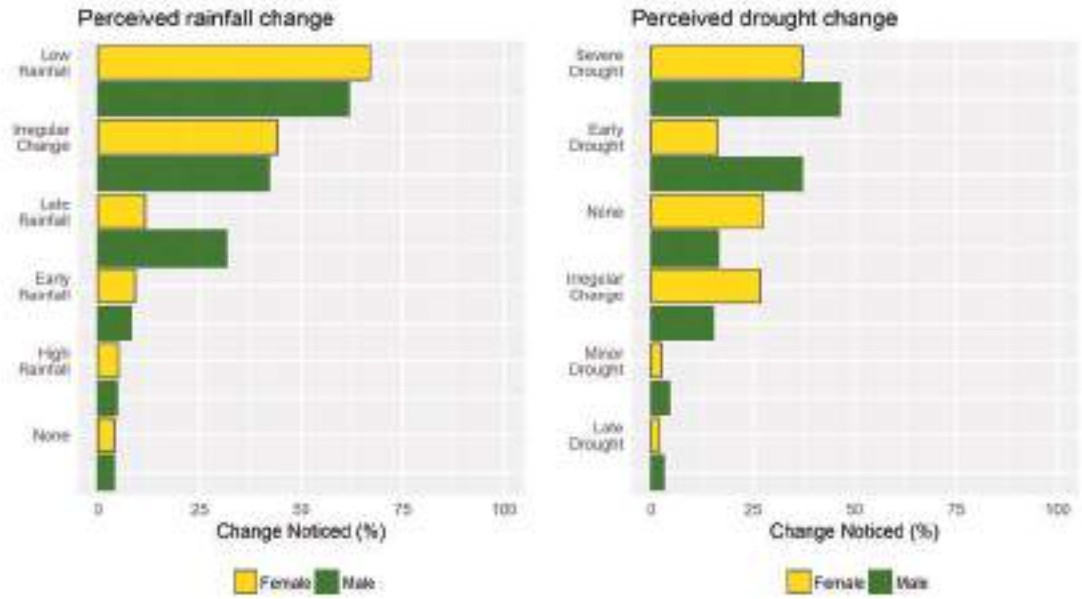

Figure 3.3. Perceived changes in rainfall and drought in the last ten years, all provinces.

Climate change stress

The results of observed weather stresses disaggregated at the provincial level are shown in Figure 3.4. It is evident from the figure that climate stress varies across the provinces in the MRD. Specifically, the largest differences can be seen by comparing the inland province of An Giang (Figure 3.4a) to Bac Lieu (Figure 3.4b) and Tra Vinh (Figure 3.4c) provinces which are located in the coastal areas. Flooding is highly reported as a climate change stress in An Giang, followed by Bac Lieu but not in Tra Vinh. Salinity is not mentioned as a climate change risk due to sea level rise in An Giang as it is farther from the coast. Conversely, salinity is reported as climate stress in the coastal provinces of Bac Lieu and Tra Vinh. Extreme hot weather or heat, and to a lesser extent drought, were both reported as more common climate stresses across all provinces.

The structure of the survey used in this study, questioning husband and wives separately, allows for intra-household analysis. This study employs this method similar to Ngigi et al. (2016), which used kappa statistics in rural Kenya to determine gender differences in climate change perceptions between spouses. This study finds more agreement between spouses regarding climate change than what was reported in Ngigi et al. (2016). While the interpretation level of the kappa value varies by change noticed, all changes are reported with a significant value with the exception of the response 'none'. However, the insignificant result is a result of the kappa statistic breaking down with unbalanced distribution. In this case, less than one percent of respondents reported 'none' for changed noticed resulting in a very unbalanced sample for this particular question. The highest levels of agreement are found for floods with a

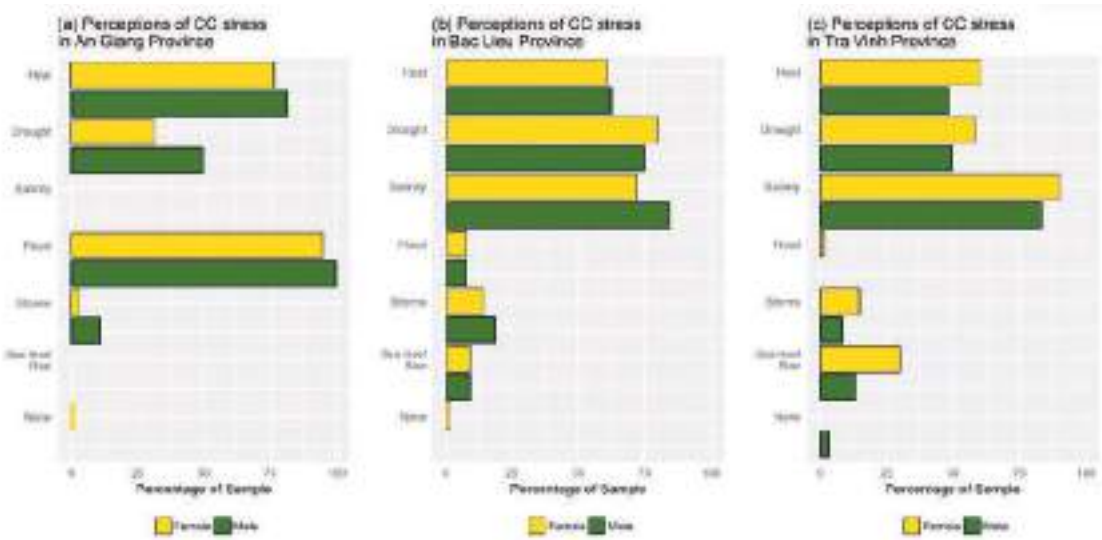

Figure 3.4. Perceived weather stress in the last ten years by province

kappa[3] value of 0.90 and salinity with a kappa[1] value of 0.78. These higher values are also a result of more equal distribution in responses (i.e., nearly 50/50 yes/no split) in concert with a higher percentage of agreement. While these two responses yielded the highest agreement, substantial agreement to almost perfect agreement, we also see moderate agreement between spouses for heat and fair agreement for drought. Generally speaking, Table 3.3 shows evidence for substantial agreement in perceptions of climate change stresses present in their area between spouses.

Table 3.3. Intra-household differences in perceptions of climate change stress

Change noticed	Husbands (% Yes)	Wives (% Yes)	Difference (%)	Chi-square	Agreement (%)	Kappa
Floods	44.39	42.52	1.87	175.50***	95.33	0.90***
Storms	12.62	9.81	2.81	9.06***	84.11	0.20***
Salinity	48.60	46.73	1.87	128.81***	88.79	0.78***
Drought	57.48	53.27	4.21	20.85***	65.89	0.31***
Heat	66.36	67.29	0.93	52.29***	77.57	0.49***
Sea level rise	6.54	11.21	4.67	9.03***	86.92	0.20***
None	0.93	0.93	0.00	0.02	98.13	-0.01

Note: '***', '**', and '*' are significant at the 1%, 5%, and 10% levels, respectively.

[3]As the kappa estimate increases, the agreement between groups (e.g., husbands and wives) also increases. Viera and Garrett (2005) offer the interpretation of kappa statistics as: less than 0, less than agreement; 0.01 – 0.20, slight agreement; 0.21 – 0.40, fair agreement; 0.41 – 0.60, moderate agreement; 0.61 – 0.80, substantial agreement; and 0.81 – 0.99, almost perfect agreement. A more thorough description of kappa statistics can be found in Viera and Garrett (2005).

Climate change impacts on rice yields

Decline in rice yields. To assess farmers' perception on the impacts of climate stress on yields, respondents were first asked if the average rice yields increased, decreased or did not change. Men (70.10%) and women (69.16%) agreed that rice paddy yields decreased due to climate stress. Their response was followed by another question, "If you observed an increase or decrease, what is the percent change?" Men reported an average decrease in yield of 41.37%. This proportion includes 31 men who reported total failure. Similarly, women reported a mean average decrease in yield of 40.71% inclusive of 22 women who reported total crop failure. The distributions of reported yield decreases are shown in Figure 3.5. This figure shows the density (i.e., percent of sample) on the Y-axis and the reported percent loss in paddy on the X-axis. This figure shows that there are almost no gender differences in perceptions on extent of crop loss as the two densities trend are almost identical.

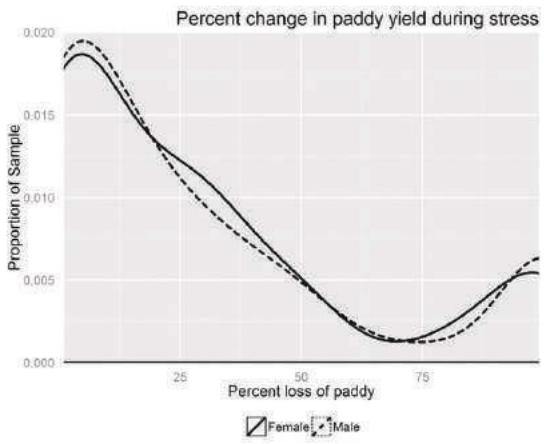

Figure 3.5. Reported decrease in rice paddy yield by respondents.

Decline in household rice sufficiency. Of the 214 households surveyed, a high proportion (78.97%), reported keeping rice paddy for home consumption. Of these households, men (88.76%) and women (85.80%) reported full self-sufficiency of rice during normal years. However, lower rice yields or complete crop loss due to climate stress have led to a decline in household rice sufficiency. Women reported 32 fewer days of rice available for home consumption and men reported 23 fewer days of rice available for home consumption during times of stress. The consequences of this loss of rice self-sufficiency can be substantial, particularly if the households are unable to compensate these losses by purchasing rice from the market. Decreased food security can lead to negative consequences on the well-being (health and nutrition) of the members of the households. Although farmers borrow money for purchasing inputs during normal years, they tend to borrow more frequently after floods or drought. Consequently, they are deeper in debt.

Decline in livestock production. Both men (31%) and women (32%) respondents reported that livestock production declined due to climate stress. Due to climate stress, the incidence of disease of livestock increased. Moreover, low or non-availability of green fodder for large animals during times of drought, extreme hot weather and high incidence of diseases during floods, are some of the negative effects of climate stress on livestock production. In fact, the low proportion of household income from sales of livestock can be attributed to climate risks which can easily lead to livestock mortality. Decline in pigs and poultry affect

women more than men because they take full responsibility in almost all of the pig and poultry management activities.

Gender division of labor in rice production

The major reason for the similar perceptions between men and women on extent of crop (rice) loss can be attributed to the active labor participation of women in rice production. In south Vietnam, women and men have distinct, but not necessarily rigid, tasks and responsibilities which often vary by crop or activity. In some activities in smallholder farming systems, the wife and the husband share the same tasks to a greater or lesser degree and the wife can also take over the task of the husband, due to outmigration (Chi et al. 2018). A general trend is that men are involved in what are culturally defined as heavy tasks, such as land preparation (particularly tillage), broadcasting chemical fertilizer, spraying pesticides, threshing (mechanical thresher) and hauling farm products, Women conduct the majority of farm operations related to cleaning the fields, some work in leveling, pulling and transplanting seedlings, weeding, manual harvesting and postharvest processing. With regard to the later, key activities such as seed cleaning, selection, storing seeds for the next cropping season, dehusking the grains, cooking rice or preparing rice into products for home consumption or sale typically lie within women's domain. Women's responsibility in farm management also includes cooking for workers, visiting the farm, and overseeing the work of hired laborers, especially when men migrate to other places on short-term or long-term periods. Harvesting is usually jointly conducted when this is not mechanized, although more women than men engage in this activity, along with other family members, including both sons and daughters. Although irrigation and spraying of pesticides are traditionally men's responsibilities, women also perform these tasks when men are not available (Paris et al. 2009; Chi and Paris 2018; Grassi et al. 2017).

Coping strategies

In the earlier section, our results show that men and women have similar experiences on the negative impacts of extreme climate variability. Several studies in Africa reveal gender differences in perceived climate changes as well in making changes to adapt to climate change. Adaptation strategies adopted by men and women also depend on their access to and/or control over resources and their participation in decision-making processes (Twyman et al. 2014). Below, we describe the individual and farm-level coping strategies in response to climate change risks.

Individual coping strategies. Respondents were asked how they cope with the negative impacts of climate stress. The majority of the respondents did nothing in response to the negative impacts of climate stress. A higher proportion of men prefer not to do anything in times of stress or after stress. Men cited reducing food/rice consumption (26.64%), securing bank loans (21.50%), and working more (21.50%). Women cited reduced consumption (30.37%), securing bank loans (27.57%), use of savings (21.96%), and working more (21.03%) as coping strategies. Although both men and women have similar

coping strategies, only the women mentioned using up their savings. This indicates that women tend to keep money or save in anticipation for any family emergencies e.g., illness, calamities. It is also interesting to note that a higher proportion of the women borrow money. In this particular case, the male head in the household may not be aware of the wife's use of financial strategies. It can be assumed though that women borrow from informal money lenders who impose high interest rates or from friends, relatives and other people within their social networks. Borrowing money also puts more pressure on women to repay debts, thus they need to work more to earn income. Although not common, selling livestock (small animals and poultry) is a coping strategy by women more than men. This finding can be used in identifying appropriate climate smart agriculture (CSA) and practices not only for rice but also for livestock, particularly for production of small animals (pigs and poultry). The results can be seen in Figure 3.6.

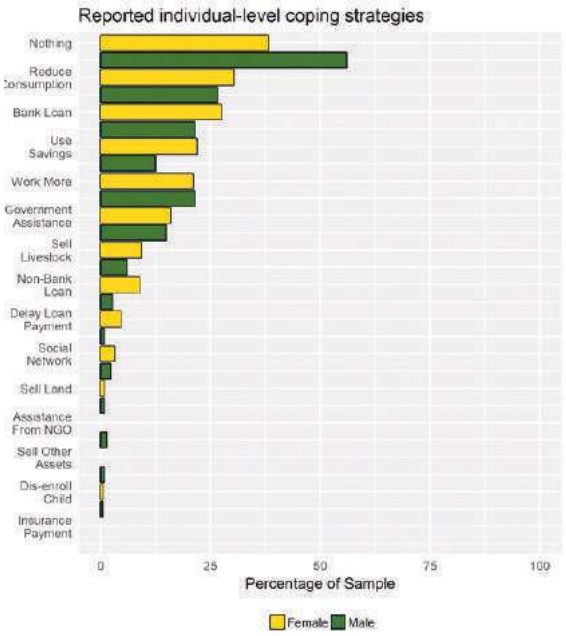

Figure 3.6. Reported individual coping strategies by gender, all provinces.

In Table 3.4, this study again uses kappa statistics to determine the level of agreement between spouses in each household. While we again see many significant kappa values, the magnitude of the agreement is less than seen in the previous uses of the kappa statistic. The majority of the agreements for changes made to climate change stress were only slight to fair agreement. The change with the highest reported kappa value was using savings as a response to climate change stress, which is still only considered to be fair agreement. These results reaffirm that while perception of climate change stress and perceived impacts of climate change stress are quite similar between husband and wives, individual coping strategies differ between them.

Farm-level coping strategies. Figure 3.7 appears to show a greater consensus between husbands and wives regarding the adaptation strategies of the farm household as compared to individual coping strategies seen in Figure 3.6. Using a different rice variety is the most common coping strategy reported by women (46.73%) and the second most common by men (44.39%). No change was reported most often by men (45.79%) and second most often by women (39.25%) as a farm-level response to climate change. Additionally, change of cropping pattern was cited 19.63% and 15.42% by men and women, respectively. Also, leaving lands fallow was reported by 19.63% and 11.21% by men and women, respectively.

Table 3.4. Intra-household differences in reported individual coping strategies in response to climate change stress

Change made	Husbands (%)	Wives (% Yes)	Difference (%)	Chi-square	Agreement (%)	Kappa
Do nothing	56.07	38.32	17.75	11.59***	59.81	0.22***
Reduce consumption	26.64	30.37	3.73	18.20***	71.03	0.29***
Sold land	0.93	0.93	0.00	0.02	98.13	-0.01
Sold livestock	6.07	9.35	3.28	13.85***	89.25	0.25***
Sold assets	0.93	0.00	0.93	-	99.07	-
Friends' assistance	2.34	3.27	0.93	4.53**	95.33	0.14**
Gov't assistance	14.95	15.89	0.94	17.23***	81.31	0.28***
NGO-assistance						
Bank loan	21.50	27.57	6.07	7.43***	69.63	0.18***
Loan other	2.80	8.88	6.08	12.90***	91.12	0.21***
Delayed loan payment	0.93	4.67	3.74	9.31***	95.33	0.15***
Worked more	21.50	21.03	0.47	1.19	64.02	-0.07
End child school	0.47	0.47	0.00	0.01	99.07	-0.01
Used savings	12.62	21.96	9.34	30.31***	81.31	0.36***

Note: '***', '**', and '*' are significant at the 1%, 5%, and 10% levels, respectively.

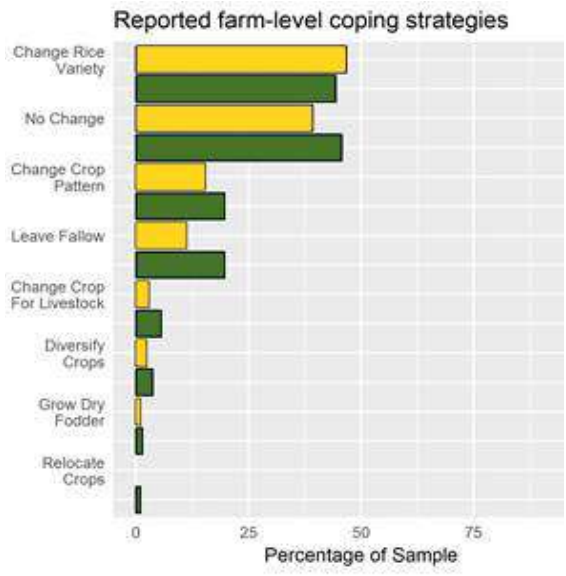

Figure 3.7. Reported farm adaptation strategies, all provinces.

Other adaptation strategies such as changing crop to livestock production, diversifying crops planted, growing dry fodder crops, and relocating crops were scarcely mentioned by the respondents.

While the responses in Figure 3.7 show similar responses between men and women, a more finite analysis at the household level between husbands and wives in Table 3.5 shows less agreement. The only kappa value with fair agreement is the response for leaving the ground fallow. The kappa value for changing the cropping pattern and moving from crop to livestock are both significant but the magnitude only shows slight agreement. Overall, the results of Table 3.5 show that there are gender differences

Table 3.5. Intra-household differences in reported farm-level coping strategies in response to climate change stress

Change made	Men (% Yes)	Women (% Yes)	Difference (%)	Chi-square	Agreement (%)	Kappa
Cropping pattern	19.63	15.42	4.21	2.82*	74.30	0.11**
Rice variety	44.39	46.73	2.34	0.99	53.74	0.07
Crop to livestock	5.61	2.80	2.81	8.97***	93.46	0.19***
Diversify crops	3.74	2.34	1.40	0.19	93.93	-0.03
Grow fodder crops	1.40	0.93	0.47	0.03	97.66	-0.01
Crop relocation	0.93	0.00	0.93	-	99.07	-
Leave fallow	19.63	11.21	8.42	20.44***	81.31	0.29***
No Change	45.79	39.25	6.54	0.99	54.21	0.07

Note: '***', '**', and '*' are significant at the 1%, 5%, and 10% percent levels, respectively.

between husbands and wives' responses to farm-level coping strategies in response to climate change stress.

While the responses in Figure 3.7 show similar responses between men and women, a more finite analysis at the household level between husbands and wives in Table 3.5 shows less agreement. The only kappa value with fair agreement is the response for leaving the ground fallow. The kappa value for changing the cropping pattern and moving from crop to livestock are both significant but the magnitude only shows slight agreement. Overall, the results of Table 3.5 show that there are gender differences between husbands and wives' responses to farm-level coping strategies in response to climate change stress.

Access to information on improved cropping patterns, agronomic practices and weather forecast

A higher proportion of the men (80.84%) than women (76.17%) reported that they have access to information on improved cropping patterns and agronomic practices. Although the gap is small, more women farmers should be encouraged to participate in agriculture-related training programs. More men (98.13%) than women (92.52%) reported having access to information on weather conditions. This small gap can be attributed to the use of public loudspeakers in the village as the fastest channel to disseminate information, particularly about extreme weather forecasts. However, women generally obtain farm-related information from other information channels such as their husbands, relatives, women's associations and other women in the village.

Respondents were asked what future trainings they want to enhance their skills in order to better adopt the technologies. Pest management was the most demanded training from men (78.50%) and women (70.09%) alike. Men also would like to attend training activities on crop production, crop nutrient management, seed health management, water management, and animal management. In addition to pest management, women preferred to participate in training programs on seed health, crop production, and animal management.

Climate-smart agriculture (CSA) technologies and practices to cope with climate change stress

In the future, climate change is likely to provide increased challenges in agriculture. Table 3.6 shows several potential climate-smart agriculture (CSA) technologies and practices which were presented to the respondents (whether they are acceptable or not). As shown in this table, the use of stress-tolerant rice varieties is the most acceptable to men and women. The next commonly cited technologies/practices reported by the respondents relate to changes in varieties and input use or different management practices such as pest and disease management. Finally, respondents are least interested in coping strategies related to livestock, which is expected because only a small proportion of our sample is engaged in livestock production.

Excluding the coping strategies related to livestock production, Table 3.6 can almost be viewed as being sorted from least labor-intensive coping strategies to more labor-intensive coping strategies. For example, with a stress-tolerant rice variety, the technology is embedded in the seed and there is essentially no additional input from the farmer. However, practices such as changing land management or pest and disease management will have a

Table 3.6. Reported acceptable technologies and practices for adoption to cope with climate change (percent of responses)

Technologies and practices	Husbands	Wives	Difference
Stress-tolerant varieties	90.57	85.71	4.85
Improved cropping system	20.28	19.52	0.76
Changes in varieties	70.14	61.43	8.71**
New land management techniques	23.11	15.71	7.40**
Efficient water management	15.57	6.67	8.90***
Pest and disease management	67.92	42.38	25.54***
Disease and pest resistant varieties	14.22	3.33	10.88***
New livestock breeds	2.37	0.48	1.89*
Animal health management	11.79	3.35	8.44***
Change in cropping calendar	45.28	36.19	9.09**
Change in input use	63.98	34.76	29.22***
Crop rotation	15.79	5.71	10.08***

more-intensive learning curve and in many cases may even involve additional labor inputs from the farmer. The results may signal that farmers are interested in optimizing their time inputs in climate-change coping strategies. There is a wide gap between men and women's acceptability or non-acceptability of CSA technologies and practices such as pest and disease management, and changes in input use. This wide gap can be attributed to women's lack of knowledge on the importance of these aspects to combat climate change risks.

In general, most farmers expect government support to increase rice production (e.g., improved rice varieties and associated crop resource and management for better adaption to climate change). Aside from these knowledge and skills training, they want to have access to low-interest credit for farm inputs, and better access to irrigation water through canal and dike improvements. They also mentioned improved post-harvest technologies, access to markets, and better market prices of the paddy through government support.

Table 3.6 shows that there are numerous significant differences between men and women in what they consider to be acceptable technologies and practice to cope with climate change. The largest differences, significant at the 1% level, between men and women are related to changes in input use (29.22%) and pest and disease management (25.54%). In both cases, men have higher support for the technologies/practices. In addition, the average support for these two examples are high compared to other technologies from this question. Pest and disease management has an average support of 55.15% and change in input use has an average support of 49.37%. Other examples of differences significant at the 1% level include efficient water use, disease and pest resistant varieties, animal health management, and crop rotation but the average support for these technologies/practices are comparatively low – less than 12%, signaling low interest in the technologies/ practices from both men and women. The technology with the highest average support and the most agreement between men and women (i.e., no statistical difference in responses) is the use of stress-tolerant varieties. The high acceptance among both men and women should be noted by policymakers as they develop climate change policies.

Conclusion

There are no gender differences between husbands and wives with regards to perceptions of climate change based on the data used in this study. The fact that both husbands and wives have similar perceptions of climate change risks is not surprising. In south Vietnam, men and women are actively engaged in rice production postharvest and marketing. Although men are more likely to do nothing in response to climate change, women are more actively engaged in financial strategies such as taking a bank loan, using savings, or delaying a loan payment.This is expected because husbands and wives work on the same field and perform complementary roles. However, there are differences between husband and wives with regards to coping strategies at both the individual and household

level. This study reveals that in examining climate change and gender, it is important to first examine the types of climate change risks that affect specific areas. Respondents in An Giang are more concerned about flooding while respondents in Bac Lieu and Tra Vinh provinces which are located in the coastal areas are more concerned with sea level rise and salinity intrusion. Despite the significant contributions that women in South Vietnam make to rice production, the design and transfer of agricultural technology and extension services are performed with a male farmer in mind, thus leaving women's specific roles and needs along the rice value-chain unaddressed. Often, women are not explicitly targeted by extension programs because they assume that women are not farmers but only housewives who help their husbands in specific farm work. Current agricultural extension workers dealing on CSA technologies and practices for rice production such as integrated crop management, water storage and water-saving irrigation, adaptive varieties, cropping systems and changing cropping calendar, improved livestock and poultry management, etc. do not automatically include women as direct recipients of training programs (Gallins and Farnworth 2016). In order to facilitate adaptation of CSA practices by both men and women, much greater effort is needed to ensure that gender issues are addressed and integrated into the design of policies, programs, projects and other research activities.

Acknowledgement

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Chapter 4
Gender and Climate Change Adaptation: A Case Study of Flood-prone Rice-farming Villages: A Case Study in Bulacan, Philippines

Julie Ann Basconcillo

Chapter 4

Gender and Climate Change Adaptation: A Case Study of Flood-prone Rice-farming Villages: A Case Study in Bulacan, Philippines

Julie Ann Basconcillo

Introduction

For millions of Filipinos, rice is life (Castillo 2004). Rice is the staple food for about 89% of the population in the Philippines and is the source of income and employment for about 12 million farmers and family members (FAO, 2007). The Philippines is not only exposed to tropical cyclones, especially in the northern and eastern parts of the country, but also to many other climate-related hazards such as floods (e.g., in central Luzon, Bicol and Southern Mindanao), landslides (due to the terrain of the country), and droughts. According to the Philippine Atmospheric Geophysical, and Astronomical Administration (PAGASA) 2014, an average of 20 typhoons enter the Philippine Area of Responsibility (PAR) annually, of which about nine to ten have combined strong winds and rainfall which can disrupt agricultural production and cause damage to infrastructure. Climate change scenarios for the Philippines (e.g. Lasco et al. 2006, 2007; Lasco and Pulhin 2008) predict adverse environmental and socio-economic consequences including greater frequency and intensity of heat waves, droughts, floods, and typhoons, altered ecosystems, reduced output and productivity of the agriculture, fisheries and forestry sectors; livelihood losses; food insecurity, and diminished water supplies; and heightened incidence of certain diseases.

Studies show that the ability to cope and capacity to adapt to climate change varies across countries and social classes, where the poor and women are the hardest hit by climate change (IPCC 2007). Climate change impacts will be more severe on women than men because of their different roles on society due to gendered norms and women's socioeconomic status vis-a vis men (Brody et al. 2008; Lambrou and Piana 2006). However, most studies on climate change and gender were conducted in Africa (Ngigi et al. 2016; Tywman 2016) which is different from Southeast Asia where men and women work on the same fields and income pooling is practiced. It is important to find out whether men and women have similar or different perceptions of climate change, and adaptation strategies in Southeast Asia. We argue that because of their gender roles and relations, men and women adapt differently and consequently face the impacts of flooding and drought differently. This study was conceptualised to examine the gender and climate change adaptation of men and women farmers in flood-prone rice-farming villages in Bulacan, Philippines.

Methodology

Selection of study areas

The research was carried out in two villages in San Rafael, Bulacan. While there are many municipalities in Bulacan province with higher susceptibility to flooding, San Rafael was chosen because of its proximity

to the other project sites on climate change mitigation of the International Rice Research Institute (IRRI). Alternate wet and drying (AWD) technology, a water saving technology, was being demonstrated and implemented in nearby irrigated rice farming villages. The initial idea was to organize and build climate smart communities where both adaptation and mitigation projects in rice-based production systems could be implemented.

San Rafael is a municipality situated on the northwestern part of the province of Bulacan. It is politically subdivided into 34 villages covering 16,525 ha of land and is predominantly an agricultural town. Rice is the primary crop from which the majority of the people derive their incomes. Secondary crops include corn, root crops, mangoes and vegetables. Livestock and poultry production are the other agricultural activities in the municipality. San Rafael covers 2,900 ha of rice lands, of which 37% are irrigated. Two of the irrigated rice farming villages, namely Pulong Bayabas and Pansumaloc, were selected for this research (Fig. 4.1). Pulong Bayabas and Pansumaloc comprise about 160 ha and 144 ha of rice lands, respectively.

Climate in San Rafael consists of two pronounced seasons, the wet and dry. The wet season starts in May and ends in November. July and August are the wettest months. Pulong Bayabas and Pansumaloc form part of the Candaba swamp which absorbs most of the flood flows from the Pampanga River Basis. During the wet season, the farmlands as well as the residential areas are submerged for a couple of days. Based on the Tropical Rainfall Measuring Mission data from NASA (2012), rainfall has become more frequent and intense in San Rafael. The highest deviation of cumulative monthly rainfall from the normal sum for the 10-year period 2003-2012 was recorded in August 2012. Severe flooding was experienced in six of its villages from September to October 2009 and in September 2011 and August 2012. Based on PAGASA (2014) data, about eight tropical cyclones passed over 100 km radius of San Rafael from 2000-2013 and twenty from 1980-2014.

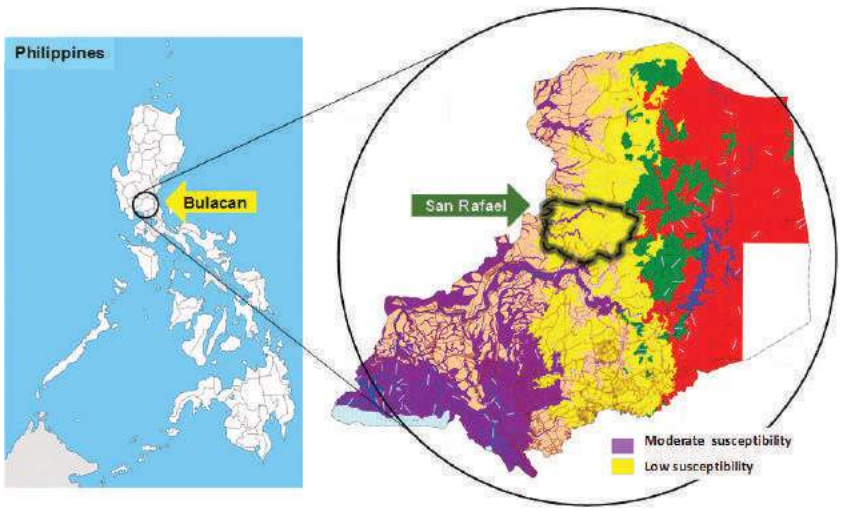

Figure 4.1 Location of study sites in San Rafael Bulacan

Source: Preliminary Flood Hazard Map of Bulacan. Bulacan Provincial Risk Reduction and Management Council (PDRRMC)

According to NASA 2012, during the wet season 2012, about 352 ha of rice fields were totally damaged by monsoon rains, which was equivalent to 12% of the planted area of the whole of San Rafael. This comprised 83% and 64% of the planted area of Pulong Bayabas and Pansumaloc, respectively. The two villages suffered the highest loss, with the average yields of 2.4 mt/ha and 2.5 mt/ha which is below that of the municipality average (4.9 mt/ha). This could have significant repercussions on food security of the villagers.

Selection of participants

The participants in various activities, such as the focus group discussions, surveys, and scoping meeting, were drawn from the list provided by the Municipal Agricultural Office. The list contained the names of people under whom farmlands were registered (i.e., landowners). Based on the list, there were about 101 landowners (of whom 25 were women) in Pulong Bayabas and 120 landowners (of whom 34 were women) in Pansumaloc. Several of them, however, were not farmer-cultivators in the strictest sense. Some had migrated to other municipalities and simply hired farmer-laborers (i.e., leaseholders) to tend their farms. Since the interests of this study were farmers who were actually involved in farm activities, the respondents for the survey questionnaires were composed of both landowners and leaseholders (whose names were therefore not in the list). Respondents, composed of 56 and 51 farming households from Pulong Bayabas and Pansumaloc, respectively, were selected via random sampling. Officers and some members of the irrigators' association as well as the agricultural and irrigation technicians assigned in the two villages participated in the focus group discussions.

Data gathering

Pre-tested structured questionnaires were used to gather detailed information from women and men farmers at the lowest costs and most rapid manner. The survey questionnaires encompassed eight major components: (i) household profile; (ii) farm profile; (iii) labor; (iv) knowledge and perceptions of and attitudes toward climate change and variability; (v) perceptions on impact of climate change; (vi) risk-coping and adaptation options; (vii) farming technologies and practices; and (viii) institutional support. The surveys were conducted in September 2013.

Data analysis

Rice production operations were grouped into the following categories: land preparation, crop establishment, crop care and management, and harvest and post-harvest operations. Logit regression analysis was used to identify the characteristics of women and men farmers that influenced their participation in rice farming. Participation (0 for non-participation and 1 for participation) was the dependent variable. Correlation coefficients between selected variables were also obtained if and when necessary. Collected data were either dichotomous or continuous. For dichotomous variables, farmers were coded 1 if they possessed those characteristics or 0 otherwise.

Results

Production system

Pulong Bayabas and Pansumaloc are two of the irrigated rice farming villages located within the Angat-Maasim River Irrigation System (AMRIS). Rice is grown in two crops per year reflecting the pattern of distinct dry and wet season in this region (Climate type I). Wet season rice cropping is between June and November and the dry season is between November and April. In recent years, AMRIS has promoted the adoption of the Quick Turnaround program in selected areas, allowing farmers to increase their annual production by triple cropping (Figure 4.2). Most farmers grow short-duration varieties and high yielding varieties such as NSIC RC216, NSIC RC222, PSB RC-10 and PSB RC 82. For example, NSIC RC222 has potential yields of 6.1 to 10 tons per hectare. Only a few of them are using hybrid varieties such as Bigante and other varieties. The average farm size of farming households is 1.5 hectares. Half of the respondents are owner-cultivators and the other half are tenants.

Since cropping 2009, there has been a huge gap in rice yields between dry and wet seasons. For both villages, the 5-year average yield during the wet season is 2.4 tons per hectare, only half of the dry season's yield of 5.3 tons per hectare. During the wet season, the yield trend showed erratic movement over the years which can mainly be explained by climate variability including extreme events such as typhoons and excessive monsoon rains which have markedly reduced harvested rice in these two villages (Figure 4.2 and Figure 4.3).

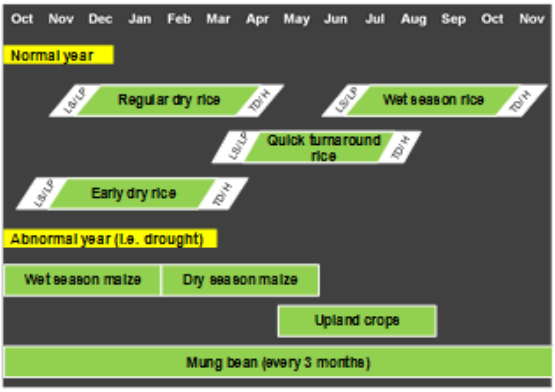

Figure 4.2 AMRIS Cropping calendar, 2012-2013

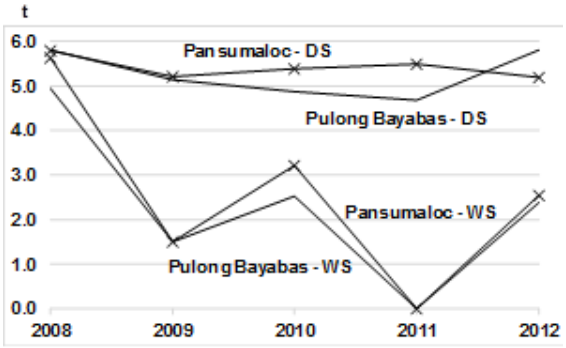

Figure 4.3. Average yields In tons per hectare

Note: PA-program area, LS-land soaking, LP-land preparation; TD-terminal drainage, and H=harvest; WS-wet season, DS- dry season

Gendered perceptions of climate change

Understanding how farmers perceive climate change risks and how this affects their willingness to adopt adaptation practices is critical for developing effective climate change response strategies for the agricultural sector. Studies show that men and women have different perceptions of climate change and they are impacted but it in different ways due to the distinct work men and women

do (Brody et al. 2008). Earlier studies by Tym et al. 2014 showed in the West Africa site, the most common shocks experienced were storms and floods. In terms of gender disparities, there were no over aching patterns across the sites with respect to perceived changes in weather-related shocks over the last five year, but within sites, they found some differences. For example, in Uganda, Africa, droughts were reported by the majority of both men and women, but women were more likely to report them than men, Women may be more likely to report droughts since they are responsible for collecting water and for on-farm vegetable production. (Kyazze and Kristjanson 2011).

In this study, men and women among rice farming households experienced climate change in the form of weather patterns (changes in temperature, rainfall, occurrence of tropical storms and weather related shocks/ extreme events. i.e. droughts and floods). The sample respondents were asked separately about their perceptions of climate change that they experienced in the last ten years. These changes include change in temperature (early water stress and increase in extreme temperature), change in rainfall (more intense

Table 4.1. Gendered perceptions of climate change

Indicators	Women (%)	Men (%)
Change in temperature		
Early water stress	62	59
Increase in temperature (hotter)	50	54
Change in rainfall		
More intense rainfall	48	53
More frequent rainfall	31	38
Early arrival of southwest monsoon	41	51
Change in occurrence of tropical storms		
More tropical storms	55	59
Stronger tropical storms	59	57
Unpredicted tropical storms	44	45
Change in flooding		
Deeper flooding	59	64
Flash flooding	49	52
Longer duration of flooding	38	45
No. of samples	116	120

Source: Household surveys, 2013

and more frequent rainfall, early arrival of southwest monsoon, (change in occurrence of tropical storms (more, stronger and unpredicted), and change in extreme events (flooding patterns (deeper, flash and longer duration) and drought. As shown in Table 4.1, there are no distinct differences between the percentages of women and men who experienced the changes and variability in climate change. This is expected because in the rice areas in the the lowland areas of Luzon, Philippines, family manage farms (Tisch and Paris 1994; Akter 2017). Thus, they experience the changes in extreme temperature (heat and drought), rainfall, tropical storms which cause flooding which affect rice production and other sources of livelihoods such as livestock production, working as agricultural workers, renting out machinery, and other farm-related income sources.

Sources of income

Based on household surveys, farming households in these flood-prone areas are engaged in diverse sources of livelihoods. Income from rice constitutes the major source of income (70%). The remaining 25% of total household incomes come from non-farm sources, namely self-employment (10%), salaried jobs (7%), pension and remittance receipts from relatives abroad (5%) and other jobs such as welding and construction (3%). Self-employment refers to management of neighborhood retail stores and tricycle driving and trading of apparel and frozen goods. The rest (5%) come from livestock (3%), vegetables (1%) and working as hired agricultural workers (1%). Thus, when floods or droughts occur, the major sources of income from rice sales, livestock sales and working as hired agricultural workers will be negatively affected. Since women are primarily responsible for taking care of pigs and poultry, then they are more affected than men in terms of losing their assets and income due to extreme weather events. Women among poor households work also as hired laborers in transplanting, gap filling and harvesting rice. Thus crop loss caused by extreme weather events will result to income losses and will incur more debts.

Gender division of labor in rice farming

Several gender differences in perceived climate changes are often attributed to the distinct work men and women do, which are largely dictated by gender norms (Brody et al, 2008). Thus it is important to understand whether there are distinct gender roles within a given rice production systems. As described earlier, farmers in San Rafael, Bulacan grow two crops of rice during the wet and dry season. Rice farming is a labor-intensive and a risky enterprise. As reported by both men and women, they experienced increase in extreme temperatures, i.e., hotter as well as changes in rainfall, tropical storms, flooding and early water stress. These stresses affect rice production which is their major source of income.

Since rice production is seasonal, all the operations should be started and finished at the scheduled time. The sequential rice operations are grouped under these categories: land preparation (seedbed preparation including sowing, plowing, harrowing, levelling), crop establishment (transplanting,

direct seeding, pulling and hauling seedlings into the field, thinning and gap filling), crop care and management (weeding, application of fertilizer, irrigating/ draining the fields, application of chemicals such as pesticides and fertilizer), and harvesting and post-harvesting (harvesting, threshing, hauling, milling). To meet the schedule, family members (male and female) work on their own farms as well hire other agricultural workers particularly during the peak season. Thus, how men and women adapt to climate change is important. In rice farming systems, tasks or operations are done separately or jointly by men and women. However, women's labor participation vis-a-vis men, vary based on many factors such as the type of production systems (irrigated lowland, rainfed lowland, uplands), type of crop establishment method, use of machinery, availability of male labor, education status, stage in the life cycle, income and social status) as shown in several studies (Pandey et al, 2012). Studies have shown that the labor participation of female family members is higher in lowland and upland rice farming than in irrigated production systems. Technologies are not gender neutral. When labor saving technologies are introduced, men usually take over operations which were traditionally women's responsibilities (Rathgeber 2011).

In this study, participation is counted if one (male or female) respondent provides labor in at least one of the sub-activities or rice operations. Traditionally, women in irrigated rice farming are mainly responsible for crop establishment (pulling of seedlings and transplanting). However, with the complete adoption of direct seeding, women's labor participation has declined as men are mainly responsible for direct seeding (Figure 4.4).

However, when flood occurs, rice seedlings are swept away by the floods, thus there is

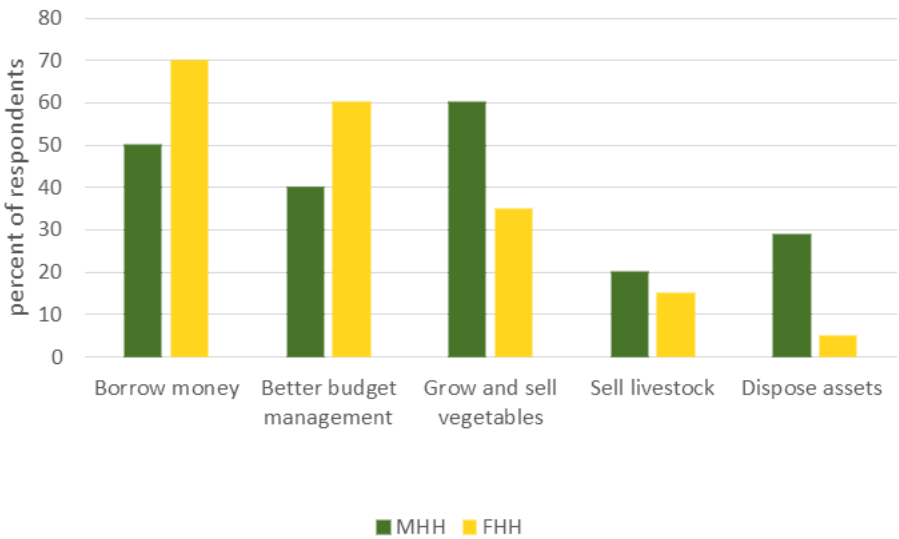

Figure 4.4. Percentage labor participation of women and of men in crop production and harvesting activities

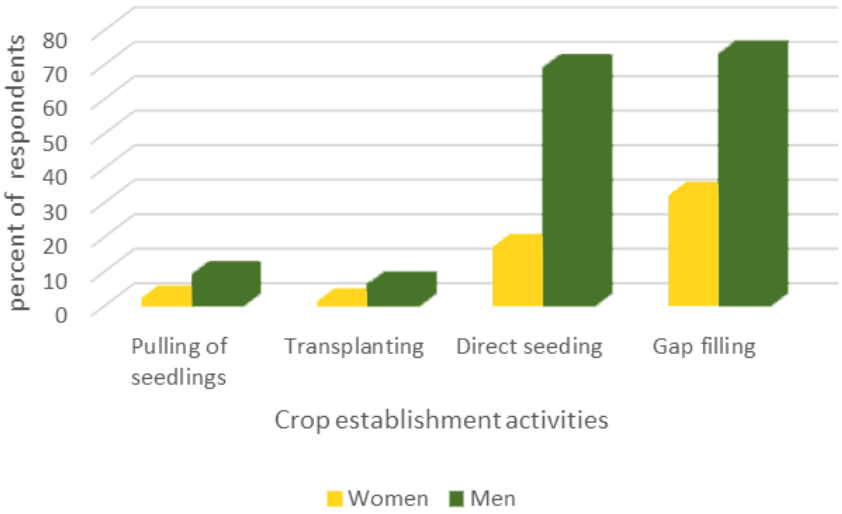

Figure 4.5. Percentage labor participation of women and of men in crop establishment activities

a need for re-sowing to sustain rice yields. Women contribute their labor in re-sowing. Crop care (spraying pesticides, broadcasting chemical fertilizer) are predominantly done by men (Figure 4.5). Both men and women are involved in harvesting. An interesting change in rice farming is the reliance on hired labor particularly for operations such as weeding, application of fertilizer (organic and inorganic), irrigating the fields and hauling of harvest.

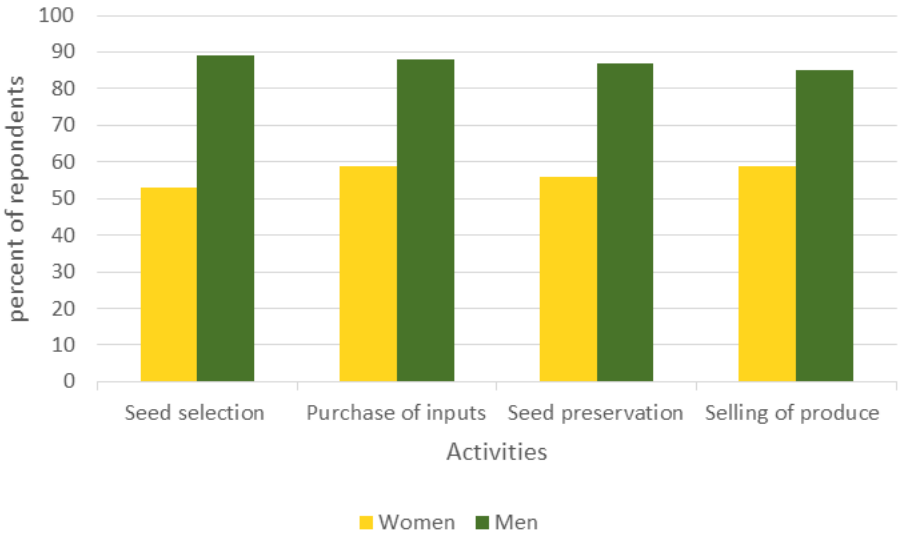

Figure 4.6. Percentage labor participation of women and of men in non-field rice related activities

As presented earlier, women provide labor in field activities, although their share is relatively lower compared with men. The pattern is similar in non-field rice-related activities. Figure 4.5 shows higher percentage for men in seed selection, purchase of inputs (pesticides, fertilizers), seed preservation and selling of products. The dominance of men in seed selection and seed preservation can be due to new practice of purchasing certified seeds from the market rather than the traditional practice of exchanging seeds with other farmers (Figure 4.6).

Impact of flooding events

In this study, men and women were asked separately how flooding had affected them. As shown in Table 4.2, the impacts of floods on them are based on gender roles in the farm and in the household. Although both men and women reported that they were highly affected in terms of rice crop loss and low yields, men (89%) reported that they were more affected than the women (72%).

As mentioned earlier, since cropping 2009, there has been a huge gap in rice yields between dry and wet seasons. For both villages, the 5-year average yield during the wet season is 2.4 tons per hectare, only half of the dry season's yield of 5.3 tons per hectare Thus, flooding events lead to rice crop loss and low yields which affect food availability and potential income from rice sales. Since rice is the staple food and only major source of income, poor farming households will suffer due to decreased food (rice) security and loss of income. With changes in climate, men (57%) also reported increased workload in the farm than the women (26%) because in times of flooding, they have to drain the fields. During drought, men have to cultivate and irrigate the field more frequently. Flooding

Table 4.2. Self-perception on impacts of flooding

Impacts	Women (%)	Men (%)
Rice crop loss and low yields	72	89
Increased workload in the farm	26	57
Pressure to hire labor and machines	21	19
Increased workload at home	50	17
Increased pressure to seek other income	13	9
Increased indebtedness	22	19
Pressure to acquire loans	11	12
Pull children out of school	14	8
Increased health problem	22	9
Decreased quantity of food	15	13
Decreased quality of food	12	9
Increased pressure to provide food	7	15
Less available drinking water	14	10
More stressed/ anxious	19	13
No of respondents	116	120

Source: Household surveys, 2013

also increases women's labor inputs. When flood or drought occurs during the crop seedling phase, the women have to replant new seedlings in between spaces to reduce crop loss or maintain price yields. Based on gender roles, a high proportion (50%) of the women experienced increased workload at home. Women's workload include household chores, taking care of children, ensuring availability of quality food and drinking water. Due to floods, women have to do more household chores such as cleaning the house, washing dirty clothes due to floods. During typhoons when there is no electricity or gas, the burden of cooking food is borne by women. When there is no electricity, the women have to keep unperishable goods. The women and children suffer increase health problems due to flooding events. Children in particular are more susceptible to diseases such as diarrhea, fever and other communicable/infectious diseases due to contaminated water, poor sanitation, etc. Aside from increased health problems, both men and women experienced decrease in quantity and quality of food but the men are more pressured to provide food for the family. For women who take care of pigs and poultry, their workload in cleaning the pens and feeding also increased. Men experience increased pressure of providing food for the family. Extreme drought may exacerbate existing shortages of water. In rainfed rice growing areas, the water table decreases thus access to irrigation and drinking water also decreases. Women are largely affected as they use water for domestic consumption and for many uses for family members.

Adaptation measures and risk-coping strategies[4]

In the earlier section, we found out that men and women have similar observations/ experiences on climate change and climate variability. However, men and women's adaptation measures and risk-coping strategies may differ. Adaptation strategies adopted by men and women also depend on their access to and/or control over resources and their participation in decision-making process.

Employing the Wilcoxon-Mann-Whitney test to compare the ranked sum of adaptation measures and risk-coping strategies between genders, statistical differences were found on men and women's risk-coping strategies, namely building dikes at 1% level and re-sowing or gap filling and acquiring loans both at 1% and 10% level (Table 4.3). Majority of the respondents – women (70%) and men (82%) – would customarily engage in re-sowing or gap filling when floods or typhoons damage their rice crops and store food and other necessities in anticipation of floods. This response, especially from women, is worth noting. At the onset of the interview, each of the respondents was deliberately asked whether he or she was involved in rice production activities. For instance, only 22% of the total women respondents said that they participate in rice production. However, 70% of the women claimed that they were involved resowing/gap filling. These results reveal that when flooding occurs, women's labor participation increases. However, they previously declared not to be part of. It could

[4]Shorter-term plans to overcome immediate challenges. These plans do not always take into account the longer term consequences. Coping strategies help men and women to get by, but do not later after their long-term vulnerability. If they are exposed to the same climate conditions in the future i.e., flood they will still likely to adversely affected.

be gleaned from the data that the women were underreporting their participation or undervaluing their crucial labor contributions as unpaid family members. Although changing rice variety was mentioned by a few men and women respondents, this practice remains to be promoted by providing farmers access to good quality seeds of stress tolerant varieties.

A higher proportion of men respondents (40%) than women (28%) acquire loans (mostly from formal sources, e.g., farmers cooperatives, irrigators' associations). Both men and women borrow from private money lenders, friends, and relatives to finance the new seedlings and labor required in re-sowing, settle any existing debts, or cover other household expenses. Twenty- eight percent of the wives take loans from formal sources, e.g., cooperative and irrigator's association the bank. Over and beyond the gender differentiated strategies, men and women have limited access to credit. Only 28% of the women and 40% of men borrow loans from formal sources. The majority do not borrow money for many reasons such as lack of necessary documentary requirements for loan approval.

Utilizing savings is also one of the common practices among the respondents, albeit not statistically different between the genders. This is not surprising due to social norms that in the Philippines, husbands and wives have joint savings accounts and communal pool of assets. Furthermore, they often consult each other in whatever strategies they want to pursue in response to climate change risks. More men than women seek support from relative and friends, during times of climate events.

This could partially explain the practice of selling off rice stockpile originally meant for household consumption. However, this action make households vulnerable to food insecurity as they had to buy rice in the future, possibly at a higher price. Reducing food consumption, rice in particular, is also one way to extend the remaining stock of rice in the household. Moreover, spending less particularly on consumer durable goods and other items is one strategy mentioned by both men and women as shown in Table 4.3.

Seeking government support and insurance programs is seldom practiced. While there had been efforts by agricultural extension to promote insurance programs, farmers admitted that they are not interested to apply for insurance had it not been for the free premium. The Philippine Crop Insurance Corporation (PCIC) provides free premium to encourage more farmers to apply for crop insurance. The farmers however claimed that the insurance benefits are not really "beneficial". They would just receive a sack (50 kilograms of seeds) for re-sowing seeds and some cash.

Despite the risks faced by farmers, they never thought of leaving the land to fallow or change the cropping calendar. Seeking alternative livelihoods, migrating and selling assets and mortgaging lands are not in the list of options for them either. Raising livestock or poultry is seldom practiced due to lack of capital.

Table 4.3. Adaptation measures and risk-coping strategies often

	Women	Men
Crop and natural resource management		
Change rice variety	18	22
Resow/Gap filling*	70	82
Build higher dikes ***	1	19
Financial services		
Use savings	56	64
Acquire loan*	28	40
Seek support from relatives and friends	26	36
Human and social capital		
Reduce food consumption	21	23
Secure all valuable properties in elevated place	41	42
Store food and other necessities	71	70
Spend less	38	42
No. of respondents	116	120

Note: *** and * indicate significance level at 1% and 10%, respectively.
Source: Household surveys, 2013

Men and women's access to resources, information and services

There is a big gap in access to information through attendance in seminars, workshops and training on agricultural technologies and on weather/climate events. (Table 4.4).

However, there seems to be no gender gap in access to information on weather/climate events. These findings suggest that women have other means of gaining access to information, despite the low attendance in seminars, workshop and training compared to men. Over 40% of the women said that they usually get information from government

agencies such as the Philippine Rice Research Institute Rice (PhilRice) located in Nueva Ecija province, and the Municipal Agriculture Office (MAO). Another 40% obtained their information from radio and television, and 10% from their fellow farmers. Among men, over 40% said that they sourced their information from government agencies and another 32% from radio and television, and 15% from their fellow farmers, respectively. It is interesting to know that a higher percentage of men obtained information from their fellow farmers than women. This could be explained by the fact that more men are members of Farmers' Cooperatives than women.

Despite women's low attendance in seminars, workshops and training program, they have access to information on farm from their husbands who attend meetings on behalf of their households. Women's participation in demonstration trials for new rice varieties was very low. Moreover, while approximately 60% of the women participate in seed

Table 4.4. Men and women's access to information (percentages of responses)

Access to information	% of Women	% of Men
- Improved agronomic practices in rice production	73	94
- Use of new farm machinery	74	93
- Weather and climate events	92	99
Attendance in seminars, workshops and training which focus on		
- Improved agronomic practices in rice production	42	84
- Use of new farm machinery	44	82
- Weather and climate events	68	90
No of respondents	116	120

Source: Household surveys, 2016

selection and seed preservation (See table 4.5), women were seldom provided with extension services on seed technology. Women were not invited by agricultural extension personnel to seminars, workshops and training programs unless researchers explicitly required their engagement. The gender biases in institutions are still very prevalent among the extension staff themselves, despite the fact that majority of the agricultural extension staff members are women.

Knowledge and awareness of climate change and variability

While CSA practices can help smallholders adapt to climate change, these farmers also need good climate information from reliable sources at the correct time in order to adopt such practices. A high percentage of respondents mentioned that they had observed changes and variability in the climate in the past 30 years. Yet, only 64% of the women and 77% of the men knew about the term 'climate change' (Table 4.5). This suggests that an experience or simply perceptions of climate change does not necessarily imply knowledge of the term. Those who know and are aware of climate change and variability have heard the term primarily from the television (97% of women and 97% of men). About half (52% of women and 49% of men) obtained information from the radio. In general, households have access

Table 4.5. Knowledge and awareness of climate change and variability

Descriptor	% Women	% Men
Awareness that climate change is happening	64	77
Sources of information Television Radio	 97 52	 97 49
Number of observations	115	120

to electricity. Majority of the households have access to television and radio.

Summary and conclusion

Men and women have similar perceptions of climate change risks. This is expected since in some rice operations, men and women work together on the same plots/ fields. Consequently, both suffer from the negative effects of climate change such as yield reduction or complete yield loss that result to loss in income, incurring debts and also reduction in household rice supply. Farmers rely heavily on short-term risk coping strategies. Majority of respondents would customarily engage in re-sowing and replanting when floods or typhoons damage their crops. This substantially increases the farm workload of women who have lower labor participation in rice farming activities except during harvest period.

Third, next to crop losses and increased workload in the farm and at home, increased indebtedness ranked third among the impacts of typhoons and flooding events on women and men farmers. The lack of access to formal credit institutions necessitated them to borrow from informal sources which required higher finance charges. The increasing prices of seeds and of other inputs further strain the household budget as the meagre incomes from the previous cropping season and from other non-agricultural sources were hardly sufficient for the household daily needs. During flood events, farmers reported decreased quality and quantity of food, thus impacting food security.

Finally, with regards, to information sources, while a high proportion of women (73%) reported that they had access to information on farm practices and agricultural technologies, women are not direct recipients of information provided by agricultural extension services.

For gender-responsive planning and design of CSA technologies and practices, the following are suggested:

- Train women and men farmers on management of natural resources and financial resources. During the dry season, 60% of the total costs go to fertilizer and seeds. Since women are the custodians of household budgets, it is necessary for women to gain knowledge on CSA technologies and practices that can reduce input costs and promote a more efficient use of resources, with any reduction in input costs diverted to other expenditures such as children's education, and better quality food. Thus, the entire household are likely to benefit if more women participate in workshops or training programs on resource and financial management.
- Finally, introducing CSA technologies and practices to women farmers particularly on livestock management along with their participation in community savings and credit programs is also suggested. Women need CSA technologies which can provide them with alternative sources of income and enable them to have emergency funds or savings during times of calamities.

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Chapter 5
Gender, Climate Change and Root and Tuber Crops: A Case Study in Eastern Visayas, Philippines

Arma Bertuso

Chapter 5

Gender, climate change and root and tuber crops: A case study in Eastern Visayas, Philippines

Arma Bertuso

Introduction

In the Philippines, staples such as rice, corn and other cereals are widely considered as "primary crops" and thus have been traditionally accorded the highest priority in terms of research, extension and government policy. Root and tuber crops (RTCs) such as sweetpotato, cassava, taro and yam are considered as "secondary crops" and are often associated with poor farming communities cultivating marginal lands. Contrary to the experts' label as "secondary crops", root and tuber crops are utilized in many parts of the world for multiple purposes under different agro-ecological and socio-economic conditions. Worldwide, sweetpotato and cassava rank within the top ten agricultural crops based on total annual production (UPWARD 2002; Campilan 2002). Root and tuber crops play an important role in food security and livelihood of poor farming households in many less favorable agro-ecologies and remote communities. They are traditional/seasonal staples for many Philippine ethnic communities and are widely known as buffer crops during agro-ecological and socio-economic crises. The "value-adding potential" of root and tuber crops is now increasingly recognized and as a result, there are rapidly expanding industrial and other commercial applications locally and abroad (Data et al. 1977; Pardales et al, 2002). According to FAO (1993) the main nutritional value of roots and tubers lies in their potential ability to provide one of the cheapest sources of dietary energy, in the form of carbohydrates, in developing countries. This energy is about one-third of that of an equivalent weight of grain, such as rice or wheat, because tubers have a high water content. However, the high yields of most root and tuber crops ensure an energy output per hectare per day which is considerably higher than that of grains. Cassava, sweetpotatoes, and yam contain some vitamin C and orange/yellow varieties of sweetpotatoes, yam, and cassava contain high level of β-carotene, a precursor of vitamin A. Taro is a good source of potassium. Similar to other crops, the nutritional value of roots and tubers varies with variety, location, soil type, and agricultural practices, among others. Root and tuber crops are also seen as climate-resilient crops that could ensure greater food security for smallholder farmers. It contributes directly to food security through their production in smallholder farming systems, as food and source of income, especially during the lean months. Root and tuber crops can withstand typhoons, floods and droughts and their short production cycles facilitate recovering from these shocks. In November 2013, typhoon Haiyan, known as Super Typhoon Yolanda in the Philippines, was one of the strongest tropical cyclones ever recorded which led to loss of lives, crops and livestock. In the most devastated areas, only sweetpotato stood green and robust in the fields and in the uplands amidst 95% fallen coconuts and trees,

and dried-up grain fields. When food supply was most difficult in the first few weeks after the typhoon, harvests of sweetpotato and taro provided local people with food, while communications and transport disruption made marketing the produce to Tacloban impossible (Roa et al. 2017; FoodSTART+ 2016).[5]

Most notably, documentation studies have revealed an important gender dimension to root and tuber crops agriculture. Secondary crops like RTCs are closely associated with those often similarly considered, the "secondary farmers" – women – who in fact have been shown to be mainly responsible for making decisions and actions on the crop's cultivation, utilization and marketing; (Paris 2002; Sister 2002; Mondala 2002; Adion 2002; Bartolini and Pardales 2002, Gabunada 2002, FoodSTART+ 2016). However, not much is known about the effects of climate change on men and women who grow RTCs as minor crops in marginal and risk prone areas and how they use RTCs as an adaptation strategy in response to typhoons and drought.

Little is known on the context-specific social factors that support/hinder the uptake of potential Climate Smart Agriculture (CSA) practices on RTCs in the uplands and coastal communities. Promoting the production and use of root crops, will potentially bring women more actively into the process of designing and disseminating CSA practices on root and tuber crops farming. Studies suggest that more female-as well as male-farmers adopt CSA technologies and practices (including, root and tuber crop production) when women's awareness, knowledge and access to information about such practices increases (Kristjanson et al. 2015); and that the resilience of household, communities and food systems are enhanced as a result (World Bank, FAO, IFAD 2015).

In view of this, this paper will:

(1) Assess whether there are gender differences or similarities on men and women's livelihoods and gender roles in RTC production in Eastern Visayas (EV)
(2) Identify context-specific social factors including gender norms that support/ hinder uptake of new or potential CSA practices and technologies on RTCs in upland areas, and
3) Recommend CSA technologies and practices related to RTCs relevant and available to the local population in EV.

Methodology

Selection of study areas

Eastern Visayas (EV) was selected as the study site due to its vulnerability and exposure to climate change. The region, due

[5]Food Resilience Through Root and Tuber Crops in Upland and Coastal Communities of the Asia-Pacific (FoodSTART+) is a three-year research project (2015-2018) funded by the European Union and the International Fund for Agricultural Development (IFAD).The overall goal of FoodSTART+ is to enhance food resilience among poor households in upland and coastal communities of the Asia-Pacific region through the introduction of root and tuber crops (RTCs) innovations. This project is coordinated by the International Potato (CIP) and Implemented in collaboration with the International Center for Tropical Agriculture (CIAT) in Asia and the CGIAR Research Program on Roots, Tubers and Bananas (RTB). The project aims to enhance food resilience among poor households in upland and coastal communities of the Asia-Pacific region through introducing root and tuber crops (RTCs) innovations (FoodSTART+ 2017).

Figure 5.1. Location of Calbiga and Lawaan in Eastern Visayas

to its geographic location in the center of the country, has been a constant site for land fall of typhoons entering the Philippines. Moreover, according to the Center for Environmental Geomatics (2005), in the Philippines, the areas most at risk to projected rainfall changes are Central, South and Southeast Luzon and EV. Specifically, EV is prone to extreme high temperature, extreme rainfall events, and sea level rise. The research sites in this study were selected according to the following criteria: importance of root and tuber crops livelihood and representation of a market-oriented (MO) and subsistence-oriented (SO) communities. The selection was based on a previous scoping study conducted by FoodSTART+ in 2015. Two municipalities, namely Calbiga in Samar and Lawaan located Eastern Samar were chosen for this study (Figure 5.1). Calbiga municipality, in Samar was selected to represent the market-oriented site as this is known as the "trading area of root and tuber crops" in the region. Majority of the farming households have access to a regular market ("tabo") which is held twice a week. It is also located in a strategic location for commuters and traders between major cities. Calbiga is about 48 kilometers south of Catbalogan, the provincial capital town and 59 kilometers northeast of Tacloban City in Leyte. The town center lies along the Philippine-Japan Friendship Highway (Maharlika Highway) that links Samar and Leyte to the islands of Luzon and Mindanao. On the other hand, Lawaan municipality in eastern Samar was selected as the SO communities where most households do not have access to major markets. Lawaan is predominantly agricultural. Many families rely on coastal and deep-sea fishing as well as lowland and upland farming as their means of livelihood. The main agricultural product is copra.

Sources of data

Secondary data such as previous reports and articles were collected and reviewed (CIP-UPWARD[6] publications, FoodSTART+ scoping study). Primary data were gathered using Participatory Rural Appraisal (PRA) tools namely key informant interviews (KIIs), Focus Group Discussions (FGDs), seasonal calendars, pie charts, and problem tree diagram (vulnerability and adaptation strategy) with men and women. These tools were found to be effective in face of the limited available funds and time for field work (FAO 2013; Jhost et al. 2014).

Four FGDs were conducted with separate men and women's groups. A total of 20 participants participated in the four FGDs: nine (4 men and 5 women) in Calbiga, Samar and 11 (5 men and 6 women) in Lawaan, Eastern Samar. All the participants are engaged in farming, including RTCs and are mostly tenants cultivating 0.25 to 0.5 Ha. The majority of the participants are married (70%), with very few widowed (15%) and unmarried (15%). The age of respondents in Lawaan ranges from 38 to 63 years old and 40 to 60 years old in Calbiga, Samar. The topics discussed in the FGDs were: sources of livelihood in MO and SO communities, gender division of labor, and degree of women's decision making regarding productive inputs and household; access to resources (varieties, inputs) and agricultural services (information, training); climate change perspectives including vulnerabilities and adaptive strategies. The climate resilient agriculture and gendered PRA tools were livelihood systems matrix (farm, off-farm[7], non-farm), seasonal calendar (occurrence of drought and rains during the year), agricultural calendar (planting and harvesting dates of crops grown during the year), livelihoods calendar (raising livestock, off-farm and non-farm employment), preference ranking of root and tuber crops, gender analysis (with a focus on who provides labor in specific root and tuber crops production), seasonality of food availability (months rice supply is high and low; months when animal fodder is high and low); months when pigs and chickens are sold, and daily activity clock.

Results and discussions

In conducting gender analysis in relation to climate change, it is important to understand the specific context in order to draw patterns. In this study, farming households were classified based on the degree of market orientation related to root and tuber crop production. As mentioned above Calbiga, Samar was classified as MO while Lawaan is SO. In SO communities, root and tuber crops are mainly grown for home consumption. In the MO communities, root and tuber crops are mainly grown for the market and the rest for consumption.

A typical household in a rootcrop-growing village is engaged in several farming activities (mixed crop production, livestock raising) and off farm and non-farm activities. According

[6]CIP-UPWARD (International Potato Center -Users Perspectives with Agricultural Research and Development)
[7]Off-farm are working as hired agricultural or seasonal workers in other farms within the village while non-farm activities include self-employment e.g. buy and sell, domestic helpers, masseuse, tricycle driving, construction and other service sectors.

Figure 5.2. A typical mixed cropping system

to the FGDs participants, they are involved in these diverse activities to ensure food and income security throughout the year. Rice (upland and lowland) and coconut are the main crops among communities in EV. Most households grow different types of root and tuber crops namely sweetpotato (*Ipomoea batatas*), taro (*Colocasia esculenta*), cassava (*Manihot esculenta*), yam (*Dioscorea* spp), giant taro (*Alocasia macrorhhiza*), cocoyam (*Xanthosoma sagittifolium*) and giant swamp taro (*Cyrtosperma chamissonis*). These RTCs are grown either as a cash crop or as staple food in mixed cropping systems. Farmers also grow various vegetables for food and cash income and grow fruits such as pineapple and banana intercropped with other crops such as rice, corn and RTCs. Mixed cropping is commonly practiced in both MO and SO communities. A typical mixed cropping systems in an upland area involves several crops including coconut, banana, upland rice, taro, cocoyam, and yam. The average cultivated area is 0.5 Ha for both SO and MO communities. In the MO communities, farming households grow a number of vegetables which are

Figure 5.3. A woman selling her home grown bananas, root and tuber crops and ginger in the market

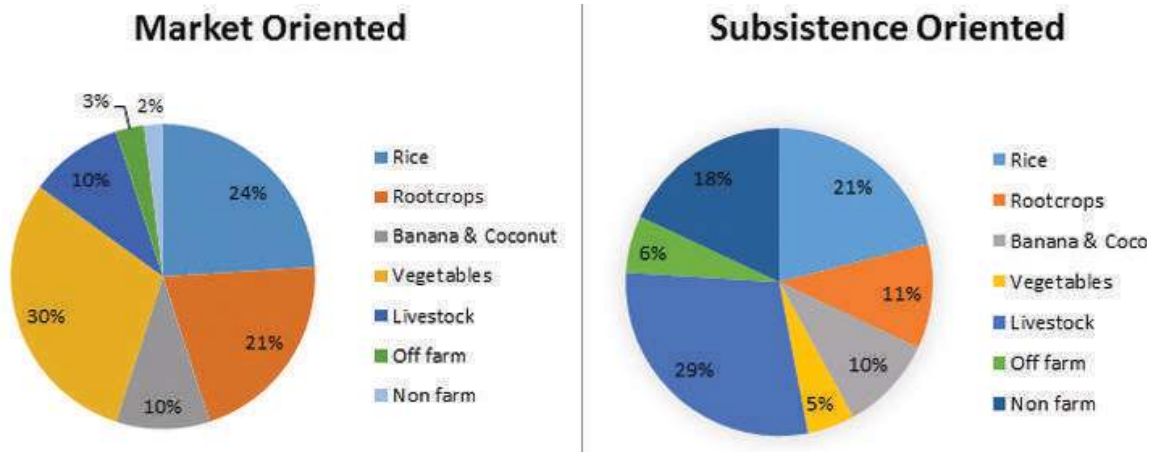


Figure 5.4. Percentage contribution of sources of livelihoods in MO and SO

grown for income all year round. In the SO communities, vegetables are only grown for home consumption with minimal surplus for sale.

Share of various sources of livelihoods to household income

As shown in Figure 5.4 in the MO communities the sale of vegetables (30%), rice (24%) and root and tuber crops (21%) are the major sources of household income. Income from perennial crops (bananas and coconut) and livestock are quite low at 10% each. The contribution of off-farm and non-farm income is low (5%). In contrast, in the SO communities, livestock comprises the highest share (29%) followed by rice sales (21%) and non-farm activities (18%). Sales from root and tuber crops are lower at 18% because they are mostly used for home consumption. Sales from vegetables (5%) and off-farm income (6%) are the least contributors to household income. Thus, SOs rely heavily on non-farm income unlike in the MO communities wherein the share of non-farm income is very low. These findings reveal the differences in the contribution of these different income sources to local livelihoods. It is worthwhile to note that in both SO and MO communities, rice is not the major source of income as in the case of lowland rice farming.

Importance of root and tuber crops

A closer look into the contribution of root and tuber crops to the livelihood of the men and women in the MO and SO communities shows that root and tuber crops (cassava, taro, sweetpotato) are important sources of food and income (Table 5.1). Although rice is considered the main staple food, both men and women in both MO and SO communities mentioned that root and tuber crops are alternative or secondary food when rice is not available, thus they plant them regularly in their farm.

Table 5.1. Preference ranking of root crops production for income and food MO and SO

Root and tuber crops	Market-oriented (Calbiga)		Subsistence-oriented (Lawaan)	
	Men	Women	Men	Women
Cassava	1	2		3
Taro	2	1	1	2
Purple yam	2			
Giant taro	3	3		
Sweetpotato			2	1
Cocoyam			3	2

Code: (1=most important; 2=moderately important; 3=important)

Among MO households, women value taro while men rank cassava as most important crop. These gendered differences can be attributed to gender roles and other cultural factors. Men prefer cassava because it is an important source of income as well as for cultural practices (i.e., it is best eaten with roasted pig and coconut wine). Women prefer taro because it provides income all year round from sales used for delicacy.

Among SO households, women rank sweetpotato as the most important RTC followed by tuber crops such as taro and cocoyam and then cassava. In contrast, men rank taro as the most important RTC followed by sweetpotato and cocoyam. Sweetpotato is important to women because they cook this rootcrop for food and snack. The women are mainly responsible for cooking sweetpotato and use sweetpotato vines as well as reject roots as primary feed for pigs. Sweetpotato can be easily prepared (boiled) as an alternative to rice as staple food. In particular, RTCs are easy to sell and available all year round for income and food. The availability of a local food industry for RTC products (*binagol*, *sagmani*, *ginan-an*) also contributes to the preference of both men and women in MO communities for taro variety *iniito*).

Figure 5.5. Popular taro variety being sold in Calbiga, Samar

Impacts of climate changes on livelihood activities

As mentioned in the earlier section, the EV region is considered as one of the vulnerable areas to climate change in the country being prone to extreme weather events, particularly drought, typhoons and southwest monsoon. Aside from FGDs, we used the livelihood and vulnerability calendar as a tool that allows for discussion of the linkages between climate variability and specific key activities and resources that occur or are available at different times during the year. Figures 5.6a and 5.6b show the crop production and vulnerability calendar of men and women's groups in the MO and SO communities.

Figure 5.6a. Crop production and vulnerabilities, in MO communities

Livelihood Activities	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Drought												
Typhoon												
Sweet potato				P			H	H	H			
Taro	H			P						H	H	H
Cassava		P							H	H	H	H
Cocoyam*									P			
										H	H	H
Giant taro*	H			P								H
Yam	H			P								H
Banana*				P								
		H	H									
	P											H
Corn				P	P			H	H			
Upland rice				P	P	P			H	H	H	
Lowland rice						P			H	H		
Vegetables* -eggplant -bell pepper -pepper -string beans -bitter gourd -gourd												
Ginger			P	P							H	H
		H		P	P							
Pineapple	P				H							P
Coconut* (copra)												

Legend: P- Planting H- harvesting (main season)
* income all year round (staggard harvest as needed)

Figure 5.6b. Crop production and vulnerabilities in SO communities

Livelihood Activities	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Drought												
Typhoon												
Southwest Monsoon												
Sweet potato	H								P			H
		P			H							
Cassava	H	P						H	H	H	H	H
Taro	H	H	H	H	H	P						H
	H	P										H
Cocoyam*	H	H	H	H	H	P						H
Yam	H	H	H	P								H
Banana*	P	P										H
Corn	P				H							
						P				H		
Upland rice						P				H		
Lowland rice						P				H		
Vegetables -Squash -Bittergourd					P				H	H		
Coconut*												

Legend: P- Planting H- harvesting (main season)
* income all year round (staggard harvest as needed)

Men and women groups in MO reported that drought usually occurs in the months of April to July, while typhoons occur from October to December. SO communities mentioned that drought usually occurs in the months of April to June, while typhoons occur from September to December. The SO communities in the coastal areas, mentioned southwest monsoon occur from July to August. Thus, the livelihoods of the farming communities are affected by these climate hazards.

During the months when drought and typhoons occur, farmers grow and harvest root and tuber crops. As mentioned by the respondents, root and tuber crops are alternative food to rice, usually harvested only

in particular months, particularly in times of calamities. Men's group mentioned coconut as one of the main crops in the market-oriented communities. Sales from coconuts represent an important source of income all year round. On the other hand, women did not mention this, perhaps because men are more responsible for coconuts. Market-oriented communities derive all year income from banana, cocoyam and giant taro production and vegetable production (eggplant, bell pepper, pepper, string beans).

During the drought season, root and tuber crops such as sweetpotato, yam, taro and giant taro do not require much water compared with rice. They are planted in April on the onset of drought taking advantage of the residual soil moisture. Their chances of survival are higher compared to other crops (e.g., rice). Roots and tubers are grown underground and thus have less exposure to typhoons. At times when typhoons damage rice and other fruit trees, farmers have assured root and tuber crops which can be harvested and consumed or sold. Cassava is planted in February and main harvesting is done in September-December while the rest of the roots are left in the ground and harvested only when needed. It can be noted that in SO communities, root and tuber crops are harvested in almost all months of the year, as they are used more as a source of food. Most harvest of root and tuber crops are also towards the end of the year, when much of the rice harvest is likely to have been already consumed. They grow root and tuber crops all year round for food even in times of drought, typhoons and southwest monsoon. Their harvest is important during the months of May to December when drought and typhoons occur. They consider root and tuber crops as alternative food to rice, particularly at times of calamities.

Farmers usually plant giant taro in April and harvest in December to January. Farmers can harvest giant taro after 2 or 3 years. They are used for local snacks "binagol". Men process (grate) the rootcrop and cook them with coconut milk and sugar. Since this is a commercial good, then men are more in-charge. Men are engaged in processing taro because the grating process is tedious and makes the skin itchy. Moreover, processing takes the entire day and women are busy with their household chores, child care, and other responsibilities. Yam is also usually planted in April and harvested from December-January.

Planting and harvest of banana is a yearly activity. It provides income all year round, particularly for MO communities.

Cash flow

Figures 5.7a and 5.7b show the seasonal calendar of non-crop income for MO and SO communities. As mentioned for MO, drought occurs from April to July while typhoons occur from October to December. Subsistence-oriented households noted longer periods of drought from April to August and typhoons from November to December. Thus, the subsistence households are more exposed to longer periods of drought. However, to reduce risks, MO and SO households resort to various sources of livelihoods for cash income.

Figure 5.7a. Seasonal calendar, cash availability in MO communities

Livelihood Activities	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Drought												
Typhoon												
Southwest monsoon												
Pig/native chicken raising	cash				cash	cash						cash
Renting out carabao for plowing	cash			cash	cash	cash						cash
Hired labor				cash	cash	cash						
Charcoal making			cash	cash			cash					
Making root and tuber crops delicacies*												

Legend: * income is all year round

In SO communities, members of farming households, obtain cash by working as hired labor from April to August. Men leave their villages and earn income as construction workers from January to May. Others catch and sell fish from April to May and August to December.

Figure 5.7b. Seasonal calendar, cash availability in SO communities

Livelihood Activities	J	F	M	A	M	J	J	A	S	O	N	D
Drought												
Typhoon												
Southwest Monsoon												
Pig and native chicken raising				cash	cash	cash					cash	cash
Hired Labor				cash	cash	cash	cash	cash				
Construction worker	cash	cash	cash	cash	cash							
Fishing				cash	cash			cash		cash	cash	cash
Vending/peddling*												

Legend: *income is all year round

Livestock raising. Livestock raising (pig and native chicken) within the backyard is considered an important source of livelihoods of men and women in SO than in MO households. Women take care of piglets and sell them during the months of December to January (Christmas and New Year season) when the demand is high. Women also sell pigs from May to June (start of classes) because they need cash for the children's enrolment and other expenses. Farming households who own large animals also earn cash by renting them out for land preparation, plowing and harrowing. Thus, cash is available from December to January and from April to June.

Off-farm income. Off-farm income such as working as agricultural hired labor is also an important source of income but is seasonal. The demand for seasonal agricultural workers for rice production is high from April to June and extend until August in SO communities. Men and women who work as hired agricultural workers earn 150 to 250 pesos per day (US$2.88-4.80) depending on the type of work. Since most farmers have small plots, farmers depend on family members to meet the labor requirements in crop production. If possible, all family members work together in their own fields.

Non-farm activities. In the SO communities, farm incomes are not enough to meet the family needs. Thus, members have to earn additional income from non-farm sources. Men earn non-farm income from fishing during the months of April to May when there are no typhoons. Some women earn additional income by processing root and tuber crops, cooking and selling them delicacies. Other work include masseurs, seamstress, and small traders (buying and selling goods in the village). There are men who work as tour guides in the city and earn 300 to 500 pesos (US$5.77 – 9.62) per day depending on the tourist place, especially during the summer months. Younger men also work in the construction sector from January to May. Vending goods occurs throughout the year. Buy and sell of goods as well as processing and cooking root and tuber crops into snacks and delicacies for the market is also done the whole year round.

Adaptive strategies in times of vulnerabilities and food insecurity

Figure 5.8 shows the problem tree of risks and adaptation strategies of FGD respondents. All men and women respondents were in agreement that weather changes have occurred in recent years which affect their farming. Vulnerabilities mentioned by the respondents included more frequent and stronger typhoons and high temperature. These weather variability result to low or no yield of rice, crop (vegetables, banana, coconut) damage and death of livestock and poultry, thus leading to food and income insecurity. Based on their experience, farmers have learned to cope with these extreme weather events by adapting many strategies such as growing and consuming RTCs in case there is no rice production. However, depending upon available opportunities, farming household use may strategies such as growing RTCs as alternative food, engaging in non-farm and out-migration, harvest and plant early. Except for evacuation and relief assistance during times of disaster, these

common strategies are done by men and women to ensure food security and obtain cash income to meet their daily needs in response to extreme climate change.

However, despite these challenges, the participants indicated several adaptive strategies to cope with these vulnerabilities. An adaptive strategy of men farmers during typhoons is to adjust their planting and harvesting to minimize damage. Both men and women mentioned that non-farm employment, particularly out-migration, is a strategy when typhoons destroy their crops. Among family members, husbands and sons go to cities to work as construction workers, while daughters work as domestic helpers. Women mentioned that they also prepare food and medicine and evacuate at times of stronger typhoons. As temperature becomes unbearable in the fields during day time, men and women respondents mentioned that they adjust the working time in the fields accordingly. For example, they work very early in the morning to avoid the strong heat, go home and go back to their fields later in the afternoon until evening.

Furthermore, men and women mentioned the importance of roots and tubers during calamities and disasters as a survival crops as they are less affected by typhoons and drought, thus representing vital food sources during these times. The men group in MO

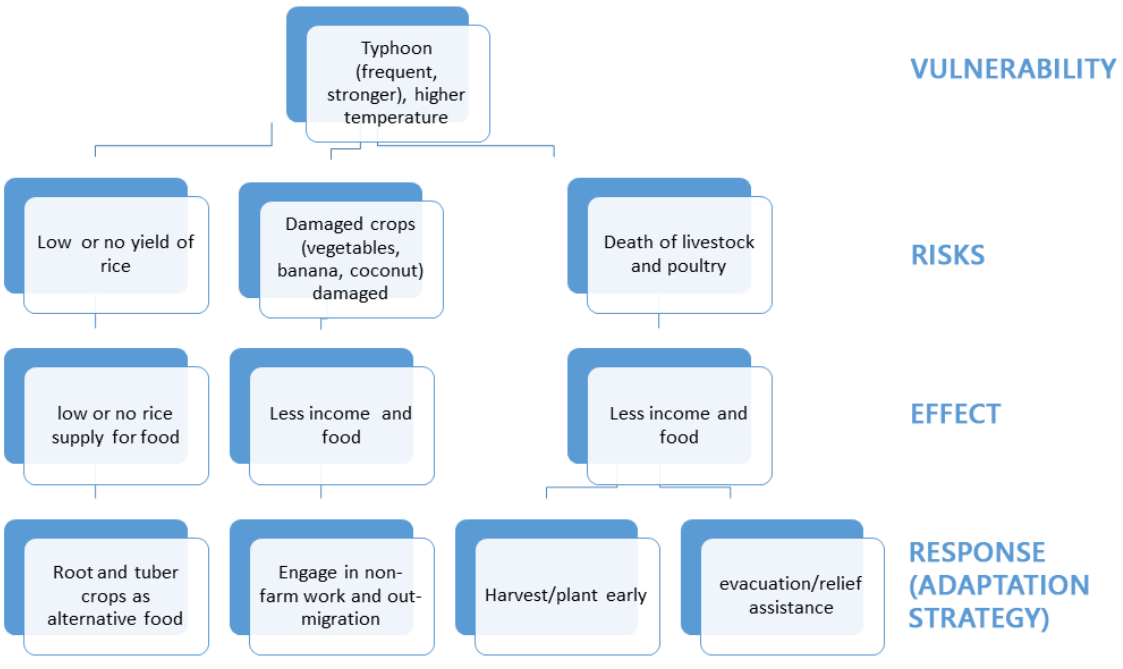


Figure 5.8. Problem tree of climate change risk and adaptation strategies of men and women in market-oriented and subsistence-oriented communities

communities mentioned that they prefer the cassava variety, "*Kalibre*" because it matures in three months, similar to some sweetpotato varieties. It can also be easily harvested especially in times of typhoon and drought. They also recognized that root and tuber crops are alternative crops when rice is not available, thus they make sure that these crops are planted in their farms. As reported by women's group in subsistence and market-oriented communities: "*Root and tuber crops play an important role in times of typhoons. They are survival crops to overcome hunger (("pantawid gutom"), as they are unlikely to be damaged by typhoons and calamities. It is also easier to plant and maintain without much management. They have also nutritive value which is good for our health, especially for people with diabetes.*"

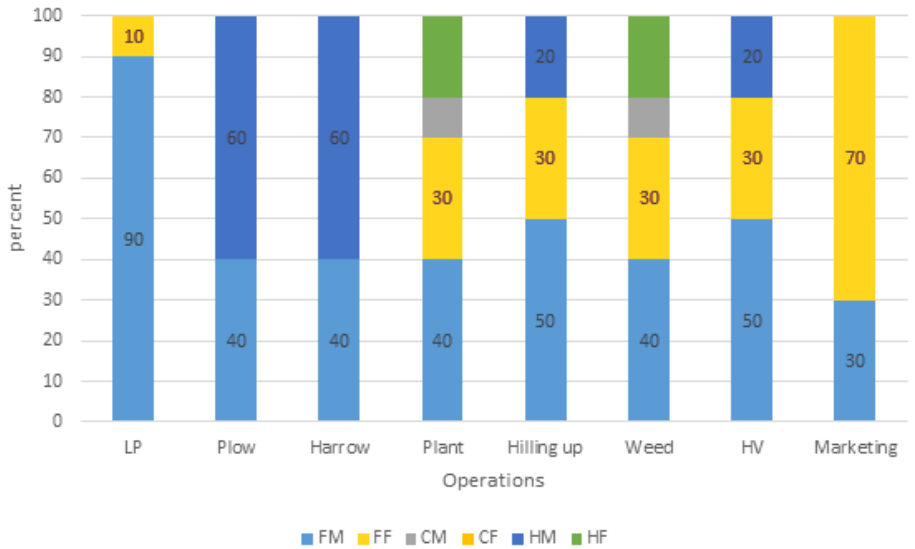
While the men in SO households mentioned that:

"*Thirty years ago, the giant taro were abundantly growing in marginal wet lands and used for food. Now, due to the conversion of these lands to rice paddies, the area of giant taro declined, thus affecting food and source of income of farming households*".

Men and women in SO households also shared the change in positive perception on root and tuber crops. They say that thirty years ago, RTC were regarded as a "poor man's crop". Only the poor substitute RTCs when rice is not available. However, nowadays, more people eat RTCs for better nutrition. .

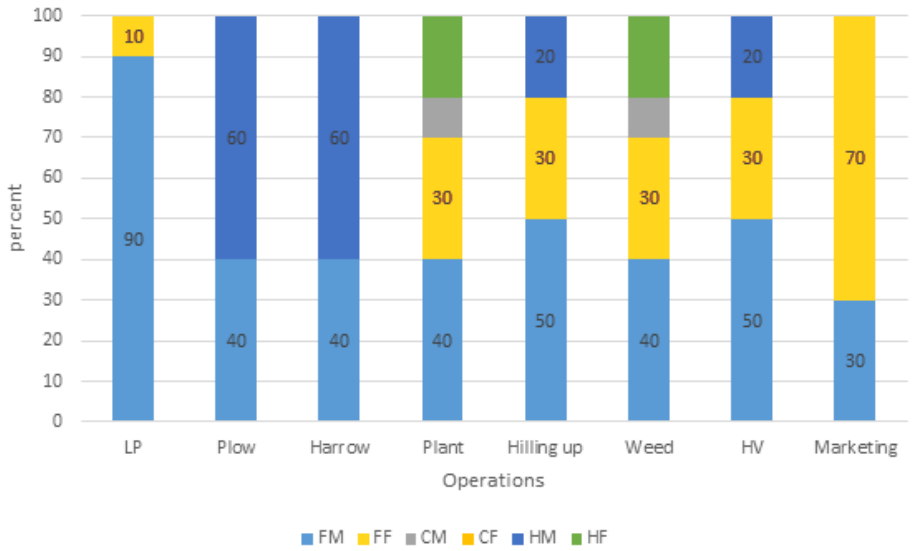
Gender roles and division of labor in root and tuber crops production

The gender roles and division of labor by types of rootcrop, by crop operation and degree of market orientation (SO or MO) will be discussed in this section.



Legend: FM = Male; FF = Female; CM = Children Male; CF = Children Female; HM = Hired Male; HF = Hired Female; LP= Land preparation; HV = Harvesting

Figure 5.9a. Percentage labor contribution, taro production, marketed-oriented communities

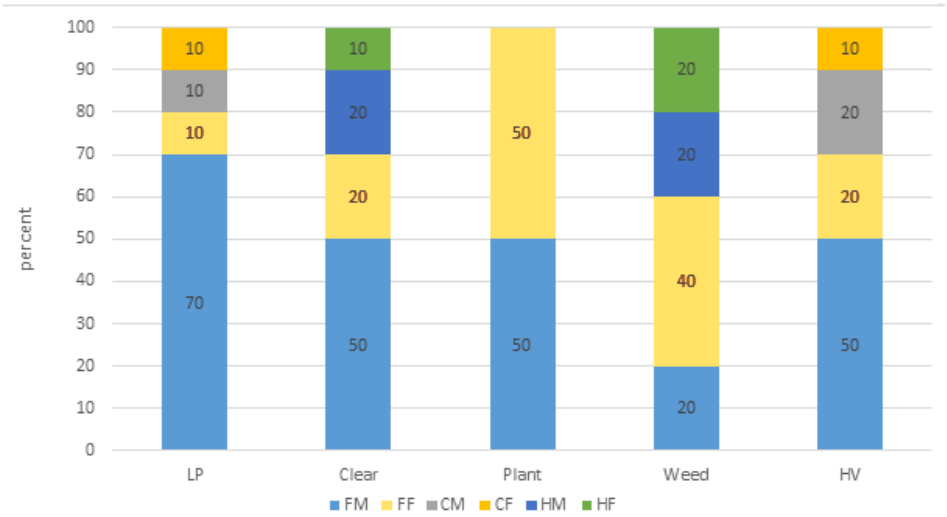


Legend: FM = Male; FF = Female; CM = Children Male; CF = Children Female; HM = Hired Male; HF = Hired Female; LP= Land preparation; HV = Harvesting

Figure 5.9b. Percentage labor contribution in taro production, market-oriented

Taro production. Taro (*Colocasia esculenta*), called gabi in Leyte, is one of the most important food crops in EV. Figures 5.9a and 5.9b show that in taro production, labor requirements which require physical strength such as for land preparation, plowing and harrowing are met by male family and male hired workers. However, women participate in operations such as planting, hilling up, weeding, and harvesting. Marketing is done predominantly by female family members (70%) rather than male family members (30%). There is a slight difference in the labor participation of men and women across the MO and SO households. These findings are similar to those of Ponce and Reoma (1985). They studied the levels of participation and work involvement of family members in small-scale taro production and processing in two provinces of Northern Leyte and Southern Leyte. Their findings show that the husband/ male household head are the regular workers, except in selling the produce, which is done by wives/ female household heads. The wives help their husbands in most of the tasks. The male children are more involved in taro production than other household members. The female children never assist in any of the taro production activities.

Sweetpotato production. A different pattern can be seen in the labor participation in different sources of labor by gender in SO sweetpotato production. As shown in Figures 5.9c and 5.9d, all family members help in land preparation. However, in land clearing, hired females also participate along with family male and family female members. Female children do not participate in land clearing. Both male and female family members participate in planting. Weeding is predominantly done by the family female members with the assistance of male family members, hired male and hired female workers. Harvesting is mainly a family task with the help of male hired workers (Figure 5.9c).

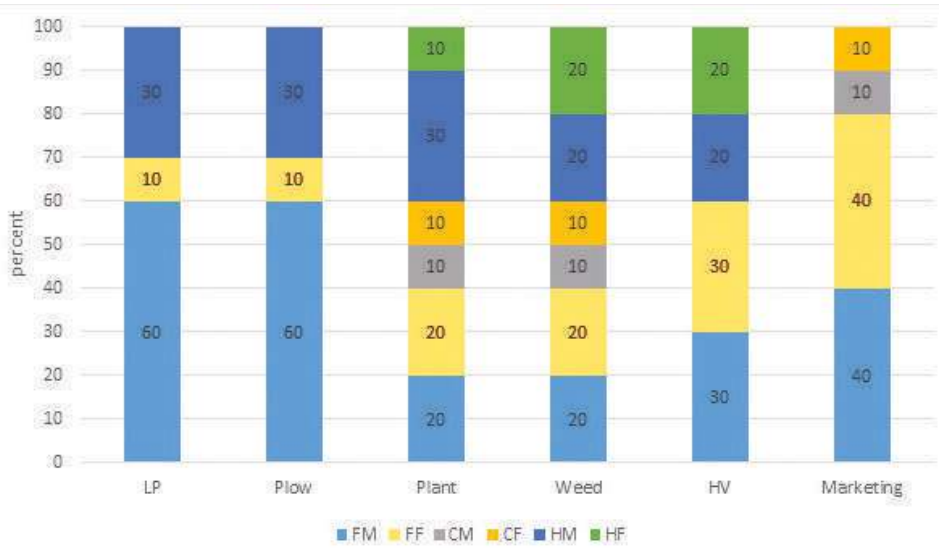


Legend: FM = Male; FF = Female; CM = Children Male; CF = Children Female; HM = Hired Male; HF = Hired Female; LP= Land preparation; Clear = Clearing; Plant = Planting, HV = Harvesting

Figure 5.9c. Percentage labor contribution in sweetpotato production, subsistence-oriented, men's group

In the MO households, family female members also work with family men and hired men in men land preparation and plowing. In planting and weeding sweetpotato, almost all (family male, family female, male and female children as well as hired workers (male and female) help in completing production operations. Harvesting is also mainly done by male family members (father and sons) and male hired workers with the participation of female family members. In the MO, sweetpotato production (Figure 5.9d), despite women's lower labor participation in field activities in rice, rootcrop and livestock production, compared with men, their roles as unpaid family workers and income earners are often undervalued.

Gender differences in decision-making. Because increased productivity is related to management decisions, it is important to understand who is doing the work but also who is making the decisions. Direct involvement in an activity gives a family member decision making authority, related to that activity. Both MHHs and FHHs during the FGDs mentioned that husbands are more responsible for decisions for farming activities while wives are empowered in making decisions on household matters. In both SO and MO communities, women are mainly responsible for marketing rootcrop products. Thus they have the responsibility in deciding on the sale of root and tuber crops and hence, retain the money they earn from the sale. In other cases, the common practice is for men to sell the produce and collect the money and then hand it over to the women to pay for household expenses. Women also take on more responsibility for participating in community activities and allocate money for social obligations.



Legend: FM = Male; FF = Female; CM = Children Male; CF = Children Female; HM = Hired Male; HF = Hired Female; LP= Land preparation; Clear = Clearing; Plant = Planting, HV = Harvesting

Figure 5.9d. Percentage labor contributions in sweetpotato production, market-oriented, women's group

Summary and conclusions

Root and tuber crops are important components of mixed cropping farming system of MO and SO households in EV. Crops such as sweetpotato, taro, cassava, yam, giant taro, cocoyam and giant swamp taro are intercropped with rice, corn, coconut, banana and vegetables. Root and tuber crops contribute not only to food consumption but to income as well. Root and tuber crops are important part of the food and survival strategies of farming households in EV. Respondents regarded root and tuber crops as "survival crops" especially in times of vulnerabilities such as typhoons, droughts, and others, not only as a food in time of disasters but as important resilient crop for farming. Root and tuber crops are now considered an important food and the negative perceptions on root and tuber crops have changed - it is no longer seen as a "poor man's crop".

Findings from this study confirmed that weather changes have occurred in recent years which affect farming activities. Vulnerabilities include more frequent and stronger typhoons (destroying crops), higher temperature (making it difficult for farmers to work in the fields during day time), drought (reducing or compromising yields) and flooding brought by heavy rains and typhoons. Women respondents also mentioned more prevalent disease occurrence. These similar perceptions are based on the active involvement of men and women (children in some operations) in almost all operations in root and tuber crop production. While men are mainly responsible for land preparation, harrowing and hilling up, female family members also help to some extent in field activities. More women are engaged in planting, weeding, harvesting and marketing. Among MO communities, women play greater roles in marketing. Women are

mainly responsible for keeping the money as well as the expenditures for the household, children's education, transportation, and food while men take care of large expenditures such as purchasing land, animals, machinery, major farm inputs, etc.

Research conducted by CGIAR Research Programme on Climate Change, Agriculture, and Food Security in South-East Asia (CCAFS-SEA) found that women and men farmers in developing countries have different vulnerabilities and capacities to deal with the impact of climate change on agriculture (Huyer et al 2015; Gonda 2016). In this study, men and women's adaptive strategies were also found to differ. Husbands and male children go to the cities to work as construction workers, while wives stay behind to look after the farm and household. Adult female children also work as domestic helpers outside to help their parents. An adaptive strategy done by men farmers during typhoons is to adjust their planting and harvesting to lessen damage. Women mentioned that they also prepare food and medicine and evacuate in times of stronger typhoons. As temperature becomes unbearable in the fields during day time, men and women respondents mentioned that they adjust working time in the fields. For example, they work very early in the morning to avoid the strong heat, go home and go back to their fields in the afternoon until evening.

Key R&D recommendations to support men and women

Both men and women are important agents of change in response to climate-induced change. Engaging women and men in technology design and management encourages changes in gender relations and facilitates the generation and adoption of agricultural innovations which can contribute to enhanced food security and income at community level. Additionally, women's as well as men's resilience strategies and local traditional knowledge are valuable resources for recovery and adaptation, thus it is important to support them. Below are key R&D recommendations for the Local Government Units of the Department of Agriculture in support of women and men farmers in root and tuber crop agriculture:

1) Test high-yielding root crops; to introduce resistant cassava and sweetpotato varieties through participatory action research with both men and women farmers
2) Encourage women pig raisers to utilize other parts of root and tuber crops as local feed to reduce expenses for commercial feeds
3) Support men and women engaged in rootcrop and tuber farmers in terms of providing them access to new knowledge and technology, development support services, and substantial help to link them to markets
4) To develop processing technologies for root and tuber crops, e.g., sweetpotato which will enable women among subsistence communities to increase their incomes from rootcrop production, and
5) Provide women and men with knowledge and skills in new methods of multiplication of sweetpotato planting materials.

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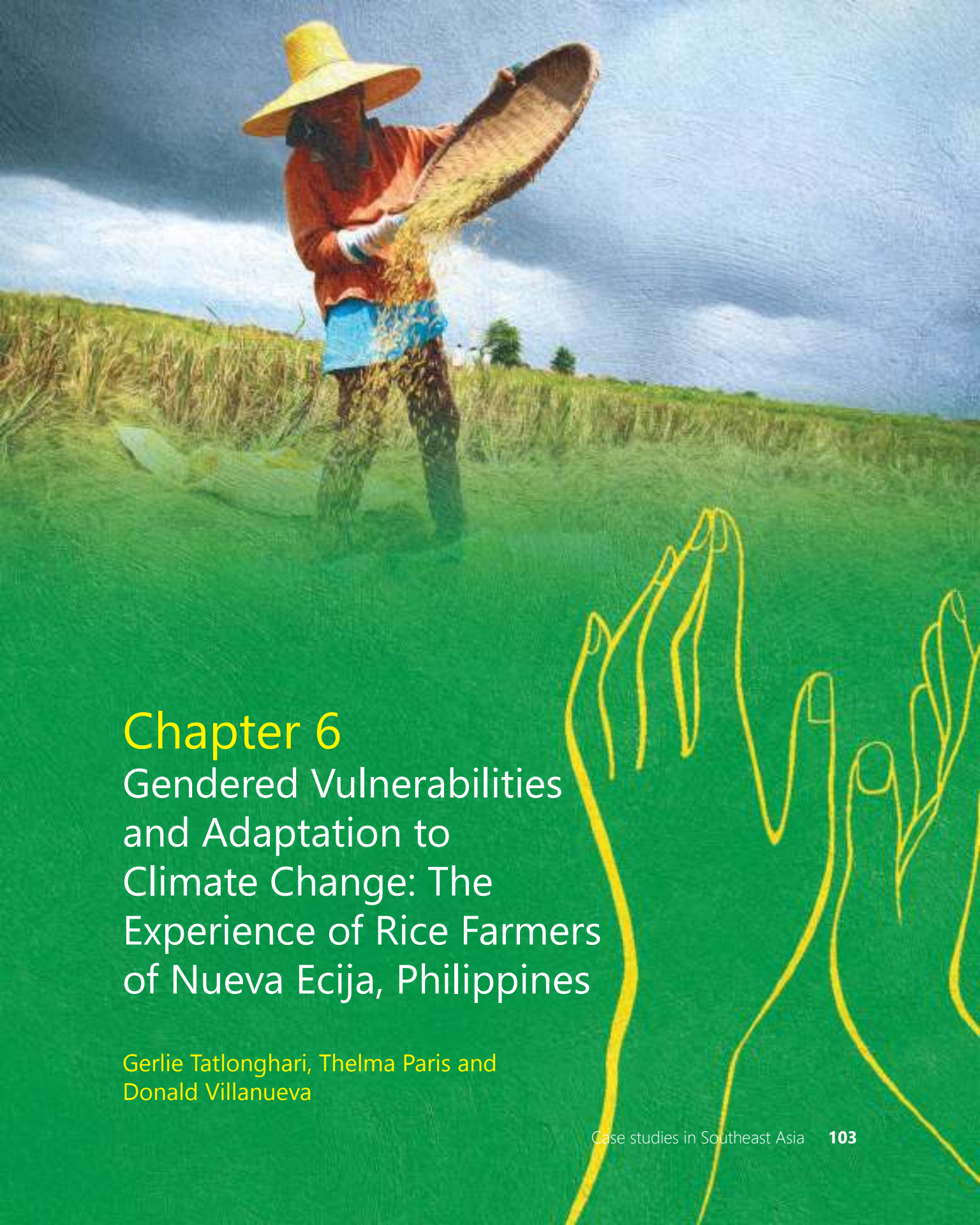

Chapter 6
Gendered Vulnerabilities and Adaptation to Climate Change: The Experience of Rice Farmers of Nueva Ecija, Philippines

Gerlie Tatlonghari, Thelma Paris and Donald Villanueva

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Introduction

In the recent IPCC (2012) study, it was shown that climate change is leading to changes in extreme weather and climate events. Since the 1950s, extreme hot days and heavy precipitation have been observed and have become more common. Climate change posts a bigger threat to a developing and disaster-prone countries like the Philippines. According to the 2011 World Risk Report, the Philippines ranks third highest disaster risk area. This finding is consistent with the study of World Bank in 2010, ranking the Philippines in the top 10 countries worldwide at risk for both climate change and disasters (Birkman et al. 2011). According to the World Bank (2010) study, during the last decade, the country experienced the highest recorded rainfall and the strongest typhoons. Weather-related disasters accounted for 98% of lives affected and 78% of lives lost between 2000 and 2008. Natural disasters already account for more than 0.5 % of gross domestic product (GDP) annually, and climate change is expected to increase these losses further. It is also expected that climate variability could lead to an increase in the number, severity, and unpredictability of events.

Agriculture is one of the vulnerable sectors to climate change. In the Philippines, agriculture plays a major role in the economy. It is the main generating income and employment sector in rural areas of the country. A large part of the Philippine agriculture operates at subsistence level and is quite vulnerable to weather changes (IFAD 2012), particularly the rice farming sector. For instance, from 1970-1990, 82.4% of the total Philippine rice losses were attributed to typhoons, floods and drought (Lansigan et al. 2000). The loss of livelihood does not only mean economic losses; this also has various social implications. Moreover, adverse impacts do not fall proportionately among men and women due to the underlying causes of vulnerability. Indeed, several studies around the world showed that the consequences of changing climate are worse for women (Terry 2009, Diametriades and Esplen 2010, Alston 2007, 2010, Lambrou and Nelson 2010).

One of the pressing social conditions often neglected in most societies is the existing gender inequalities. It is one of the main causes of differential vulnerabilities among men and women, where women are the disadvantaged and vulnerable group. Globally, women have less access than men to resources such as land, credit, agricultural inputs, decision-making structures, technology, training and extension services that could help them to develop their adaptive capacity to avoid or minimize the adverse effects of extreme weather events (Denton 2004). However, these resources are hard to access and in some instances are institutionally unavailable to women (Osman-Elasha 2009). For instance, the customary law for some countries does not

allow women to share land property rights with their husbands or, in some instances, female heads of household are excluded from land entitlement schemes (Demetriades and Esplen 2008, FAO 2010). Because of this restriction, they cannot provide the collateral required for credit, and so limit their access to seed, new technology and information. This limited access to resources could hinder their adaptive measures (Denton 2004). Moreover, two-thirds of the one billion illiterate in the world are women and girls which limits their intellectual capacity to adapt (Crooks 2009, UNESCO 2007). Having a good understanding of their situation could help women to better adapt, but their limited education caused them to experience more hardship, be voiceless and remain in a cycle of poverty. Women are also likely to be adversely affected by damage to economic livelihoods because basic survival strategies such as securing water, food and wood for heating purposes often fall on women, representing an extra burden on top of caring for and nurturing the family (Enarson 2000).

In Philippine society, women are also vulnerable and are the disadvantaged group. This is due to their traditional roles in the domestic spheres such as child bearing and rearing, household chores and responsibilities. Moreover, given the economic condition in the country, they are now also expected to contribute to household income. They contribute to economic production in the informal sector, normally labour-intensive tasks with low wages. These tasks in additional to tasks given to them in the community, normally burden women's everyday routine. Because of these gendered roles and their weaker socio-economic status, the impacts of weather-related disaster will be more severe on women than men (Peralta 2009).

On the other hand, men have also specific vulnerabilities that can affect their health and safety that are also linked to ascribed gender roles, traditional norms and values and how the ideas of masculinity are constructed. Aguilar (2009) pointed that men are usually exposed to risky situations and even die since they are expected to take on risky tasks due to the belief that they are the 'stronger sex' that needs to take on heroic actions. For instance, immediate deaths were recorded among men when Hurricane Mitch struck Central America, due to the fact that they are engaged in outdoor activities and they took fewer precautions when facing risks (Bradshaw 2004). This is further confirmed by the study of Neumayer and Plumper (2007) stating that on average, more men are engaged in outdoor work and leisure activities during disaster events and are more reckless in their behavior towards risk.

In response to the threat posed by climate change, adaptation is viewed as urgent in the Philippines. Adaptation is understood as a modification of behaviour that can either alleviate adverse impacts or open new opportunities in response to observed or expected changes in climate and associated extreme weather events (Adger et al. 2004, 2007; Nielsen and Reenberg 2010). Adaptation strategies can be linked to existing gender roles and relations and are likely to contribute to the increased vulnerability of women to increasing flood events.

The concept of resilience is a starting point to look at how communities with long experiences of climate hazards adapt to their changing environment. Resilience is defined as a form of adaptation that seeks to secure the continuation of desired systems that can absorb disturbance through enabling alteration in institutional form (Nelson and Stathers 2009, Pelling 2011). Resilience of a community is often facilitated through social learning and self-organization. This often happens to communities where changes in climate challenge the existing norms and relations. Some studies showed that because of some adaptation strategies undertaken by women, there were some alteration in the existing gender roles that caused a shift in current power relation within the household and community (Enarson 2000, Lambrou and Nelson 2010, Sultana 2010).

Given that adaptation strategies can either moderate or aggravate the gendered vulnerability and impacts of changing climate, it is a challenge to recognize and explain how gendered adaptation practices are produced and reinforced. Hence, a case study was conducted in two villages of the municipality of San Antonio, Nueva Ecija, Philippines. The study aims to contribute to the limited existing knowledge by assessing the adaptation strategies of men and women in rice farming communities when faced with flood events. Mainly, the study attempted to explain how gender adaptation is informed by the gender identity and practices. It also discussed how agency is possible in times of crisis and whether it can be an opportunity to challenge the status quo and examine how to lessen women's vulnerability, in particular, during extreme weather events.

Methodology

Site selection

Nueva Ecija is considered as the rice granary of the Philippines. However, because most of the rice farming is located at its low lying areas and it is consistently visited by typhoons, the province is considered as the second most flood-prone province in the Philippines (Manzanilla et al. 2008). One of the most affected municipalities of Nueva Ecija is San Antonio. During the rainy season, the municipality is characterized as the catch basin of water coming from neighboring provinces. Consequently, it is very much susceptible to flooding from intense rainfall and typhoons. Thus, San Antonio was chosen as site of the study. Two villages were selected for the case study, the villages of Papaya and Cama Juan. Severe flooding has become worse in recent years due to frequent typhoons which has devastated rice farming in the villages, particularly in September 2011 when the villages were heavily devastated by typhoon *Pedring*.

Data collection

The study used both qualitative and quantitative approaches to know how gendered adaptations were shaped and produced in rice farming communities in the Philippines by using gender as an analytical category. There were two sets of data collection activities conducted for each approach. For the qualitative analysis,

activities such as secondary data collection, key informant interviews, PRA activities, focus group discussions (FGDs) (separate men and women) and up to 20 in-depth interviews with men and women were conducted. Combined results from the initial primary and secondary data collections were used to design a questionnaire for a structured survey conducted with 402 males and females coming from the same households from two villages as part of the quantitative analysis. This was conducted to compare and analyze the household-level decision-making processes, impacts and management mechanisms done by men and women. The interview enabled the researchers to further compare men and women's vulnerabilities, capacities and perspectives about climate change.

Data analysis

Statistical tests such as chi-square test of independence, student's paired t-test and Wilcoxon signed-rank test were used to test for significant differences among chosen variables. Chi-squared test of independence was used to asses if there is a significant association between two categorical variables. Student's paired t-test was applied to determine if there are significant differences on the means of numeric variables between normal year and flood year. To examine whether there are significant differences in the perceptions between principal males and principal females, which are in likert scale (ordinal variable), Wilcoxon signed-rank test was used.

Results

Climate change risks

Changing climate is now a reality in the ground as observed by men and women farmers in the studied areas. According to farmers, flooding depends on the number of typhoons and rainfall intensity. They have emphasized that typhoons and flooding have increased in recent years. These observations are consistent with the recorded flooding events and typhoons for the last 30 years. Within a ten-year period, flooding increased by 200%, while storm events increased by 42% (14-42) from the 1970-2010 (See Figure 6.1).

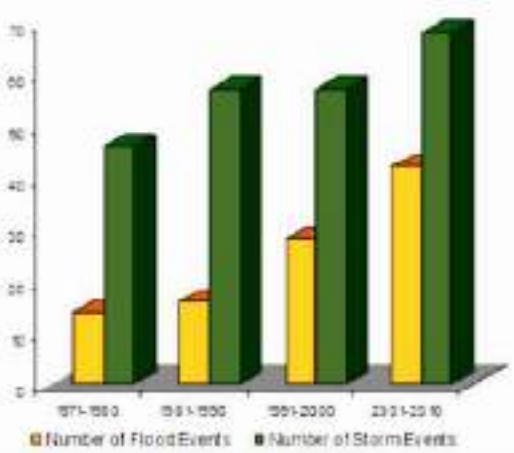

Figure 6.1. Number of floods and typhoon events in the Philippines, 1971-2010.

In San Antonio, Nueva Ecija in particular, time series records from 1951-2005 showed that 50% of the rainfall was brought about by tropical cyclones that passed through the province (Manzanilla et al. 2008). This was also observed by both male and female farmers who said there were changes in the

Table 6.1. Observed changes on climate variability and flood occurrence for the last 20 years in two rice farming villages in Nueva Ecija, Philippines by gender, 2011

Change	Percent Reporting Change (%)		X^2 test
	Male	Female	
	(n=201)	(n=201)	p-value
Climate variability			
Temperature	23	20	0.683
Rainfall	53	53	
Extreme weather events	24	27	
Flood occurrence			
Frequency of flooding	16	16	0.080 *
Intensity of flooding	58	68	
Duration of flooding	25	15	
Other observed changes	1	1	
* Significant at 10%			

rainfall patterns (53%) and extreme weather events (24-27%) (Table 6.1). Generally, men and women have the same observation about climate change; however there is a significant difference in their perception about flooding occurrence. More women perceived the risk and threat of the intensity of flooding, while more men observed the longer duration of flooding that can greatly devastate their farming activities.

Impacts of climate change on rice production

The rice productivity of farmers is directly affected by extreme flooding which would have adverse impacts on farming households' income and food security. Since most of the households are into subsistence farming, crop losses would mean hunger for some of the households who just rely on their harvest for food. As lamented by one of the female farmers:

"All the families are very sad because we don't have anything to eat. You are fortunate if you have stock food in your house but if you don't have, you are pitiful. You just have to survive by drinking warm water" (woman farmer #2 in FGD).

This heartbreaking situation, commonly happens during the wet season, when flooding occurs for three to five times, depending on the typhoon that passed through the village. Flooding in 2011 had more devastating effects on farmers of Papaya village as they did not just incur crop losses but also had negative income, which means, they needed to acquire loans or opt to have other sources of income to augment their losses from farming (Table 6.2). Most of them did not harvest anything and their crops were buried in mud. One male farmer narrated his experience during that flooding:

"*I just asked myself why such losses happened to us. It was just so untimely that the flood came in October*

Table 6.2. Average rice production and net rice income, Nueva Ecija, Philippines, 2011

Parameter	Normal year		Flood year		t-test	
	Wet season	Dry season	Wet season	Dry season	Wet season	Dry season
Papaya						
Area (ha)	2.13	2.74	2.16	2.72	0.620	0.832
Production (kg)	6,015	13,340	1,376	13,524	0.000 ***	0.612
Yield (t/ha)	2.97	4.80	0.69	5.15	0.000 ***	0.240
Income (Php)	21,543	63,101	-5,021	63,399	0.000 ***	0.935
Cama Juan						
Area (ha)	1.74	2.45	1.85	2.43	0.079 *	0.622
Production (kg)	5,307	13,937	2,492	13,568	0.000 ***	0.472
Yield (t/ha)	2.95	5.77	1.35	5.58	0.000 ***	0.152
Income (Php)	18,306	81,171	1,637	78,283	0.000 ***	0.508
All						
Area (ha)	1.93	2.59	2.00	2.58	0.110	0.678
Production (kg)	5,659	13,640	1,937	13,546	0.000 ***	0.766
Yield (t/ha)	2.96	5.28	1.02	5.36	0.000 ***	0.641
Income (Php)	19,916	72,181	-1,676	70,878	0.000 ***	0.647

**Significant at 10%, **significant at 5%, ***significant at 10%*

when our crops were in the flowering stage, so we really incurred crop loss. The lost is more of a personal thing to me. I already lost the harvest that I was hoping for, it's already gone" (male farmer #6).

However, the income sources of farming households do not change, during a normal year and a flooding year; rice farming remains the main source of income of households during normal and flooding year (Figure 6.2). Although farmers incurred many losses during flooding periods, they can have very high income during the dry season (Table 6.2). This also explains why most farmers are still hopeful about their farming. They still anticipate that they can recover from their losses once they have abundant harvest in the next dry season. This has been pointed out by a couple of farmers during an in-depth interview:

"If you incurred losses and you stop farming you will not be able to recover from your losses. Just like now, our son resows some seedlings (after the flood subsided). Those who quit never win. If you quit there's nothing left for you" (husband farmer #3).

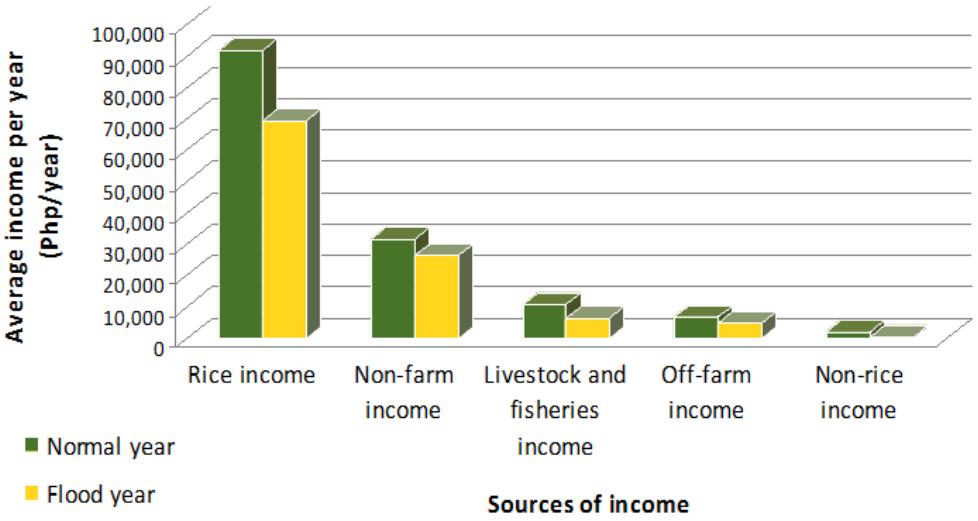

Figure 6.2. Income sources of farming households during normal and flood year, Nueva Ecija, Philippines, 2011

It is also important to note that income from other sources also decreased during flooding period. Since the studied villages are rice farming communities, other economic activities such as off-farm and non-farm labor and businesses are related to farming. Moreover, because flooding is a disaster in the community, all other source of livelihoods such as livestock, fishing and other non-rice production were also devastated by flooding. Consequently, food sources and health are affected by flooding. Both men and women reported that there was a decrease in basic food such as meat, fish, rice and drinking water for consumption during severe flooding. Most of them mentioned rice, the staple food of households, decreased during those difficult times. Also, more women reported that human health worsens during flooding (Table 6.3). Health problems are aggravated during flooding, which affects young children and women. Extreme weather events often create conditions conducive to outbreaks of infectious diseases, athlete's foot and common sickness such as colds, cough and fever that are normally brought about by changes in weather.

Table 6.3. Average rice production and net rice income, Nueva Ecija, Philippines, 2011

Impacts	Men	Women
Meat for consumption	30	33
Fish for consumption	26	19
Availability of drinking water	20	24
Availability of rice for consumption	52	57
Human health	67	74

In general, both men and women agreed that flooding caused low yields (41%), increased indebtedness among households (28%) and for some, a total crop loss (24%). Although there was a decrease in food available for consumption among the households, only

Table 6.4. Men and women's perception of the most important impacts of severe flooding to regular agricultural activities, Nueva Ecija, Philippines, 2011

Impact	Percent change (%)			X^2 test
	Male	Female	Both sexes	
Low yields	40	41	41	1.225 ns
Food insecurity	4	4	4	
Increase indebtedness	26	30	28	
Crop loss	25	22	24	
Others	3	2	3	

4% reported that there was food insecurity during flooding periods (Table 6.4).

The culture of cooperation and sharing food and resources during a crisis is strong among people in the community. Women in the FGDs shared their experiences during these periods:

"We are not like other people that don't mind each other. In our barangay, we have unity. We are like brothers and sisters. When we are about to eat, the rest (of our neighbors) will eat, even if our food is only dried fish, we share and eat together. We are like this for a week" (woman in group discussion).

Gendered vulnerability to severe flooding

As shown in the previous section, flooding can have a devastating impact on rice farming households. However, these impacts are not experienced by individuals in the same manner because of the differences in vulnerabilities among different socio-economic groups such as among men and women. The result of the study confirmed that vulnerability to severe flooding is gendered due to differences in access and control over resources, found to be the underlying cause of vulnerabilities. Although both men and women have limited access and control over resources, the situation is worse for women. As shown in Table 6.5, few women (2%) have land ownership. Land is considered the most important asset of the farmers and having access and control to it means having more power, status and wealth in the rice farming communities. Since only few women own their farm lands, their decision about farming is limited. Only 1% of women can decide about the varieties to grow. Moreover, a 'farmer' status is designated to men, thus extension services is still biased towards men. Even some women interviewed do not consider themselves as farmers, although they also do almost all the farm work. A widow farmer shared her experience about farming:

"When my husband was still alive, I used to help him in every farm work, it was only operating hand tractor that I did not do... and my body had some rashes already. It was just so itchy but I just endured it since I'm a farmer's wife" (female farmer #8).

Most of the women consider themselves as helpers and supporters of their husband in

Table 6.5. Access and control over resources of men and women in two rice farming villages in Nueva Ecija, Philippines during flooding period, 2011

Descriptors	Male (n=201)	Female (n=201)
Average years in school	7	7
Average years in farming	23	11
Land ownership (%)	19	2
Who decides on:		
What varieties to grow (%)	76	1
Livestock management (%)	54	39
Who has decent rural employment		
Off-farm labor (%)	49	25
Non-farm labor (%)	11	11
Who has accessed extension services (%)	26	18
Who acquired and repaid loans (%)	41	49
Who received support (e.g., relief goods) (%)	87	91

rice farming. Because of the limited access to capital and continuous losses in rice production, when severe flooding occurs, men relied on women to acquire loans through informal sectors and get support from relatives and neighbors. More women are getting support particularly from relief rations as some men are too shy to receive support from others.

Given that women have limited access and control over resources, they are more vulnerable to climate variability than men. Nevertheless, their vulnerabilities are not because of their physical capacities but because of women's positions and identities that made them socially vulnerable.

Gendered adaptation to severe flooding

Differences in men and women's access and control over resources and gender roles not only create specific gendered vulnerabilities and risks but also generate gender-specific capacities that influenced their adaptation strategies to climate change. Results of the study showed that men still dominate in taking actions in response to severe flooding (Table 6.6). In term of the changes done by men and women in their farming activities, men have more control in changing rice variety (63%), adjust planting activities (38%) and cultivate smaller rice area during flooding period (26%) since more males owned and controlled the land. Men's control over land also implied they have also the capacity to acquire loans (67%) compared to women (58%).

Moreover, adhering to gender roles is observed in terms of the changes done in their farming activities. More males responded that they made changes in their planting activities such as resowing (44%), replanting (42%) and building higher dikes around the plots (54%) in comparison to their female counterparts.

Table 6.6. Adaptation strategies done by male and female farmers in response to severe flood, Nueva Ecija, Philippines, 2011

Adaptation strategies	Percent response	
	Male	Female
Change rice variety	63	52
Adjust planting activities	38	26
Cultivate smaller area than usual	26	15
Resow when crops damaged	44	35
Replant when crops damaged	42	32
Build higher dikes around the rice plots	54	41
Look for wage labor	25	22
Go fishing for food and/or extra income	37	20
Acquire loan	67	58
G support from relatives/friends	17	23
Secure all valuable items in elevated position	67	62
Spend less	79	78
Store food and other basic necessities	81	74

The differences in their responses can be attributed to ascribed gender roles of males as the 'farmers' and females as the 'helpers' or 'farmer's wives'. Men are expected to take more responsibility in changing their farming practices as 'farmers'. Men also predominantly decide about the security of their households. However their adaptive actions within the households were done hand-in-hand with women. A high percentage of men and women mentioned that they secure all valuable items in elevated positions, store food and other basic necessities and spend less during flooding periods.

Women consider family and friends networks as their main source of support capacity during flooding. However, only 23% of them were able to get support from their relatives and friends since most of their friends and relatives were also affected by the floods. Nevertheless, it is important to note that more women than men took support from their relatives and friends. Most of these support are in the form of monetary and in kind help like food and shelter during flooding. Most of the women took loans from their social networks due to lack of assets to collaterals that can be used in taking loans from the formal sector. One female farmer narrated how she acquired and repaid loans to the people she knew in the village:

"There are farming expenses that you can delay the payment, so what I do is just to pay for the wage of the machine operator first. Then I will talk to the owner of the machine that I will pay him next time, then for other expenses I will pay during harvest season. You can take loans from people here who have "taling-giik" arrangement, that is in return for the loan that you took from them, you are bound with them to rent their thresher during harvest season." (female farmer #3).

Table 6.7. Men and women's most significant perception about the impact of severe flooding to their lives, Nueva Ecija, Philippines, 2011 (in percent)

Impacts	Percent response	
	Male	Female
Increased health problems	5	11
Increased violence	1	1
Increased disagreements among family members	1	2
Increased pressure to provide food for the family	27	10
Decreased quality of food	1	1
Decreased quantity of food	3	5
Pressure to hire labor and machines	3	3
Pressure to acquire loans	34	20
More stressed/anxious	7	18
More alcohol intake	0	5
Physical isolation	2	18
Increased workload	6	6
Increased pressure to seek other income	10	11
Total	100	100

On the other hand, men and women learned to negotiate their gender roles. Men learned to assume reproductive roles while women were compelled to spend more time outside their homes to seek income from non-farm work. Thus, farming households were deemed resilient during flooding and it resulted to alternation of gender roles

"I also have to bear the responsibility of repaying my loan and to find other sources of income, aside from farm income. So I told myself, I need to have an additional income just to pass through this" (woman farmer leader).

Due to lack of income opportunities in the villages, some farmers took their chances to look for jobs in other places. Even women had to look for jobs and in some instances have to go abroad, which some familes find difficult to adjust to the situation. A male farmer shared their experience:

"There's no other choice but to let her work outside the country for us to start a new life. We don't have any resources. Now, she's sending P8,000 to P10,000 per month". It's difficult and challenging, I need to take on a woman's role. Now, I help my wife by swine raising" (male farmer #1).

Impacts of severe flooding on men and women's lives

Traditional gender roles and relations resulted to differential impacts of flooding. Most of these impacts are being experienced by both men and women but in varying degrees. Table 6.7 shows the details of the impacts of severe flooding. In summary, the perceived impacts of severe flooding on men include

pressure to acquire loan (34%), increased pressure to provide food for the family (27%) and increased pressure to seek other income sources (10%). On the other hand, the perceived impacts of severe flooding on women are increased pressure to acquire loans (20%), they become more stressed/anxious (18%) and increased work load (18%).

One of the major impacts of severe flooding is the pressure to acquire loans because of their losses due to flooding. Both men and women felt the burden of acquiring loan just to have capital for the next planting season. Because men are deemed as the family provider, men felt the pressure to provide food for the family (27%) but because of the production losses due to flooding, they are also pressured to seek other sources of income aside from rice farming. Meanwhile, women mentioned that they became more stressed and anxious (18%) during severe flooding. This is due to their increased concern about the safety of their family during flooding. Moreover, they become more anxious when their rice fields have been destroyed. Crop losses would mean that the family would not have any income and food to eat. More women felt that their workload has increased due to severe flooding. On top of women's daily household chores, they bear the burden of caring for the sick and elderly. Increased pressure to take on extra off-farm and non-farm labour after severe flooding, added to the workload of women.

Farmer respondents were also asked about their perceptions about the impact of severe flooding to themselves and their partners. Using Wilcoxon-signed rank test (see Appendix Table 1 and 2), their responses reveal that there are significant differences in perceptions among men and women in terms of the impacts of severe flooding in the lives of men in terms of food intake, pressure to acquire loans and increased women's workload. Firstly, for food intake, more men felt that their food intake has decreased because of lesser food available during flooding period. This might be due to the fact that more men need to eat more food as they exert more physical effort when doing farm labor while women perceived their food is enough as long as there is food to fill in their stomachs.

In terms of pressure to acquire loans, men and women differ in their perceptions about the effect of acquiring loans to men's lives. Men felt that they are more pressured to acquire loans which was less perceived by women. Although both men and women are obliged to take some loans for their farming expenses, the repayment of the loans are more of a burden to men since they are the main income earner of the family and the owner of the land. They are the ones who took the risk of using the land as collateral when acquiring loans from banks and other lending institutions.

In regards to increased women's workload, a significant difference in perception among men and women about women's workload was observed. More women felt that their workload has increased due to severe flooding. They had to do more in the field and at the same time do most of the household chores and responsibilities. Men perceived that women just stayed in the

house while men do more work in the fields. However, flooding brought about adverse effects to the welfare of the household such as increased health problems, food shortage and loss of livelihoods. Women needed to respond to these problems particularly in the reproductive sphere.

Conclusions

Differences in climate change perceptions, vulnerabilities and adaptation to climate change of men and women resulted to differences in impacts of climate change. Although both of them faced the same extreme weather event, the lived experiences of women are different from men. As shown by the study, more women than men perceived the risk and threat of severe flooding; consequently, they were more anxious about the safety of their family and the long-term effects of flooding on their livelihood and the welfare of the household. Both men and women are affected by losses brought about by severe flooding. However, women became more vulnerable than men because of the unequal access and control over resources that can be used to reduce the impact of severe weather events. Consequently, their adaptation responses are limited in comparison with men. Men dominantly dictate what to do in their farming activities and changes that can be done in their rice farms. However, women, like men are capable of taking some actions in response to climate change. They learned to negotiate with men their gender roles. This resulted to increased resilience among farming households.

Women's assets largely determine how they will be affected by and respond to the impacts of climate change. Therefore, actions should be taken to build up the asset base of women as a fundamental source principle in adaptation strategies. There is a need to remove gender-specific barriers to building assets (tangible and intangible) so that men and women can better adapt to the effects of weather shocks. Moreover, women's potential talents as key agents of change and their resourcefulness in adapting to climate change should be enhanced by providing them opportunities to participate in agricultural training and extension as well as in livelihood programs.

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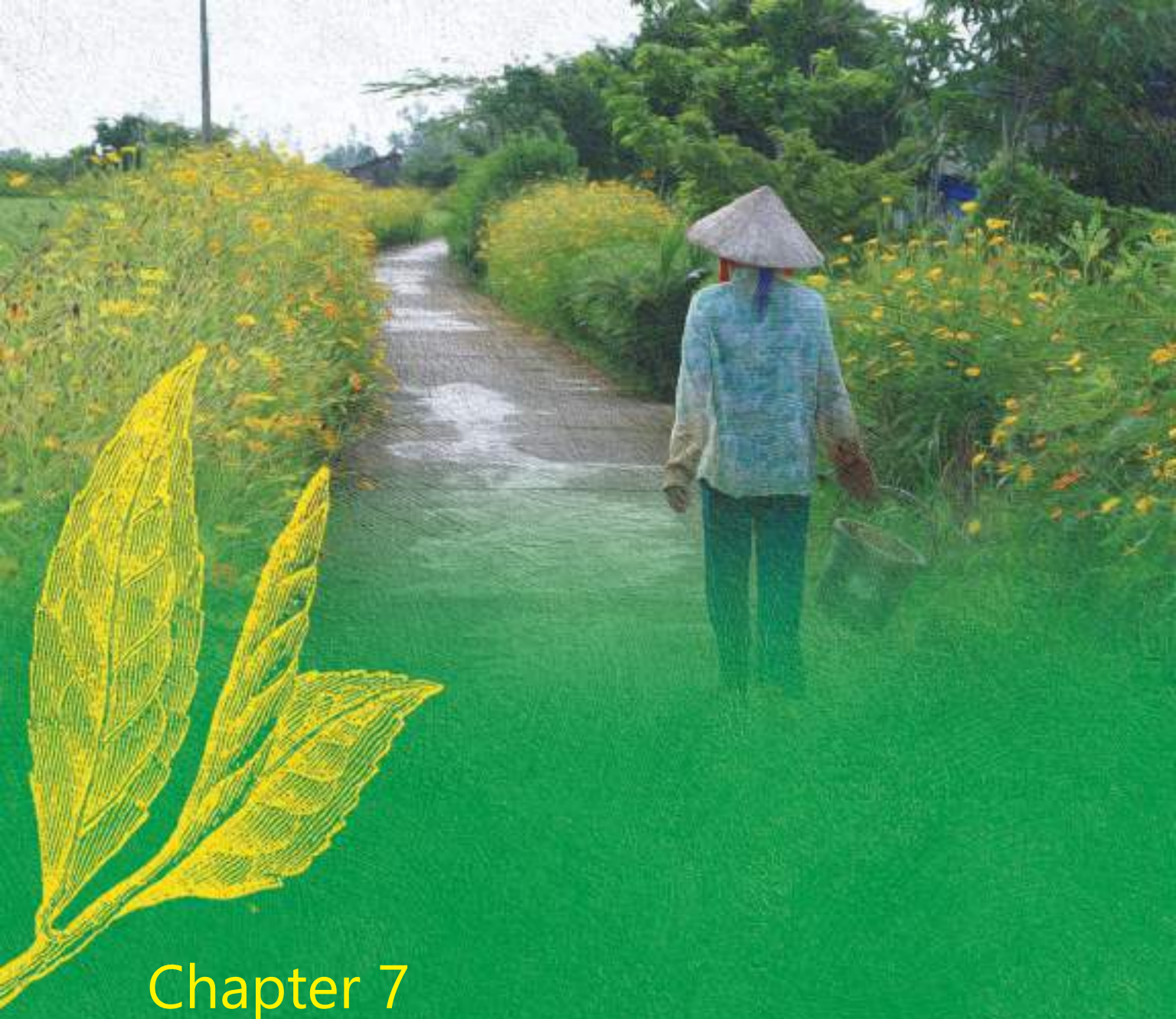

Chapter 7
Gender and Climate-Smart Agriculture: A Case Study in Tra Hat Village, Bac Lieu Province, Vietnam

Tran Nhat Lam Duyen, Bjoern Ole Sander and Reiner Wassmann

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Introduction

The Mekong River Delta (MRD) is one of the two most important rice granaries of the country. About 10,000 square kilometers of the MRD are under rice cultivation, making the area one of the major rice-growing regions of the world (Ninh 2008). The delta has three rice crop seasons; the main crop is the Autumn – Winter (AW) and the other two are Winter – Spring (WS) and Summer – Autumn (SA). According to Marsh and MacAulay (2003), the average farm size of MRD is 1.2 hectares and this is considerably larger than average farm sizes in the Red River Delta. The climate risks in the MRD are increasing frequency and magnitude of flooding, sea water intrusion with high tide, sea level rice (SLR), and seasonal tropical storms (Ninh 2008). Under the effects of climate change (CC), rice yield in the MRD may be reduced by over 40 percent in the SA season due to excessive flooding in the tidally inundated areas as well as longer flooding periods in the central part of the Delta (ICEM 2009). However, the effects of CC vary among different parts of MRD. While the flood-risk depth, caused by SLR, was most significant in upstream areas of the MRD (near the border with Cambodia), coastal areas such as Ca Mau Peninsula were minimally affected by the flow of the Mekong River). The hotspot areas which are affected by salinity risk are mainly located at the interface between fresh and saline water along the coastal provinces, in particular on the East Sea side (Can Tho, Ben Tre, Tra Vinh, Soc Trang, Kien Giang, and Bac Lieu provinces) where tidal variation is higher than on the West Sea side (Phong et al. 2015). Bac Lieu is one of the major rice producing provinces which is located on the southeast of the MRD. This province can be a representative for MRD in terms of both agriculture and aquaculture. It is strongly affected by SLR accompanying CC and hence exerts a strong impact on agriculture and aquaculture production (Phong et al. 2015). In particular, drought and salt-water intrusion influenced almost 2,000 hectares out of 7,000 hectares of paddy rice in Bac Lieu province. Thus, people in these vulnerable rice environments face climate change risks which affect their livelihoods and food security. To develop the resilience of poor rice farming households, Tra Hat village located at Vinh Loi District, Bac Lieu province was selected as one of the six Climate Smart Villages (CSVs) in the Climate Change, Agriculture and Food Security (CCAFS)-Southeast Asia (SEA) project. In this CSV, several Climate Smart Agriculture (CSA) technologies and practices are being tested on farmers' fields to understand the interconnections between CC adaptation, mitigation, gender and food security.

All aspects of agricultural research, including CSA technologies, from problem identification, planning, testing, evaluation and dissemination have social implications.

It is important to know the characteristics of the individual decision makers or groups of decision makers, such as their ability to perceive climate change and climate risk (and other aspects of their cognitive capacity), their values and beliefs, and other individual attributes such as livelihood activities, asset holdings, age, marital status, or level of education (Kristjanson et al. 2017). In South Vietnam, women and not only men are actively engaged in agriculture (crop, livestock and fisheries) and in rice farming in particular. (Chi et al. 2017; Grassi et al. 2016). The ultimate goals of the project are to ensure that men and women can equally benefit from any intervention in agriculture to reduce risks linked to CC. An analysis of gender issues in the implementation and dissemination of potential CSA technologies in rice production is necessary to understand how different social expectations, roles, status, and economic power of men and women affect CC adaptation (Huyer et al.2016).

This study was conducted to: (a) gather the perceptions of male and female farmers on climate change and their adaptation strategies; (b) identify the impacts of climate change on men and women in rice production; (c) identify the constraints faced by male and female farmers in the uptake of and in scaling out of CSA technologies and (d) to suggest gender-responsive policies which can help women combat the negative effects of climate change.

Survey location and sampling selection method

Selection of study area

Tra Hat village (Figure 7.1), is a CSV in southwestern Vietnam, which is administratively in Chau Thoi commune, Vinh Loi district, Bac Lieu province. Tra Hat's total rice production area is around 316 ha and has an average yield from six to seven tons per ha

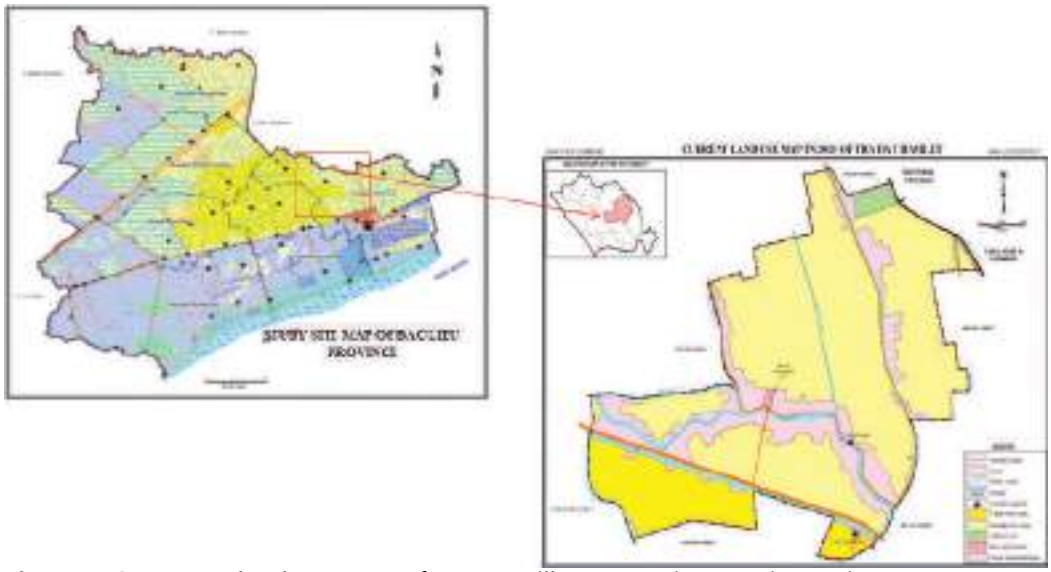

Figure 7.1. Present land use map of Tra Hat village, Bac Lieu province, Vietnam
Source: Phong et al. 2015

per crop season. Available sources of fresh water for agriculture in Tra Hat village are mainly rainfall, water from Quan Lo Phung Hiep (QLPH) canal and groundwater (Phong et al. 2015). Currently, it lacks internal irrigation canals which limit crop diversification and other alternative farming techniques that can reinforce livelihoods. With an area of 306 hectares, Tra Hat is located at the tail end of QLPH – a salinity control canal system for the coastal area of Ca Mau peninsula, where agriculture is usually faced with the problems of lack of fresh water and threats of salinity intrusion during the dry season (December to April) (Minh et al.2015). Moreover, in the rainy season (from May to November), some low areas in the village are inundated by heavy rains. The situation is expected to be more serious in the future with the impacts of CC and SLR (Phong et al. 2015). Rice production which occupies 84 percent of the land is the major source of cash income and food security. However, monoculture is sensitive to CC and has low resilience. Tra Hat village is considered the representative in the MRD in implementing the dissemination of CSA technologies in rice production.

Data collection

Both primary and secondary data were used in this study. Secondary data was gathered from relevant sources such as the CCAFS-SEA project, IRRI, Bac Lieu Department of Rural Development (Bac Lieu DARD), General Statistics Office (GSO) of Bac Lieu Province as well as previous studies, statistical materials, research papers, and reports.

Primary data was collected through surveys. A simple random sampling method was employed to select respondents. The sample size was calculated based on Cochran (1963:75). A total of 110 respondents (49 male heads and 61 female heads) from rice farming households were interviewed using a structured questionnaire. The study used some of the criteria recommended by FAO and CCAFS (2012) and CARE (2009) for evaluating whether CSA-sensitive practices are following a gender-responsive approach to better respond to the needs and views of women and men. These criteria include the main activities of male and female farmers in rice production including labor inputs (person days per hectare), the participation of men and women in decision-making on rice production and household activities, perceptions and adaptation strategies of male and female farmers with CC, constraints faced by male and female farmers in applying CSA technologies in rice production as well as the factors affecting CSA technology adoption to reduce the effects of CC.

Data analysis

Descriptive statistics such as means, totals and percentages were applied in the analysis. The data included socio–economic characteristics of the male and female heads of households (such as age, educational attainment, years in rice farming), farm size, gender differentiated labor use in rice production per hectare, decision-making, perceptions of climate change, perceptions on CSA technologies and factors affecting adoption of CSA technologies as perceived by men and women.

Two sample t-test (unequal sample size and unequal variances) were also applied to test for significant differences in responses, i.e., the extent men and women report comparable perceptions on CC. In order to capture perceptions of men and women and their reactions to extreme climate variability, respondents were asked to report their perceptions on multiple CC variables (such as temperature, rainfall, drought, flood, salinity) that they have noticed in the past ten years.

Results and discussion

Socio-economic characteristics of the sample

Before introducing any CSA technologies, it is important to first gather information on the target population or the intended beneficiaries. Based on the samples interviewed, all respondents are engaged in rice farming and have, on average, 1.8 hectares of land. Owned land is larger (1.5 ha) than rented land (0.4 ha). On the average, men are one year older than women and have one year more farming experience. There is a gap between men and women in terms of educational attainment. While men have seven years in school, women have lesser education (5 yrs). This difference is statistically significant. This gender gap in education has diminished among children due to government rules which promotes gender equality in access to education. The majority of the farming households interviewed are owner-cultivators, cultivate two crops in a year and grow rice as the major source of income (Table 7.1).

Gender division of labor in rice production

Though less often acknowledged, it is also true that technologies are not gender neutral. In every society there are distinct gender roles and gender-based division of labor. Thus, CSA technologies may have different impacts on men and women. The rigidity and flexibility of these roles for controlling and using resources is historically, pragmatically culturally and or/religious based. The gender division of labor depends on many factors such as the type of production systems (irrigated or rainfed), economic status of households, availability of male working

Table 7.1. Characteristics of respondents in Tra Hat village, Bac Lieu province, 2016.

Variables	Male head		Female head		Total sample	
	Mean	SD	Mean	SD	Mean	SD
Age (years)	51.00	12.72	50.00	11.39	51.00	11.95
Education level (school years)	7.00*	3.49	4.75*	2.37	6.00	3.09
Farm experience (years)	29.00	13.65	28.00	12.55	28.00	13.00
No. of observations	49 (45%)		61 (55%)		110 (100%)	

* indicates statistical significance at 1% level.
Source: Survey data, 2016.

members, and degree of mechanization of specific operations (Pandey et al. 2010).

When analyzing the gender pattern of activities, it is important to observe how rigid or flexible the gender specification of task is. Traditional roles are changing under conditions of rapid economic transformation going on in the South Vietnam. For instance, the rise in mechanization has resulted in reduction of field activities for women (in terms of labor hours/day). However, the decline in women's labor participation in rice farming does not mean that women are no longer involved in managing the farm or they are not knowledgeable about farming. In fact, during the interviews, women were found to be as knowledgeable as men in many aspects of rice farming particularly on the amount and costs of inputs. When men are away for longer periods, women are compelled to take over the managerial farm responsibilities aside from doing field activities.

According to Kabeer and Van Anh (2000), the gender division of labor is not rigidly enforced in Viet Nam, but vary by geographical location and household circumstances. Labor participation of men and women in Vietnam also varies by type of production systems. The migration study of Paris et.al. (2010) showed that in irrigated rice farming, men and women contributed 48 percent and 52 percent, respectively, of the total labor inputs per hectare. On the other hand, in rainfed rice farming, women provided more labor inputs (64%) than men (36%). In North Vietnam, women and men contribute almost equal proportion of labor inputs (i.e., 52% women and 48% men) in rice production. Given women's very active role in production, their contribution to sustaining livelihoods is critical. However, marked inequalities in work burden in household and farm activities, reflect women's dual responsibilities in economic production and the domestic sphere (Grassi et al. 2017).

In Tra Hat village, rice is grown twice a year and the average farm size owned is 1.8 hectares. The major activities in rice production consist of seedbed preparation (seed soaking), land preparation, crop establishment (sowing/ row seeding; pulling of rice seedlings; transplanting/gap filling, replanting; crop care and maintenance, (irrigating the fields, application of fertilizer, spraying of chemicals, manual weeding), harvesting-threshing and post-harvest activities. Table 2 clearly shows that except for harvest operation, women contribute labor in all of the operations. However, women's labor is concentrated on two stages of the rice cropping cycle, namely crop establishment (40.7%) and post-harvest (38.7%). Specifically, women contribute their labor in seedbed preparation (66.7% of men and 33.3% of women), crop establishment (59.3% of men and 40.7% of women) and during post-harvest (61.3% of men and 38.7% of women) activities while men take the lead in all rice production activities, especially in land preparation (71.1% of men and 28.9% of women), crop care (79.0% men and 21.0% women) and harvesting (100% men). Based on the total labor inputs (person days/ha) the relative share of men is generally higher than women. Men and women contribute 72.4 and 27.6 percent, respectively, out of 20.46 person days per hectare.

Table 7.2. Labor distribution in rice production activities by gender in Tra Hat village, Bac Lieu province, 2016

Activities	Men (person-days)	Women (person-days)	Total (person-days)/ha
Seedbed preparation	0.27 (66.7)	0.13 (33.3)	0.40
Land preparation	2.81 (71.1)	1.14 (28.9)	3.95
Crop establishment	2.35 (59.3)	1.61 (40.7)	3.96
Crop care	7.99 (79.0)	2.12 (21.0)	10.11
Harvesting and threshing	0.37 (100.0)	0.00 (0.0)	0.37
Post-harvest	1.01 (61.3)	0.64 (38.7)	1.65
TOTAL	14.81 (72.4%)	5.65 (27.6%)	20.46

Note: Figures in parentheses are percentages
Source: Survey data, 2016.

A close scrutiny of the labor participation in each operation shown in Table 7.2 reveals that women provide their labor in almost all of the operations except in harvesting/threshing which is highly mechanized. Women's labor participation also varies by source (family (unpaid) or hired (paid) as agricultural workers). Female family members are mostly engaged in seed soaking to pre-germinate the seeds than female hired workers. Plowing with the use of a tractor is done either by male family or hired labor. Aside from plowing, which is done by male family labor or by a tractor (hired labor), the field needs to be cleaned. Both family male and female labor work to saturate the field/soil, build/improve bunds/field and clean the surrounding ditches. After preparing the land, pre-germinated seeds are directly broadcasted on the fields. Others use transplanting method for crop establishment. This major activity is mainly performed by female family members rather than hired workers. If the land is small, more female members do this activity. For the *Tai Nguyen* variety, farmers use transplanting method wherein seedlings are first raised in a nursery area, which usually is a small part of the rice field. After a few days, farmers pull and transplant young seedlings in the larger fields. For other varieties, farmers use direct seeding (hand sowing pre-germinated seeds). When rice seedlings mature, farmers have to replant seedlings when the seedlings are too close to each other (too crowded) and if the density of seedlings in a particular area is too low.

There are farmers who use plastic row seeder for seeding in rows. A plastic row seeder is attached to a tractor and is operated by men rather than by women. Both men and women are engaged in manual weeding. Farmers only hire workers when there family labor is insufficient and when the size of the rice land is large. Transplanting requires more labor (mostly women) than direct seeding technique of crop establishment.

In summary, men and women can work either separately or jointly on the same field. When an operation is not mechanized, more women participate in executing the activity. However,

once the activity is mechanized, then the activity becomes a male exclusive task. For example, transplanting used to be a domain of women, however, when plastic drum seeders were adopted, women no longer became involved. Similarly, women's labor was higher when harvesting was not mechanized. However, with the adoption of combine machines, women were no longer needed. According to Paris and Chi et al. (2005) the impact of these labor-saving technologies is different for women who work as unpaid workers on their own fields and for poor farming households with marginal lands and landless household.

Some of the reasons for the gender division of labor were revealed by women during the interviews.

On irrigating the fields and water management:

"Since my husband is responsible for preparing the field, he manages irrigation water for the crop too. As we need to pump water in or out of our fields, we need to carry a set of pipes and pumping machine. I am not strong enough to carry them, so it is my husband's job." (Female, 36, Secondary educational level).

On the application of fertilizer:

"Actually, I do know how to use the right amount of fertilizer and pesticides for our rice crop because I often do these work together with my husband. Usually, women don't have much knowledge about pesticide and fertilizer. Moreover, we cannot carry the heavy sprayer, so these work is always done by my husband. If he is not available, we normally have to hire male labor." (Female, 59, Elementary educational level).

On pulling up rice seedlings, transplanting, and replanting as well as straw management:

"For simple tasks like pulling up rice seedlings, replanting and collecting the straw, my husband and I work together. I'm in charge of gathering straw and piling them and my husband burns them" (Female, 52, Elementary educational level).

Gender differences in decision-making

Gender analysis, as does any socio-economic analysis of technology, starts with a series of questions related to 'who" does a specific activity in crop and livestock, who has access to or control of the products, who benefits, and who makes decisions in specific concerns. Increased productivity is related to management decisions, as it is important to understand not only who is doing the work but also who is making the decisions about crop selection, crop management, post harvest, animal husbandry, and farm investments. Knowing who makes decisions in specific areas of concerns has implications on project design and implementation. Studies on gender roles in agriculture, which include decision-making patterns, show that in societies where women participate in the market economy, in some way, and where women have direct access to cash, their power is greater in intrahousehold decision-making, and the women's status is higher (IRRI 1985). Asking who makes decisions (whether husband or wife), oversimplies the decision-making process particularly the process of bargaining, and the negotiaion between husband and wife especially during periods of stress and when resources are limited. This simplified method of asking who makes

the decisions does not capture circumstances when the husband and wife have conflict in the use of limited resources and how these conflicts were resolved. Participation in decision-making on farm-related matters and household matters would differ depending on a number of factors and circumstances, for example husband's short-term or long-term absence, women's experience, skills and knowledge received from training programs, or direct access to agricultural extension services, inputs, etc. A woman is more capable of making sound decisions on a specific issue when she has access to timely information as well as access to resources. There are also entrenched cultural issues which influence the roles of women and men. Due in part to culturally determined gender roles, men take over an activity once it becomes mechanized. For example, women participate in harvesting as unpaid family workers and hired workers. However, when harvesting-threshing became mechanized with the use of combines, the men took over which led to displacement of poor female workers who do not have alternative sources of income within the village.

Table 7.3 shows the contributions of men and women in decision-making on specific concerns. Although about half of the men decide alone what crop and rice variety to grow, about a third jointly make this decision. However, in crop management decisions, men dominate while decisions on the time of harvest is jointly done by men and women. Women alone or with men sometimes make decisions on hiring of agricultural workers.

Women's participation in decision making is generally low, even in decisions related to crop establishment and postharvest (8-26% women vs 16-87% men). However, more women than men make decisions in post-harvest related decisions. For instance, women are mainly responsible for deciding how much rice to allocate for home consumption (food security and income) (26% women vs 18% men). However, in general, men have more access to technical knowledge and information for a number of reasons. One reason is that although women are visibly doing field work, they remain excluded in farmers' training and agricultural extension activities.

As expected, women dominate in decisions related to small animals and poultry, traditionally considered women's domain. In Vietnam, women occupied nearly three-quarters of the labor force in the small-scale livestock industry since they are responsible for 80-90 percent of the work in animal husbandry. According to ADB, (2012), , women had greater responsibility for livestock than men. Likewise, this study shows that all respondents (both men and women) reported that women have a higher contribution to decision making in managing husbandry activities than men. However, more than 50 percent of overall respondents also answered that both men and women make decisions.

Day-to-day household management decisions (such as purchase of food, non-food needs, clothes, children's education, purchase of small livestock) are commonly undertaken by wife alone.

Table 7.3. Contribution of men and women in decision-making in various activities

Activities		Men alone (%)	Women alone (%)	Both (%)
Crop selection/rice varietal choice	1. Which crop to grow	50.91	11.82	37.27
	2. Which rice variety to grow	53.64	10.00	36.36
Crop management	3. When to apply fertilizer	83.64	10.91	5.45
	4. Amount of fertilizer to apply	83.64	10.91	5.45
	5. When to apply herbicide /insecticide	84.55	7.27	8.18
	6. Amount of herbicide or pesticide to spray	87.27	7.27	5.45
	7. When to irrigate/drain field	82.73	7.27	10.00
	8. Pest and disease management	78.18	8.18	13.64
	9. When, for what and number of people to hire	66.36	10.91	22.73
	10. When to harvest	30.91	13.64	55.45
Post-harvest	11. Which variety to use for next season	60.00	8.18	31.82
	12. How much rice to store for food and sell	18.18	26.36	55.45
	13. When to sell rice?	16.36	21.82	61.82
Animal husbandry	15. Number of livestock to raise	13.64	30.00	56.36
	16. When to sell livestock	12.73	28.18	59.09
Investment	17. Raise capital for rice production	31.82	16.36	51.82
	18. Allocate budget for food expense	8.18	67.27	24.55
	19. Raise funds for large investments (agricultural machinery)	38.18	9.09	52.73
	20. Purchase livestock	12.73	30.00	57.27
	21. Purchase more land for rice	13.64	10.00	76.36
	22. Raise funds for children's education	10.00	37.27	52.73
	23. Build/repair house	20.00	10.00	70.00
	24. Purchase consumer durable goods	5.45	23.64	70.91

Source: Survey data, 2016.

Decisions on investments such as livestock, purchase of rice build/repair house renovation/construction, purchase of large animals, farm machinery/equipment are jointly done by husband and wife (see Table 4), although the wife can make decisions on the purchase of small animals (e.g., pigs) as well as raising funds for children's education and purchase of consumer durable goods.

The income of the husband and wife from rice farming and other crops is pooled as family income and in most case, is managed by the wife.

Perceptions on climate change

Studies have found that there are gender differences in perceptions on climate change

Table 7.4. Gender- differentiated perception of climate change in the last ten years

Climate indicators	Men (%)	Women (%)	T-value
Increase in temperature	77.55	81.97	-0.57
Irregular change in temperature	22.45	18.03	0.57
Increase in rainfall	16.33	11.48	0.72
Decrease in rainfall	36.73	55.74	-2.01*
Irregular change in rainfall	46.94	32.79	1.50
Increase in drought	87.76	86.89	0.14
Decrease in drought	2.04	1.64	0.15
Irregular change in drought	10.20	11.48	-0.21
Increase in flood	48.98	42.62	0.66
Decrease in flood	26.53	36.07	-1.07
Irregular change in flood	24.49	21.31	0.40
Increase in salinity	89.80	85.25	0.72
Irregular change in salinity	10.20	14.75	-0.72
No. of observations	49	61	

due to differential exposure to climate change shocks and changes based on livelihood activities and roles within the household and community (Kristjanson et al. 2017). In this study, climate change is experienced in the form of climate variability (i.e., changes in weather patterns) and weather-related shocks at the local level. Respondents are knowledgeable of extreme events (changes in temperature, rainfall, drought and salinity that they experienced in the last ten years). Table 7.4 presents men and women's perceptions on climate change in the last ten years.

As shown in Table 7.4, when the respondents were asked about changes in temperature specifically, nearly 80 percent of all respondents (both men and women) reported an increase in temperature. The data suggest that both men and women perceive that temperature is on average increasing and getting more variable. Only about 20 percent of respondents perceived an irregular change in temperature. Almost no respondent perceived a decrease in temperature or no change at all.

The estimated results of the two sample t-test showed that there is a statistical significance at 5 percent with respect to differences between men and women about perceived changes in rainfall. A higher percentage of women (55.74 %) perceive a decrease in rainfall level as compared to men (36.73 %).

Men and women farmers reported similar perceptions on the occurrence of drought. Almost all respondents (about 87 %) observed an increase in the incidence of drought in the last years. Only 10 percent of respondents

perceived an irregular change in drought and only a few respondents perceived a decrease in the occurrence of drought. The study found that there is no statistically significant difference between men and women's perception of drought.

The results also found that there is no statistically significant difference between the two groups on responses to flood and salinity. However, a higher percentage of men (48.98 %) and women (42.62 %) perceived an increase in flood occurrence in the past ten years. Nearly 80 percent of men and women reported an increase in salinity. No respondents perceived a decrease in salinity and only a few respondents perceived an irregular change in salinity (10.20 % for men and 14.75 % for women).

In summary, men and women farmers in Tra Hat village reported similar perceptions and knowledge of climate variability, except for rainfall variability. This could be explained by the experiences that they accumulated during the time of rice cultivation and through mass media that cover climate information. As presented in the previous section, both men and women provide labor in rice production activities.

Climate change impacts on rice production

Both men and women mentioned that floods and salinity resulted to higher production costs and decreased or complete crop losses. Floods occur due to high levels of rainfall. This means more work for farmers. Women also have to help in gap filling or replanting when seedlings are destroyed by floods. As voiced out by a woman:

"High level of rainfall reduces the number of productive tillers and makes the rice plant weaker which cause loss or lower rice yields. Furthermore, production cost increases because we have to pump water out of the field, apply more pesticides and fertilizer. We experience heavier workload." (Female, 45, Secondary educational level).

"When salinity occurs we cannot pump water into our rice field because the local government made a dam to prevent salt water from coming in. Our production costs increase because we have to buy more chemicals which help the rice to grow better." (Male, 52, High school level).

Farmers' adaptation strategies to climate change risks

In the previous section, our data showed that there are no gender differences in the perceptions and experiences of climate change risks. However, there are gender differences in the adaptation strategies between men and women in Tra Hat village as shown in Table 7.5. A higher proportion of men (95.92%) changed rice variety followed by change in cropping calendar (79.59%), use of water-saving technique (70.83%) and use of IPM (57.14%). Aside from changing rice variety, women respondents reported changing cropping calendar (67.21%) and water-saving technique (54.10%) as important adaptation strategies. However, change in cropping pattern was not considered as an important strategy by both men and women. The water-saving technique referred to as the Alternate Wetting and Drying (AWD) irrigation

Table 7.5. Crop adaptation strategy of men and women

Crop adaptation strategy	Men (% yes)	Women (% yes)	T-value
Changed rice variety	95.92	83.61	2.21**
Changed cropping pattern	20.41	6.56	2.09*
Changed cropping calendar	79.59	67.21	1.47
Used water-saving technique	70.83	54.10	2.34*
Used IPM	57.14	26.23	3.39**
No. of observations	49	61	

*Note: Superscript * and ** indicate statistical significance at 5% and 1% level, respectively*

technique was introduced and disseminated by IRRI and Bac Lieu DARD in Bac Lieu province. Integrated Pest Management (IPM) has been organized and disseminated by Bac Lieu DARD for pest control for many years. Many training programs for IPM have been also organized for local farmers.

In summary, a higher proportion of men than women changed rice variety, cropping calendar, adopted water-saving technique and implemented IPM. These differences can be attributed to men's greater knowledge and information because they have more access to information, agricultural extension services and training compared with women.

Climate-smart agriculture (CSA) technologies and practices

In Tra Hat village, a number of CSA technologies were introduced for farmers to test on their own fields using their own resources. These CSA technologies are as follows: agricultural machinery (laser land leveler, sowing machine, straw baler machine), improved crop natural resource management (CNRM) such as certified seeds, phosphorus reduction, nitrogen reduction, AWD, IPM and change in cropping calendar.

Gender differentiated perceptions of proposed CSA technologies

Based on the initial introduction (explanation) of these CSA technologies, the research team asked men and women how acceptable or how likely are they to adopt the technologies. As shown in Table 7.6 there are statistically significant differences between men and women in choosing CSA technologies for rice production. These differences can be explained by the differences in men and women's roles (e.g., labor contribution in rice production, in other crops and livestock, participation in decision-making and marketing, access, exposure and experience in using these technologies.

Among the CSA technologies, laser land leveling, nitrogen reduction, AWD, and IPM are more likely to be adopted by men. Although a higher proportion of men more than women are likely to adopt sowing machine (plastic row seeder), straw baler machine, and phosphorous reduction, these differences are not statistically significant.

Table 7.6. Crop adaptation strategy of men and women

CSA	Men (% yes)	Women (% yes)	T-value
Laser land leveling	36.73	14.75	2.64***
Sowing machine/plastic row seeder	42.86	31.15	1.26
Straw baler machine	42.86	29.51	1.44
Certified seed	79.59	78.69	0.11
Phosphorus reduction	24.49	18.03	0.81
Nitrogen reduction	97.96	78.69	3.40***
AWD	71.43	57.38	2.54***
IPM	83.67	40.98	5.15***
Change in cropping pattern	38.78	22.95	1.78*
Number of respondents	49	61	

*Note: Superscript *, ** and *** indicate statistical significance at 10%, 5% and 1% level, respectively*
Source: Survey data, 2016.

Gender-differentiated perceptions on factors constraining adoption of CSA technologies

The challenges of CC in agriculture will require site-specific solutions as well as recognition of the specific needs and capacities of men and women, and the gender-specific barriers and incentives for adoption of CSA technologies (Nelson and Huyer, 2016). As shown in Table 7.7 a higher proportion of women mentioned that CSA technologies require costly inputs (e.g., machinery). Men have more access to service providers of machinery for land preparation and harvesting-threshing. Women's involvement in the development of new technologies can ensure that they are user-friendly, affordable, effective and sustainable. Gender inequalities in access to resources, including credit, extension services, information and technology, must be taken into account in developing activities designed to curb the negative impacts of climate change. Women should also have equal access to training, credit and skills-development programs to ensure their full participation in climate change initiatives.

Perceptions on the key factors enhancing adoption of CSA technologies in rice production

Based on the constraints discussed above, this study attempts to identify the key enabling factors which can enhance the adoption of CSA technologies in Tra Hat village as perceived by men and women. The results can provide rice scientists, agricultural extension workers and policy makers in identifying the appropriate CSA technologies that can equally benefit men and women engaged in rice farming.

Table 7.7. Gender differentiated perceptions on the constraining factors to adoption of CSA technologies

Constraints		Men (%)	Women (%)	T-value
Technical	CSA technologies are too complex to apply	44.90	45.90	-0.10
	CSA technologies require costly inputs e.g. machinery	46.94	63.93	-1.79*
	CSA technologies are knowledge intensive and require skills training	57.14	63.93	-0.72
Government policy	Lack of government policies to support CSA technologies	61.22	75.41	-1.58
	Lack of accessible service (machines, equipment, transportation)	73.47	77.05	-0.43
Resources	Shortage of labor	48.98	50.82	-0.19
	Shortage of female labor	28.57	40.98	-1.36
	Lack of capital to purchase inputs	71.43	81.97	-1.28
Market	Low market demand	73.47	59.02	1.61
	Lower price and higher production cost	69.39	77.05	-0.89
Biophysical factors	Unsuitability to location-specific conditions	79.59	83.61	-0.53

The team asked men and women what are the three most important incentives that can promote the adoption of CSA technologies. Men and women gave similar responses on what are the main incentives which enhance the adoption of CSA technologies. These are:

(1) Good rice yields and lower costs of production. Since the farmers' goal is to maximize profits and minimize production costs, the most common incentive that motivates farmers to adopt CSA technologies are good yields and lower production cost (higher profitability) by reducing inputs.

(2) Access to credit. Men and women reported access to credit as the second enabling factor which will motivate them to adopt the CSA technologies. Farmer cooperatives in the village provide farmers access to credit. Thus, farmers who are members of cooperatives can apply farm inputs at the right time and dosage through installment payment arrangements at low interest rates.

(3) Women and not only men's participation in demonstration of CSA technologies. Both men and women are interested in gaining new knowledge and skills required by CSA technologies. CSA extension models should be demonstrated in farmer field schools and demonstration farms. Additionally, training efforts and participatory engagement to overcome knowledge constraints are needed for

adoption and dissemination of CSA technologies. According to Paris et al. (2012), at least 30% of the participants in demonstration of technologies and trainings on CSA technologies should be women.

Conclusions and recommendations

The study found that there are no statistically significant difference between men and women in perceptions of climate change and constraints of adoption of CSA technologies. Among rice production activities, women participated regularly in crop establishment and post-harvest activities while men took the lead in preparing the land, managing the crop, and operating farm machines. Generally, while women are responsible for food expense and household expenses, and children's education, men are in charge of rice production activities. Both make decisions on post harvesting, large investments, or large expenditures (e.g., purchasing large livestock, land, and machinery). In fact, the level of women participation in making decisions in rice production is lower compared with men. Moreover, an interesting finding from this study is the significant difference between men and women in their responses on crop selection, farm management, and post-harvest activities. While men dominate in decisions on selection of crop variety, women reported that they do make decision in these activities. It implies that women should be given more opportunities to gain more technical knowledge and skills which are critical in making decisions on farm-related matters. Women often have less access than men to land, production inputs, credit, and education, so strategies to address women's access to these factors need to be addressed.

The majority of men and women perceived a change in weather in the last ten years. Most participants reported an increase in temperature, salinity, drought and a decrease in rainfall. Based on the results of the study, there are differences between men and women in reporting adaptation strategies to climate change and factors affecting their decision on those strategies. These differences are in perceptions on acceptability of men and women on laser land leveling (LLL), nitrogen production, AWD, IPM and change in cropping pattern. The adoption of these technologies can also be explained by the dominance of local male farmers in any IPM training for Farmer Field Schools (FFS). Likewise, men are mainly responsible for most mechanized rice operations therefore, mechanized CSA technologies are reported by men more than women. In spite of the potential of CSA technologies to improve resilience and to enhance agricultural production and rural livelihoods, farmers face several constraints in their adoption such as the lack of financial capital to purchase inputs and to avail of service providers for machinery as well as poor infrastructural facilities in most villages. Moreover, there are gender gaps in access to information and technologies. Hence, the following recommendations are made.

Firstly, both men and women should be provided access to climate information as well as training and extension materials on CSA technologies and practices. Information is a powerful tool for enhancing adaptation to CC because farmers will not accept

CSA technologies if they are unaware of the possible impact of CC on their crop. Successful adoption of CSA technologies requires recognition of the necessity to adapt and the benefits of CSA technologies by providing training and demonstration trials. CSA technologies are relatively knowledge–intensive, requiring considerable managerial knowledge about proper input application. For example, AWD does not require more labor and capital than the traditional rice cultivation technique, however, AWD requires farmers with skills and farming experience so that they can apply the technique adequately. Thus, extension services are important in promoting the adoption of CSA technologies. In addition, farmers who highly trust the skills of extension agents are more likely to adopt CSA technologies. This implies that where farmers have contacts with extension agents, the quality of extension services is an important determinant of CSA adoption. Thus, upgrading the skills of extension workers are necessary to speed up the CSA adoption and scaling out of CSA.

Secondly, agricultural scientists and extension workers should increase their consultation and discussions with women farmers and ensure the participation of women in climate change initiatives.

Thirdly, local village leaders and policy makers have to pay more attention on gender perspectives in designing effective strategies for disseminating CSA technologies. Training classes and demonstration on CSA technologies should involve both men and women. Female farmers should be provided more training opportunities in farm activities where they have already a fairly high level of engagement and that are deemed suitable for them given the nature of their farm work. Examples of these are in production of quality seeds of stress tolerant rice varieties, and crop and resource management practices.

Fourthly, agricultural research for development programs should continue to provide support to incorporate gender perspectives into their farmer-centric projects on climate change adaptation through carrying out systematic gender analysis; collecting and utilizing sex-disaggregated data; establishing gender-sensitive benchmarks and indicators; and developing practical tools to support increased attention to gender perspectives.

Finally, we need to recognize that women can make substantive contributions through their knowledge and experience on issues related to the management of natural resources.

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Chapter 8

A Feminist Analysis of Oppressive and Emancipatory Potentialities within Technology-Prioritized Climate Change Adaptation Intervention: A Case Study from Phailom Community in Laos

Auni Haapala

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Introduction

The concepts of today's climate change adaptation practice and research, from 'adaptive capacity' to 'vulnerability', have in practice remained rather blurry. Regardless of this, adaptation is currently being executed with a rapid speed both in rural and urban areas, and the solutions to address the causes of vulnerability seem to be strongly leaning on a certain direction: technological solutions are currently the most widely applied adaptive response globally, as recently concluded by the Intergovernmental panel on Climate Change IPCC (Noble et al. 2014).

In this chapter, I will approach the contemporary technified adaptation discourse from a feminist perspective, thus understanding adaptation as a highly power-laden social process. Through a case of climate-smart agriculture pilot in Phailom community, located in rural Southern Laos, I aim to reach the lived realities of those in the margins of adaptation discourse. In the community of about 102 households, adaptation technologies such as new drought tolerant rice seed varieties, direct seeding as an alternative rice cultivation method, and a dynamic crop calendar to help with timing of cultivation activities, have been adopted by local farmers since 2014. The project has been initiated by the Consultative Group for International Agricultural Research (CGIAR) as part of their international research program on Climate Change, Agriculture and Food Security (CCAFS).

Phailom appears a particularly relevant case to study the effects of technology-oriented climate change adaptation, as the community is currently a living laboratory for not just how social power relations and technology co-evolve, but also how "smart-adaptation" makes reality and shapes the lives of locals. The current food insecurity, and the predicted climate change impacts in Laos that might further accelerate the struggles over food, also demand emphasis on critically examining the very effects of the technified efforts aiming to improve the lives of those at the most margins.

Indeed, while climate-smart initiatives and similar technology-oriented climate change adaptation projects are spreading across the globe, some critical voices have started to emerge raising concerns on the social injustices such interventions may produce (Gonda 2016; Carey et al. 2012, O'Brien 2012; Kantor et al. 2015). As strongly emphasized by feminist scholars, the effects of technology on social relations are far from straightforward. Feminist scholars within science and technology studies (e.g., Haraway 1988; Wajcman 2011; Harding 1986; McNeil 2007) have worked toward unfolding this complicated nexus by showing how technology is never isolated from the society and culture where it originates from and

where it enters. As they argue, prevalent socio-cultural and political dynamics always affect how technologies made sense and adopted at local level. Correspondingly, technologies also embody certain assumptions, power, and practices, which play a role in transforming (gendered) power relations.

Through a case of a Phailom community, this chapter enters a "climate-smart" space at a moment when a technological intervention has begun to interact with the lives of locals. By applying a feminist lens, I am interested in understanding how the local farmers in Phailom, as well as the project practitioners responsible for implementing the project, "make sense" and negotiate the new technologies. An understanding of these meaning-making processes provides a way to analyze how the (gendered) power dynamics transform at the local level as adaptation technologies become part of daily life in Phailom. By leaning on the empirical data, I show how both the local power dynamics, but also local-global power frictions, interact and contribute to the making of climate change adaptation in the community.

In the following sections, I will first elaborate on the use of feminist approach as an analytical tactic for studying power dynamics within technified adaptation discourse, and introduce the methods applied in this case study. Afterwards, results of the study are presented, followed by theoretical and practical considerations, including four policy-relevant recommendations.

A feminist perspective to technified climate change adaptation

Feminist analyses have so far been scarce in climate change adaptation research. The recent contributions by feminist scholars have, however, shown that a feminist perspective can provide valuable new insights to adaptation and to the inequalities that might get reproduced within this discourse (see e.g., Nightingale 2015, 2016; Gonda 2016, 2017). The value of the feminist approach lies in the possibility to shift the focus from gender roles, relations, and gender-differentiated impact of technologies to a wider context, where the examination of masculinities and femininities provide a framework for unveiling the multiple (asymmetrical) power dynamics and knowledge production that surround climate change adaptation science and practice (MacGregor 2009). Indeed, as pointed out by MacGregor (2009), analysis of power relations between men and women and the discursive constructions of masculinities and femininities are particularly relevant in climate related studies, because these constructions "shape the way we interpret, debate, articulate and respond to social/natural/techno-scientific phenomena like climate change" (MacGregor 2009, p. 127).

As emphasized by Harding (1986) and Dankelman (2010), and what remains as the driving force for feminist studies, is that gender[9] has, across cultures and history, shown asymmetry where symbols, structures, and behavior counted as masculine are valued over

[9]I approach gender here by contributing to the recent development in the understanding of it: viewing gender 1) as a process and 'doing' that is constantly re/produced in social interaction (Beauvoir 1988; West and Zimmerman 1987), 2) as inherently tied to socio-economic structures such as division of work (see Harding 1986), and 3) as a category that is always intra-acting with other social categories such as race, class, ethnicity, and age. (Wajcman 2010; Lykke 2010).

feminine: modern/traditional, objectivity/subjectivity, rationality/irrationality, mind/body, culture/nature – where in each case the former is related to masculinity leaving the latter to femininity (Lykke 2010; Harding 2008). The asymmetrical valuations of masculinities and femininities have been widely used as an argument for various arrangements ranking from wage labor to the hegemony positions of science and technology as the "motors of progress" (Connell 2005, p. 164). Within technified climate change adaptation discourse, masculine and feminine get repeated at symbolic levels: nature and traditional, considered as feminine, gets controlled and managed by modern climate technologies.

The epistemology of situated knowledges, initially conceptualized by Haraway (1988), has strongly influenced feminist critique of scientific objectivity and prioritization of technology with a key argument: because production of knowledge is always located in specific time, society, culture and political atmosphere, all knowledge should be viewed situated, resulting in partial views (Haraway 1988; Lykke 2010, p. 4). From a feminist de/constructionist point of view, the seemingly objective and rational applications of science, such as climate change adaptation technologies, are not a direct result of techno-scientific innovation processes, but instead located in a certain socio-political context in time and thus embodying power and values (Lykke 2010: 4). Based on this view, technologies should rather be seen as power-laden social constructions that are not objective or stable, but constantly negotiated and remade (Lykke 2010; Haraway 1988; Winner 1980).

As Haraway's theorizing of situated knowledges also aims to highlight, the universal devaluation of feminine entails that some voices have remained more "on the side" and marginalized than others (Harding 2008; Haraway 1988). This is indeed what a feminist scholarship through its theoretical, epistemological and methodological framings aims to respond: to apply a research orientation 'from below' that lift up the feminine, silenced voices and knowledge which can present alternative realities (Harding 2008; Kristeva 1982). These voices thus include not only women's voice but all of those in marginalized positions. For example traditional or local environmental knowledge, often viewed as "non-scientific" or "irrational" by masculine systems, has been called for re-valuation by feminist scholars as it has been so far largely marginalized in the climate change adaptation discourse (Israel and Sachs 2013; Wangui 2014).

In addition to devaluation of "feminine" knowledge, feminist inquiry has also raised concerns about the capitalist and market-oriented power structures reinforced by adaptation (Israel and Sachs 2013; Mies and Shiva 2014; Nightingale 2015). Nightingale has shed light on the increasing trend of considering 'adaptive capacity' as something inherently linked to economic growth and diversification of livelihoods (Nightingale 2015, p. 182). In line with this, it can be observed that adaptation practices such as the "climate-smart" discourse aim for increasing crop productivity, income, and monetary benefits from labor (CCAFS n.d; Nightingale 2015).

Finally, in its endeavors to make enormous changes in global climate systems harmless, 'adapting to climate change' creates an illusion of having control over nature. Through this domination and mastery, it has been claimed to present a pronounced form of hegemonic masculinity (Tschakert and Machado 2015; Israel and Sachs 2012). According to Nightingale (2015), such view tends to create an apolitical approach to adaptation, which gives further justification to manage and use nature as a commodity.

With its critique on techno-scientific climate change adaptation discourse, the feminist inquiry thus challenges the traditional, deterministic input-output thinking that tends to surround technological processes: the rationalistic assumptions that leave unproblematized the social processes through which technology is remade and recontextualized in local settings. Thus, viewing climate change adaptation technologies from a feminist perspective it becomes necessary to pay close attention to the power structures and knowledge production in the creation and interpretation of the technologies, and to examine the voice to those who are at the center of making sense of the new artefacts.

Methods of data collection

The empirical data used in this case study was gathered in Lao PDR during March and April 2017 by applying both qualitative and quantitative methods. Following the feminist thought that views technologies as social constructs, the research methods were designed to capture the ways local female and male farmers perceive, understand and access the new climate technologies based on their differing social positions, life situations, and work burden; the aim was to gather narratives of individual meaning-making of technologies. The key data was collected through thematic interviews with six female and three male farmers in Phailom, where questions evolved around the everyday life as a woman/man in Phailom, experienced changes in weather in past years, new adaptation technologies, and the future that farmers envision in relation to the technologies.

To contextualize the realities from where the meaning-making of technologies emerge, additional supporting data was gathered from farmers through participatory rural appraisal (PRA) methods – namely seasonal calendar and history event timeline, and informal talks. PRA's were conducted separately for female and male farmers, resulting in four different sessions. Out of the 102 sample households in Phailom, fourteen female heads and 20 male heads of households were interviewed using a structure questionnaire. To gain insights to potential social inequalities and local hierarchies that might frame the access to, adoption of, and perceptions on technologies, the samples included of both those households that had been testing the new technologies, and those who had not been part of it for some reasons. The questionnaire covered a variety of aspects from a family and decision-making structures to livelihood strategies and division of labour. Several open-ended questions were also included in relation to changes in weather and farmers' experiences with the new climate technologies.

Finally, project practitioners played an important source of data for understanding the project design and its background. Narratives from them provided valuable insights on how the role and meanings of the new adaptation technologies were viewed by the implementation side of the project. In addition, secondary material about the project was derived from published project-specific report (see Yen et al. 2015; Villanueva et al. 2015).

Making sense of adaptation technologies

In the following sections, I aim to illustrate the logic of meaning-making of climate change adaptation technologies through a feminist lens from three different viewpoints. Firstly, drawing from empirical insights, I show how local hierarchies both shape and get shaped alongside the introduction of new technologies in Phailom. Secondly, I demonstrate how new creative meanings arise for the purposes of the technologies based on the local's understanding of climate and the surrounding environment. Lastly, I show how capitalist structures, claimed to be tightly compounded to the adaptation discourse, emerge also in Phailom. The three technologies under focus are described in Table 8.1 below.

Table 8.1. Overview of the three main climate technologies introduced in Phailom, as presented by the CCAFS project

Adaptation technology	Purpose of technology
Drought tolerant seed varieties A set of modern seed varieties that can tolerate drought, along with improved crop management practices, i.e., amount and timing of fertilizer application	Help farmers to maintain and improve rice yield under irregular rainfall patterns and prolonged drought periods.
Dynamic crop calendar A paper brochure consisting of a weekly timetable to help in the timing of different cultivation activities. DCC is based on meteorological data in seasonal weather predictions.	Help farmers to maintain and improve rice yield through better addressing and being prepared to seasonal weather variations.
Direct seeding A crop establishment method for rice cultivation, where seeds are sown directly to the soils after ploughing the land. Direct seeding does not require wet soil and it can be done by one person using a direct seeding machine.	Help farmers to sow seeds on dry soils especially when rainfall is delayed. The method also eliminates seed nursery, pulling of seedlings and transplanting, thus reducing labour use for rice production.

Arranging the technological intervention at local level: existing power asymmetries remain unchallenged

Through participant observation and in discussions with project practitioners and farmers in Phailom, it was clear that especially community leaders and local men stood at the forefront of the climate-smart project activities taking place in the community: fathers, husbands, brothers, sons, and sons-in-law were in several discussions viewed as the primary users of the technologies and those who had the capability, motivation and knowledge to learn. Moreover, discussions with locals and project practitioners revealed, that local community leaders held a strong gatekeeper position in relation to the ongoing project: they negotiated with project practitioners about activities held in the community, and they in the end decided the local participants for different technology trainings. A head of her household, Mrs. Thao[10], elaborated on her experiences from this:

I would like to try dynamic crop calendar even though I don't understand it yet. When there was a project training for dynamic crop calendar, our community leader called a name list of people who could attend. My brother was on the list, so after the training, I went to see him and asked what he had learned. (Mrs. Thao, 37)

Alongside with Mrs. Thao, also other farmers' narratives indicated that the existing gender roles and social norms defined who could attend public meetings and make decisions regarding rice cultivation: both female and male farmers, including the leader of women in Phailom, legitimized men's higher engagement in the new project.

Women don't participate that much, because this kind of work is men work. Rice cultivation is mainly men's work[11]. Also, usually men go to meetings and women stay at home, and therefore it is natural that men attend the training. (Mrs. Lumphai, 47 leader of women)

A head of household, Mrs. Joy's elaboration below follows the same arguments as previous examples from Mrs. Thao and Mrs. Lumphai. Her explanation also rigorously reveals that a certain project design is hindering many women's possibilities to actively participate:

Mostly women can't write or read, so they can't attend project activities. Men are heads of households, so they participate in meetings, and they can also decide. Women don't often make decisions before asking their husband, so it is difficult for them to participate. (Mrs. Joy, 36)

Indeed, in addition to decision-making, capability to read and write seems to be a precondition or at least a significant advantage to attend and benefit from the project. Data from female - and male-headed households helps to shed light on the unfavorable position many women and some elderly seemed to have in relation to majority of men to comprehend the form of information delivered through

[10]Names of respondents have been changed.
[11]Based on the data from household survey, local men mostly carry out "hard" and productive phases of rice cultivation, such as ploughing, spreading fertilizer, harvesting and post-harvesting. Women tend to be engaged more in manual work within cultivation, including seed nursery, pulling of seedlings, weeding and harvesting.

the project: The average amount of years that men had attended school was 4.6, and nearly everyone – 19 out of 20 respondents – had completed minimum one year of studying, and a quarter of them as much as 8-10 years. Conversely, 12 of the 14 interviewed women had never attended school and only two of them had completed three to six years of education. In line with the level of education, most of the interviewed women and some elderly men said they are not able to read or write, and almost a third of the households named this as the primary reason for not using dynamic crop calendar. The design of the ongoing project, therefore, seems to marginalize especially women and elderly farmers to participate in trainings and adopt certain technologies.

Finally, there emerges another interesting power-laden arrangement that has taken place among farmers in Phailom at a time when the climate-smart project provided the community with a direct seeding machine for communal use. From several female and male farmers' narratives it was evident that the new machine has clearly favored those holding a high social position in the village, namely community leaders and teachers. The direct seeding machine – the artefact itself – has thus become a status symbol at local grounds, where the access to it reflects farmer's position in the community's social hierarchy.

The given examples illustrate how local social hierarchies, combined with the specific design of the technological intervention, seem to have created spaces where it has become easier for some farmers to attend and be included in the "climate-smart" process while others remain excluded. The results show, that the arrangements made to accommodate the new technological intervention in Phailom are largely shaped by local forms of gender asymmetries and other social hierarchies, that seem to stay invisible, ignored, or out of control for the project practitioners. This becomes evident in the ways the project activities are structured at the local level in favor of men's participation, as well as in certain technologies, namely dynamic crop calendar, that is unreachable for illiterate farmers – most of them being women in all ages. It is, however, not only women, but also elderly men and farmers without high social positions in the village, who have experienced constraints with adopting or getting access to some technologies. On the contrary, the community leader, his deputy and other villagers with high social positions, as well as (male) farmers that have shown their capability and will to learn, seem to hold the strongest negotiation power over the technological intervention and its arrangements at local level.

Re-defining climate-smart technologies: contradictions and creativity from below

The climate-smart technologies have been introduced in Phailom to improve local adaptive capacity in terms of food security under climate change impacts – an aim that was frequently mentioned to me by project practitioners. In particular, the dynamic crop calendar and drought-tolerant seed varieties have the climate-controlling function embedded in the design of the technology, while direct seeding offers a tool to spread

seeds in time in case of delayed wet season. Despite the strong emphasis on the climate-related aims of technologies by the project, only a few farmers – the male leaders, who had been most closely engaged in the project – shared somewhat similar viewpoints. Indeed, a citation from the community leader reveals how a climate narrative similar to project practitioners' have been adopted by him:

Before we have transplanted and produced rice by following the natural weather. But because now it is climate change, maybe the project is important, because it is suitable to adapt us to get a high yield, (Mr. Thong, 53, community leader).

Apart from community leaders, linkages to climate remained absent in farmers' interpretation of technologies – a crucial insight considering the core aim of the climate-smart project. Indeed, none of the interviewees perceived the new seed varieties as something related to tolerance of droughts, but instead connected their increased rice yields to a better application of fertilizer. The perceived importance to use the "right" fertilizers as guided by the climate-smart project was evident for example in Mr. Khamtan's elaboration:

Last time villagers used the old fertilizer [type of fertilizer used prior the project] because it is a cheaper one, but project staff says you should use the new specific fertilizers given by the project. And that is why they did not get high yield, (Mr. Khamtan, 46 years old).

In the case of dynamic crop calendar, farmers' perceptions on the purpose of this technology were in many cases opposite to the desired outcomes intended by the project: As elaborated by project practitioners, dynamic crop calendar is based on short-term seasonal weather forecast and should thus help farmers to conduct each cultivation task in optimal time, resulting in a good yield. However, based on farmers' narratives they "can't follow the instructions, because we are dependent on the rain," as it was put by Mrs. Lounny, and confirmed by seven other female and male farmers.

Farmers' narratives about the underlying causes of droughts also revealed how locals' perceptions on changes in climate and environment differ from the "scientific" ones on which project practitioners and technologies base on. In a discussion with a group of women, there was a high consensus among them that droughts are due to deforestation that has taken place nearby the village some years ago. Deforestation, again, was explained to be due to high forest-tax which is an incentive for land-owners to convert to a cultivated land. This has resulted in cutting forest and establishing a large sugarcane farm nearby Phailom, owned by a Thai company. Women continued to elaborate, how pesticides are used in the farm, and this has had consequences also in Phailom: water quality in fish ponds has decreased, and mushrooms in community forest have gotten poisoned[12]. Women's narrative was also somewhat supported by a few other farmers, such as Mr. Vatsana:

[12]According to household data and discussions, nobody uses pesticides in Phailom even though pests and diseases are a challenge within rice cultivation. Instead, there seem to be strong resistance towards them, which was evident in the discussion with the group of women and in explanation given by another farmer: "we can't poison our land because it is the source of our food."

Before there was a forest, but now it is gone, and there is a sugarcane farm in next village. There is no protection from the forest anymore, and that is why we have droughts and sometimes storms, (Mr. Vatsana, 50).

Locals' narratives demonstrate, how their understanding of climate and environment reflects aims for maintenance of the quality of surrounding environment instead of managing and controlling it. Furthermore, the reasons and drivers for changes in climatic conditions were repeatedly tracked to the changes in surrounding environment rather than to changes in global climate systems.

The insights to farmers' relationship with climate and land help to understand why the new technologies, especially the drought-tolerant seed varieties and dynamic crop calendar, were negotiated differently to project practitioners: the absence of climate narrative regarding drought-tolerant seed varieties aligns with locals' understanding of climate as something that is not to be controlled but rather followed, and where the climatic changes were in general attributed to local environmental changes. The differing narratives between project practitioners and farmers explicitly demonstrate the co-constitutive character of technology and challenge deterministic views on it: even the most "obvious" climatic functions within technologies can be creatively renegotiated based on local worldviews and relationship with climate and surrounding environment, as it has been done by farmers in Phailom.

Marginalizing subsistence - creating space for markets?

The last section of the findings demonstrates how the capitalist structures that, according to a feminist critique, are closely compounded to the climate change adaptation discourse, emerge in the discussion with farmers and project practitioners in Phailom. Particularly, two types of narratives can be traced in relation to how farmers envision the future, and here a socio-spatial pattern emerges.

The first narrative – repeated mainly by those marginalized by the adaptation intervention such as illiterate women and elderly – arises from the struggles of everyday life in contemporary Phailom: from the realities, where many households still lack rice for the whole year, and where socio-ecological changes have resulted in new kinds of concerns towards availability of food. These farmers highly drew from their environmental knowledge in making sense of needed future paths. In their views, improvements in the rice field through technologies seem not to be enough, as the land size for farmers are getting smaller, there is a tendency for droughts, and a decline in food in the surrounding environment. Overall, farmers' future views seem to reflect hopes namely to end food shortage, either by increasing yield or by finding some extra work to pay for food and other expenses.

The second narrative belongs to those who have been closest to the climate-smart project: the project practitioners, community leaders and a few male farmers. The new technologies seemed to show a way towards

market possibilities in the minds of some farmers, such as Mr. Suan:

Next, I need to grow rice and vegetables for business. Because now we cultivate rice only for culture, only for us to eat. But in future, we can cultivate to sell and for it to be a business. Maybe it is good for us, (Mr. Suan, 44).

In line with Mr. Suan, the leaders of the community seemed to seek and desire an exit from the "traditional", that is the subsistence culture of exchanging and borrowing, to be able to enter the modern, that is "business," "money" and "modern things":

Before people exchanged together: if I have chili and I need more fish from you, we can exchange. But now and in future, it gets more difficult to do like this. There are still some households that exchange, but maybe next we should do business and use money. Not to exchange anymore, but go to the market, because there you can use money. If you don't have money, you don't buy chili, (Mr. Thong, 53, community leader).

We need more technology, big tractors, computers and new machines (…) we need to build more capacity, so we need more modern things, (Mr. Outhai, 47, deputy community leader).

The marketization-narrative further strengthens with project practitioners – those closest to the technological innovations. Indeed, stories from project practitioners give an impression that moving away from subsistence farming towards market-oriented agricultural production seems to be a necessary step on the way to adapting to climate change – or at least adaptation was used as an argument to pursue this kind of idea for future development. An interviewed officer in the Research Center of Climate Resilience in Agriculture – a new governmental department established in early 2016 – is similarly rather clear when expressing his view on the connections between climate change adaptation, technologies and need for a more market-oriented approach. Access to markets instead of continuing with subsistence farming is, in his opinion, the key way to motivate farmers to adopt new technologies, which in turn is needed to increase local adaptive capacity.

While the narrative of marketization got loudly repeated especially by those most included in the climate-smart project, there arose opposing voices too. Indeed, when I asked the government officer's opinion on whether farmers themselves were interested in making their food production more commercialized, he replied slightly frustrated: "Farmers are very difficult, because they don't understand. This is challenging" (officer, Research Center of Climate Resilience in Agriculture). He continued to explain how now, after "giving them training", some farmers have started to understand the value of increasing productivity and earning more income. Several other project practitioners seemed to have a similar point of view to locals' preference to subsistence instead of establishing a link to markets. While the project side clearly viewed the "subsistence attitude" challenging, and thus hoped to see farmers moving on to sell their products, they also recognized challenges in creating fair market access for local villagers.

Here, a clear pattern emerges in relation to devaluation of local and traditional knowledge – this is the subsistence logic of maintenance rather than profit-seeking, that seems to collide with and thus be disregarded within the technified adaptation discourse. The future envisions also reveal, that the meaning-making of technologies is characterized by contradictions. For example, the narrative of marketization told by project practitioners seem to be presented as a natural part of adaptation work and purpose of technologies, yet, in the next moment, the potential for increased vulnerability of farmers due to the logic of market-based agriculture is equally recognized.

Oppressive and emancipatory potentialities: policy-relevant insights

The examination of the meaning-making of smart-adaptation reveal that the technified adaptation intervention in Phailom is currently strongly operating within, and in some cases, strengthening several oppressive dynamics that feminist scholarship has identified to be closely tied to contemporary, technology-oriented adaptation discourse (Nightingale 2015; Wajcman 2011; Dankelman 2010; Gonda 2016). In particular, enhancement of existing social hierarchies, devaluation of local environmental and subsistence knowledge, and a direction towards marketization, seem to frame the adaptation intervention. Alongside gender, for example, family structure, age, social position in the community, and literacy, have played a role in determining the responses and access to new climate technologies in Phailom.

Moreover, the global ideals of climate change adaptation brought into Phailom through technological innovation confront the 'feminine' local knowledge – the worldviews that emerge from locals' subsistence-oriented livelihoods and their long history with and dependency on the surrounding environment. This becomes evident from the colliding ways local farmers and the project negotiate the technologies in relation to climate and future. The empirical data demonstrates, how masculinists, top-down way of constructing dichotomies emerge in the technified adaptation discourse (Lykke 2010): knowledgeable/ignorant, modern/traditional, rational/irrational – where the latter feminine characteristics tend to be associated with local farmers. In addition to global-local frictions, the technologies give birth to new asymmetries locally by creating a dichotomy between valuable scientific knowledge practiced by village strongmen, and "traditional" knowledge still practiced by those at the margins of the community and the climate-smart project.

Interestingly, locals' marginalized narratives demonstrate, how their view on climate and the surrounding environment reflect rather a sustainable relationship to nature, albeit it would not be considered rational by a scientific community. For example, locals wanted to conserve surrounding forests as those are seen to protect the area from droughts and storms, while pesticide is highly resisted due to its poisonous effect on rice fields and mushrooms in forests. It is this worldview that the adaptation discourse unintentionally shatters by, for example, placing a high emphasis on the use of synthetic fertilizers

in maintaining the fertility of the soil. This unintentional destruction and silencing of local environmental knowledge is problematic, although a widely documented pattern within climate change adaptation discourse, as it hides potential sustainable solutions to response to climate change impacts at local level (Wangui 2014; Eriksen, Nightingale and Eakin 2015).

Finally, the valuation of market-access and marketization of agriculture in Phailom seems to be another implicit narrative carried by the climate-smart technologies alongside the "scientific objectivity". However, it is also a narrative that functions as a mechanism for potentially silencing the alternative ecological, local knowledge about the environment. Indeed, if the land becomes understood as a utility for profit maximation, it may well be that the local more holistic relation to land and the subsistence worldview becomes replaced by a more utilitarian worldview.

Based on the findings, as brought into light by a feminist analysis, four policy-relevant insights could be laid out. These remarks demonstrate the oppressive potentials that were identified to characterize the ongoing climate-smart project in Phailom, yet, which could transform into emancipatory possibilities, if acknowledged and addressed adequately. The policy-relevant insights are as follows:

1) **The existing local social inequalities and hierarchies have a key role in shaping the project implementation at local level**. As the first step, it is therefore crucial for climate-smart projects to be fully aware of the (gendered) inequalities at the local level to be able to ensure, that also the most marginalized can benefit from the project. In Phailom, many women's and elderly farmers' access to knowledge provided by the project would increase, if project training and technologies would lean on a non-literate form. Furthermore, more flexible project implementation that would utilize also informal routes in delivering project information at local level would enable especially women to participate more.
2) **Adaptation technologies have a social character**, and thus the negotiation of technologies at local level may result in creative new interpretations for the purpose and use of the artefacts. This is an important aspect for climate-smart projects to be aware of, as it can provide answers, e.g., to why some adaptation technologies might not be adopted by farmers. The understanding of the new rice seed varieties by farmers in Phailom is an example of such, where majority of locals did not associate the seeds to tolerance to droughts, but instead connected the acquired high yields solely to a careful application of fertilizer.
3) **Locals have valuable (environmental) knowledge that is not understood by the climate-smart intervention**. This knowledge should not be belittled or automatically considered controversial to the project aims. Instead, reconsideration of the knowledgeable-ignorant -dynamic within adaptation interventions could enhance the integration of local and traditional knowledge in adaptation planning, including the voices of most

marginalized such as illiterate, elderly and women.

4) **Capitalist dynamics seem to frame the contemporary adaptation practices**. Thus, identifying and problematizing the linkages between climate change adaptation and marketization, including its implications on gender equality, should be part of the adaptation project cycles. By identifying these linkages, it could be possible to assess how adaptation objectives can be reached without the pressure of marketization. If marketization of agricultural production is considered as a crucial part of adaptation efforts within climate-smart projects, it regardless is necessary to identify and address the potential (gendered) vulnerabilities that such pathway might create at local level.

Conclusion

The project in Phailom, alongside similar types of "climate-smart" projects elsewhere (see e.g., Gonda 2016; Kantor et al. 2015), do not seem to reach the roots of local gendered inequalities to address them, but instead tend to further marginalize the most disadvantaged local groups. Yet, at the same time, such technological interventions seem to carry great transformational power elsewhere, that becomes evident in the emerging movement towards commercialization, profit-seeking and "business" in the case of Phailom. Then, why does such paradox exists: Are local power dynamics so unreachable that project interventions have no means to transform them? Or would it rather be, that for example capitalist mechanism are inherently embedded in the contemporary climate change adaptation discourse, whereas social equality has not been compounded to it to a similar extent.

In this chapter, I have aimed to provide some insights in relation to the above presented questions through studying the making of smart-adaptation from a feminist perspective. Specifically, I have aimed to show the value of a feminist approach in its capability to broaden the understanding of the effects of adaptation technologies, and to make asymmetrical local and global power dynamics more visible. Alongside with a slowly growing feminist scholarship, I argue that in the context of climate change adaptation, examination of masculinities and femininities can provide a highly useful framework for unveiling the multiple power differentials and constructions of knowledge that surround contemporary adaptation discourse and practice. Moreover, the consideration of technology as a social construct – something that embodies meanings and power and is constantly given new meanings – further sheds light on how the global masculine power structures and knowledge embedded in adaptation practice interact with the negotiable, local dynamics. As shown in Phailom, the "climate-smart" aims of technologies have gotten even opposite meanings as they have been negotiated based on local worldviews and understanding of climate and environment. This negotiation process is characterized by local and global power asymmetries which should not be ignored by adaptation interventions.

By revealing the "true" face of adaptation at the local level, insights from this study can give new tools for climate-smart interventions

to recognize the oppressive and emancipatory potentialities within their structures, and through this, strengthen their core aim that is extremely needed: to ensure that the efforts made at the local level truly enhance the adaptive capacity of rural communities and the most marginalized groups within.

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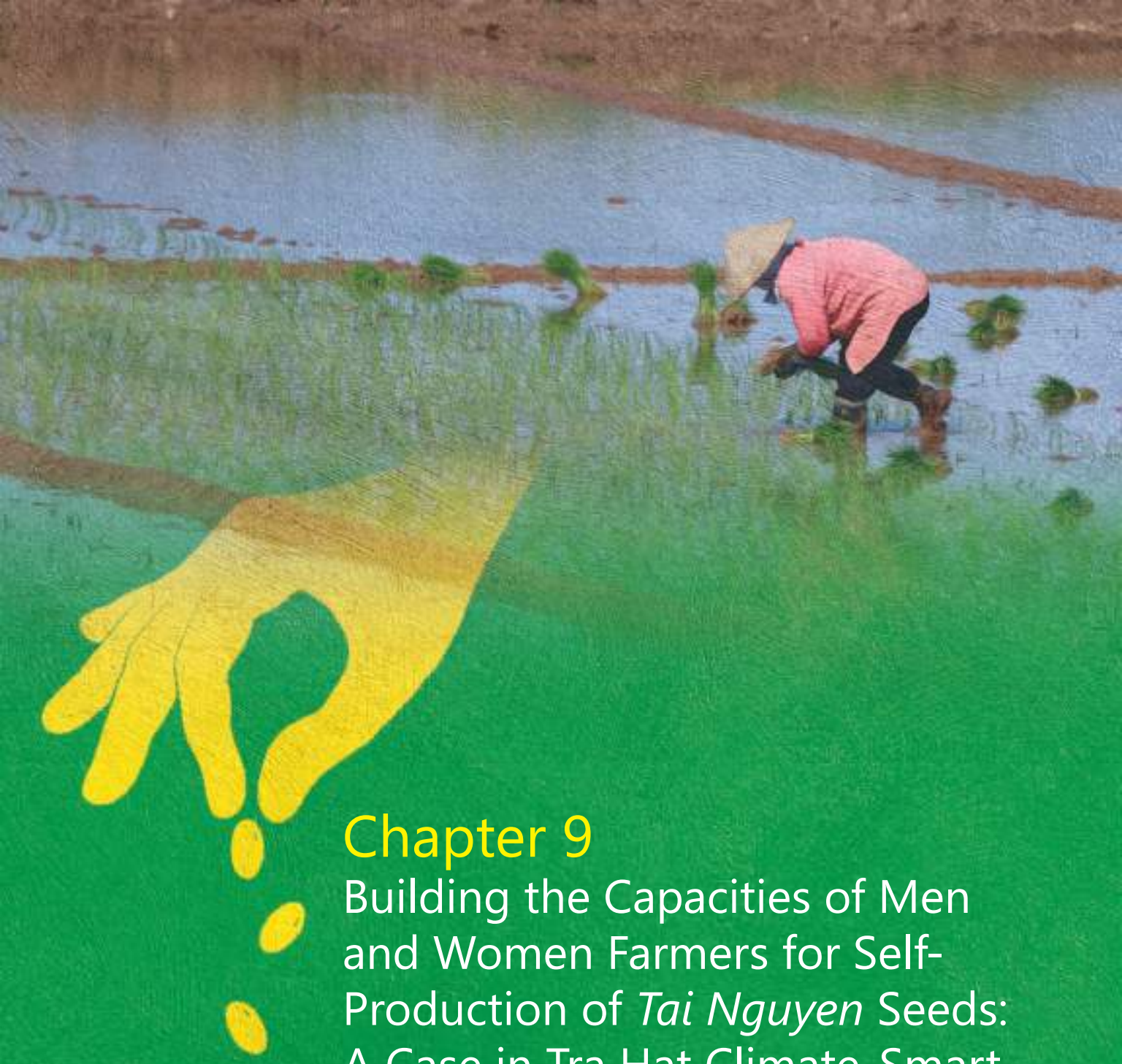

Chapter 9
Building the Capacities of Men and Women Farmers for Self-Production of *Tai Nguyen* Seeds: A Case in Tra Hat Climate-Smart Village, Bac Lieu Province

Dang Thi Tho, Truong Thi Ngoc Chi and Le Minh Duong

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Introduction

The Mekong Delta is known as the rice bowl of Viet Nam, with 3.9 million hectares of land under rice cultivation. It contributes more than half of the total national rice production. Rice cultivation systems in the Mekong Delta offer excellent field laboratories to study farmers' management of genetic diversity. Traditional varieties have been largely replaced by high-yielding varieties, but are still grown on about 300 000 ha in the saline rainfed zones of the Mekong Delta. One of the villages in this area is the Tra Hat Village. Based on the situational analysis of Tra Hat village in Bac Lieu province (Minh et al. 2015), rice production remains to be the major source of cash income of farmers. Farmers grow two crops of rice: summer, autumn and later autumn winter (or winter spring). Tai Nguyen a traditional variety is usually planted in the Winter-Spring season. Tai Nguyen yields around 7 tons per hectare. It commands a high price in the market and is easy to sell. It contributes to both household consumption and cash income. However, farmers mentioned the degradation of the traditional rice seed of Tai Nguyen, stagnant flooding (beginning of autumn winter), and lack of fresh water (after autumn-winter and beginning of summer-autumn. Farmers applied high dosage of fertilizer and agrochemicals and are dependent on credit. They apply chemicals to make the paddy stalks shorter to reduce lodging and at the same time, get a higher yield. Based on the results of the visioning exercises during the Village Baseline Surveys (VBS), the villagers gave a list of priorities, one of which is to build the capacities of farmers on Tai Nguyen rice seed purification and production of its high quality seed at the household and community level.

Within poor rice farming households, both men and women are involved in the entire rice food chain from production, harvest, postharvest and seed selection. However, women's roles in these food chain have been ignored and underestimated (Chi et al. 2016). Their potential as seed producers, particularly in reviving the seed purity of Tai Nguyen, has not been explored. Thus, a project was conducted in the Tra Hat climate-smart village in Bac Lieu province to:

1. Strengthen the knowledge and skills of the local staff and rice-farmers on self-production technology of a special rice variety (Tai Nguyen)
2. Establish local rice production groups of Tai Nguyen variety
3. Identify farmers' perception and demand for Tai Nguyen rice variety and,
4. Identify farmers' constraints and suggest recommendations for sustainable household and village level production of pure seeds of Tai Nguyen variety

This paper reports on the case study of building the capacities of men and women farmers for self-production of *Tai Nguyen* seeds in the Tra Hat climate-smart village in Bac Lieu province.

The process

Sequential training workshops

To achieve the above-mentioned project objectives, several sequential training workshops were organized. These training workshops were on seed revival and self-production technology of *Tai Nguyen* in Tra Hat village, Chau Thoi communes, Vinh Loi district, and Bac Lieu province. Thèse training workshops were conducted by staff members of Cuu Long Rice Research Institute (CLRRI), Thoi Lai district, Can Tho city, Vietnam in collaboration with the Department of Agriculture and Rural Development (DARD) of Bac Lieu province.

The training workshops which focused on Tai Nguyen rice variety were conducted in several split classes. The first training workshop was on "Seed revival from impure and pure seed sources" which was conducted on August 22, 2015. The second training workshop which was held on October 27, 2015 was on "Seed production process from source grade foundation". The third training workshop which was held on January 8, 2016 was on "Farming techniques: harvest and postharvest". This was followed by another course on "Field practice on seed production process from source grade foundation and certified seed" on February 5, 2016. Finally a review meeting was held to project completion". Lectures were given by resource persons from CLRRI and DARD of Bac Lieu province. Training manuals in Vietnamese were also provided to each participant. Field demonstrations were carried out on farmer's plot (2,000 m2) in Tra Hat, Chau Thoi, and Bac Lieu. The method followed the conventional rice-technical procedure for seed production (10 TCN 395:2006) by the Ministry of Agricultural and Rural Development (MARD) of Vietnam. The seeds were sown on August 28, 2015; transplanted on October 10, 2015 and harvested on February 11, 2016. Yields were 7 tons per hectare. Both men and women participated in demonstration trials.

Evaluation of male and female farmers' knowledge before and after attending the training workshop on "Seed revival from impure and pure seed sources"

Trained farmers (7 women and 21 men) and eleven untrained women farmers were individually interviewed to assess the knowledge on reinvigoration of *Tai Nguyen* rice variety. Focus group discussions (FGDs) with trained women and men's groups as well as untrained women's group were conducted to explore men and women farmers' capacity to participate in self-seed production team and to provide Tai Nguyen seeds to other farmers in Tra Hat village.

Initial assessment of trained men and women farmers' technical knowledge on the reinvigoration process of *Tai Nguyen* rice variety and their capacity in joining the seed production team in Tra Hat was conducted. Evaluation of the support and assistance of the local managers to the seed production

team in farmer communities was also conducted to explore the potential efficiency of the seed production team in producing *Tai Nguyen* seeds.

Questionnaires for the individual survey, men and women focus group discussion, and key informant interview were prepared to assess the outcome of the training on the reinvigoration process of Tai Nguyen rice variety.

Evaluation of the support and assistance of local managers to the seed production team in farmer communities

Key informant interviews with the local managers at the provincial, district and commune levels were conducted to confirm their support in organizing seed production teams in the community. Questionnaires for the individual survey, men and women focus group discussion, and key informant interview were prepared to assess the outcomes of the training on the reinvigoration process of *Tai Nguyen* rice variety.

Data analysis

Individual knowledge levels were assessed by calculating the amount of agreement between each farmer's response to a standard set of interview questions and the aggregated responses of other farmers. Descriptive statistics were used to summarize the data. Because the samples were small, the Mann Whitney U test was used to compare the knowledge scores between trained and untrained women, and between trained women and men. The Fisher Exact test was used to see the difference in response patterns to the knowledge statements between trained and untrained women, and between trained women and men. The qualitative information from FGDs and key informant interviews (KIS) was integrated in this report

Adoption of the method of knowledge score calculation was based from Price (1996):

$$\text{Knowledge score} = \frac{(\text{RQn x n}) - 1}{(n - 1)}$$

Where:
RQn = Percentage of correct answer
n = is the number of choices
(n=3:where 1=yes, 2=no and 3-don't know)

Results and discussion

Knowledge levels on seed quality and production of *Tai Nguyen* variety

The results of the analysis are presented in Table 9.1. As shown in the table, two domains of technical knowledge were classified. One is knowledge on seed quality and production of *Tai Nguyen* with eleven knowledge statements and the other one shows the knowledge score on revival of *Tai Nguyen* variety with twenty statements (Appendix Table 9.1). Results show that the knowledge score on seed quality and production of *Tai Nguyen* seeds of trained women (0.86) is significantly higher than those of untrained women (0.64) However, the scores of trained men are higher than trained women, although the scores are not statistically significant.

Table 9.1. Overview of the three main climate technologies introduced in Phailom, as presented by CCAFS project

Knowledge domain	Trained women (n=7) (a)	Untrained women (n=11) (b)	Trained men (n=21) (c)	Mann-Whitney U	
				Difference (a) & (b)	Difference (a) & (c)
Seed quality and production of Tai Nguyen seeds (n=11 statements)	0.86	0.64	0.90	0.01584*	0.06640
Revival of Tai Nguyen variety (n=20 statements)	0.65	-0.05	0.83	0.00025**	0.00384**
Overall (n=31 statements)	0.72	0.20	0.85	0.00006**	0.00252**

**Significant at 0.10; ** Significant at 0.05*

The knowledge score on domain of revival of *Tai Nguyen* variety of trained women (0.65) is also significantly higher than those of untrained women (-0.05). These differences are statistically significant. The knowledge score of trained men (0.85) is higher than trained women (0.65) and these differences are statistically significant. This trend is similar to the results of overall knowledge of two domains (Table 9.1).

These findings reveal that there is a high potential for training more women on seed quality and production as well as the revival of *Tai Nguyen* variety from production, harvest and post-harvest operations. Details of the knowledge scores (See Appendix 9A) reveal that almost all of the trained and untrained women are knowledgeable about the necessary conditions of pure and impure seeds. However, trained and untrained women have very low knowledge scores on the required seed moisture. In contrast, trained women have higher knowledge scores on the required seed moisture of 14% or lower for better germination of seeds. Trained women and men already know that using certified seeds ensure production of good quality seeds.

Before the training, women have some knowledge on manual selection of seeds which they have practiced for a long time. Some trained women mentioned that they know more about transplanting (planting one seedling per hill in rows) and removing off-types and diseased plants.

Knowledge levels on reinvigoration of *Tai Nguyen* variety

Despite the trained women's claims that they are knowledgeable about these practices, trained women have low levels of knowledge about the method of reinvigoration of Tai Nguyen variety. They complained that the

lessons were too complicated and long. Thus, training workshops for women should be done several times (3-4) along with field practice on farmers' fields. Among the topics, women are familiar with manual selection of seeds, which they have practiced for a long time. Some trained women mentioned that they have some knowledge on transplanting (planting one seedling per hill in rows) and removing off-types and diseased plants.

Despite women's participation in training, more than half of them still do not know the methods of seed production of basic seed and certified seeds of *Tai Nguyen*. Since this was the first time they participated in this kind of technical training, they had difficulty in remembering all the information they received through lectures. The rest who had adequate knowledge learned by observing and applying their knowledge during field work. Moreover, they received frequent visits/ guidance (every 1-2 weeks) from technical staff members. The untrained women who want to be trained indicated that the suitable time for training is from 10:00 (after cooking) to 2:00 in the afternoon. As expected, all untrained women farmers do not know about the method of seed reinvigoration. They also have not heard about it. Most of the trained men farmers know a little or do not know the method of seed reinvigoration at all because the training provided was their first, although some of them have been practicing this in the field. They indicated that the method of seed reinvigoration is difficult to remember as the process is too long and complex. Some pages in the material are difficult to understand. The material is not clear to farmers. The materials were written from the scientist's view. Thus, it needs to be simpler and the training needs to be repeated 2-3 times. Some trained men know the method of seed reinvigoration well from training and through observing the practice in the field.

Regarding knowledge domain related to the method of reinvigoration of Tai Nguyen variety, there is significant difference in response to the knowledge statement on "*Reinvigoration of rice variety can use initial materials obtained from production field*" between trained and untrained women, but not between trained women and men. Similar trends were found on a number of knowledge statements including "*In the 1st crop season, and land preparation has been done, transplanting only requires one tiller per hill in rows*"; *"The field producing pre-basic seeds must be segregated from other fields by at least 20 m"*; "The field producing basic seeds or certified seeds must be segregated from other fields by at least 3 m" This indicates that untrained women did not know much about methods of reinvigoration of Tai Nguyen variety. Similarly, there is a significantly different response between trained and untrained women groups and trained women and men groups in regards to "*Reinvigoration of rice variety must be conducted in 4 crop seasons*". There was no difference on responses to the rest of the knowledge statements between trained and untrained women and trained women and men farmers.

Knowledge levels on rice cultivation, harvest and post-harvest of *Tai Nguyen* variety

Most of the trained women know well, or very well, the methods of cultivation, harvest and

post-harvest of *Tai Nguyen* variety because they managed farms. Women have experience in rice farming for several years (more than 15 years). They attended the training related to these methods.

Most of the untrained women know a little about the methods of cultivation, harvest and post-harvest of *Tai Nguyen*, very few know well about these based on their long experience in rice farming. They are willing to been trained to understand better these methods.

More than half of the trained men know very well the methods of cultivation, harvest and post-harvest of *Tai Nguyen*, and some of them know well about it because they attended training, or have experience in rice farming for more than 15 years. They participated in all rice production activities. Some do not know well about the method because they did not understand all the training materials. The lesson in the training was explained only one time.

It is interesting to know that most of the trained men know the method of seed production because aside from the lectures, they also observed this in the field as well as practice in the field. They said that some parts of the training materials are too complicated to understand. Moreover, they want to have frequent (2-3 times) training to improve their understanding. They mentioned that farmers are familiar with manual seed selection such as removing the off-types and diseased plants. Aside from training, some gained their knowledge by watching television documentary shows on seed production in An Giang and Vinh Long provinces.

Farmers' capacity and willingness to join the village seed production team

Trained men and women have several reasons for their willingness to participate in the village seed production team. These are: a) expectations for higher profits and good quality rice; and b) to have a trade name for this variety. Based on the information from the training workshops, they are motivated that production of high quality seeds will command higher price in the market and consequently, higher income. High quality seeds commands a higher market price (1000 to 1250 VND/kg). Moreover, seeds of revived *Tai Nguyen* rice variety have good eating quality (i.e., leftover rice remains soft). Women prefer this quality because during their busy schedule, they are not able to cook rice in the morning; they have to eat left over rice cooked during the previous dinner. Trained men said that they also want to produce pure seeds of *Tai Nguyen* variety to have their trade name for this variety. Trained men farmers said that pure seeds will produce good quality rice, which command higher prices thus, higher returns. At present, the fields planted with *Tai Nguyen* seeds (longer-duration) are near the areas planted with short-duration rice varieties. The anthers of these short- duration rice varieties can fly to the *Tai Nguyen* fields. Thus, after reinvigoration of *Tai Nguyen*, the basic seeds and certified seeds of this variety need to be produced by the seed production team.

Constraints and lessons learned

Limited land and time. A few of the trained women farmers said that they will not be able

to join the Seed Production team because they face several constraints such as limited land (e.g., only 0.2 hectares) and time. Women have to work as unpaid family labor and as hired agricultural workers to earn income. Aside from field work, they have do household chores, take care of young children, cook and do other income-generating activities.

Complex teaching modules on seed reinvigoration. As mentioned previously, farmers found the training materials too complex. Farmers, especially the women, find it difficult to retain the lessons due to its complexity.

Lack of policies to provide support to rice production teams. When DARD first introduced the *Tai Nguyen* seed invigoration project, farmers were not convinced that they can be seed producers. They lack the capital, resources (e.g., machinery, irrigation, etc.). They need assurance from DARD that they will be provided with loans on low interest rates, seed certification and reasonable prices and markets for the seeds.

Requirements for sustainable seed production of *Tai Nguyen* seeds

Based on the evaluation, below are some critical conditions to enable sustainable seed production of Tai Nguyen seeds:

Establishment of seed production teams in Tra Hat

There is a need to first establish seed production teams which can produce *Tai Nguyen* seeds and provide continuous supply of quality seeds in Tra Hat village. This will require the strong support and cooperation among government offices such as DARD of Bac Lieu province, DARD of Vinh Loi district and the authority of Chau Thoi commune. DARD of Bac Lieu province should collaborate with Bac Lieu seed center which can buy seeds produced by local seed production team. DARD of Bac Lieu province should assist in providing the training classes depending on the available funding. DARD of Vinh Loi district should request the Vinh Loi People Committee to allocate funds for building the seed production and multiplication model to transfer to the localities within the district. The district should assist in providing the initial breeding materials (which is bought from a research institute or university), conduct technical trainings and processing of quality seed approval. The District is also responsible for allocating farm areas for planting pure stock of *Tai Nguyen* for continuous seed supply.

Selection of farmers including women as members of local seed production team

The local authority of Chau Thoi commune should identify potential male and female farmers with sufficient land to be allocated for seed production. Members of the local seed production team should be committed in joining the team of seed producers of *Tai Nguyen* variety. The local authority should assist in the formation of the seed production team, assigning the area for seed production of *Tai Nguyen* rice and organizing the training activities. At present, the commune has two groups of rice seed producers; each group is comprised of 15 farmers. These groups will be upgraded to seed production team.

The leaders of Tra Hat village will assist in forming the seed production teams. Tra Hat village needs three seed production teams to produce seeds of *Tai Nguyen*. The collaboration between the seed production teams and the Seed Center is necessary to have an assured buyer of seeds. DARD of Vinh Loi district said the groups of rice producers or cooperatives with managers as chairmen or directors need to help the local seed production team to smoothly and effectively manage the production of revived *Tai Nguyen*. DARD of Bac Lieu province emphasized that the participation of active farmers in the seed production teams is crucial for the effective operations of the local seed production teams. The local authority of Chau Thoi commune mentioned the required conditions as following: (1) Farmers should first agree to participate in the seed production team; (2) Farmers should have a strong interest in reviving *Tai Nguyen* seeds; (3) Members of the seed production team should be trained very well on the revival of Tai Nguyen seeds; and (4) Women and not only men should be members of local seed production teams.

Provision of adequate resources to farmer seed production teams

At present, farmers have individual small pumps using their own fuel. They also transplant rice manually. With these limited resources, it will be difficult for the farmer-seed producers to meet the requirements for producing reinvigorated *Tai Nguyen* seeds on time. There should be a common electric pumping station, and other agricultural machinery (e.g., transplanter). The price of inputs such as pesticide and fertilizer need to be stable and the inputs must be of good quality.

Building the capacities of the members of the local seed production teams

One-time training is not enough. Due to the systematic process of seed production, farmers need to be able to understand as well as develop the skills through "hands-on" experience. Farmers found the lectures too complicated. Thus farmers need to have frequent training workshops to strengthen their technical knowledge and skills on seed revival of *Tai Nguyen* rice variety. For the first training workshop, seeds should be provided. The training organizers should also assess which topics should be simplified, given more emphasis, or reduced, to enable farmers, both men and women, to effectively absorb the learnings based on their level of education and experience.

Inclusion of women farmers and rural youth in the local seed production team

Women and youth are members of the village who are often ignored as potential members of the local seed production team. Women in South Vietnam are actively engaged in rice production and postharvest activities. Women dominate in transplanting, gap filling, and drying. Husbands and wives provide labor in almost all rice operations and in farm management. When the husband is away, the wife takes care of managing the farm as well as taking over operations such as spraying pesticides. According to DARD:

"Women have the potential to help in the management of the team operations and implementation of plans. The inclusion of women in a team, will make the team stronger. Compared with men, they are more meticulous in crop care. Women are better managers. Men, often use their leisure time drinking with friends, and when they get drunk, they are no longer able to work".

The authority of Chau Thoi commune said:

"Women perform their roles in field management, transplanting, gap filling, drying, weeding on the rice bunds, identification of insect pest, and selection of good brand of fertilizer.

The leaders of Tra Hat village added that:

"Women give suggestions in rice production. They remind the men (husbands) to do rice operations on time as men like to play chess, cards, drink and may forget their work. On the other hand, women are hardworking and are often overburdened as they combine their productive (agricultural work) and reproductive roles (childcare, household chores). They wake up at 4:00 in the morning and sleep late at night to accomplish their daily tasks. To enhance men and women farmers' technical knowledge and skill on seed reinvigoration and multiplication/production, the trainings should be repeated 2- 3 times with field practice. The training materials should be precise, short, and simple. To help women concentrate during training, the training for women should be in the later time in a day (10 AM to 4 PM)."

With regards to women's participation in the seed production team and seed reinvigoration team, DARD of Bac Lieu province suggested that:

"*Women should comprise 30 to 40% of the team members. This representation can help women in the team to be more confident in expressing their opinions and in participating in the production operations". Similarly, DARD of Vinh Loi district, authority of Chau Thoi commune and leaders of Tra Hat village also mentioned that "Women's participation rate should be 30% to 35%. With these representation, women can contribute in the selection of quality seeds, supervision of proper amount and timing of inputs (e.g., pesticides, and fertilizer). Women know all the rice stages and they can monitor the water level in the field. On the other hand, male or female youth who are interested in farming (mostly children of farming households) should also be invited to join the local seed production. They can play important roles in connecting the contract farmers and the buyers or markets. They take advantage of communication technologies (e.g., cellphone, internet) in marketing the pure seed and access to other sources of information such as prices, climate information, sources of inputs, etc."*

Establishment of policies for effective operations of the local seed production team

There is a need for DARD of Bac Lieu province to have a policy to enhance the capacity of team members in management through training the team/group leaders, and farmers. Policies related to marketing the seeds are needed. DARD of Vinh Loi district needs to develop policies on the provision of loans with low interest rates for seed production teams. There should also be a policy that can consolidate farmers' fields to enable farmers to use large machinery such as laser land leveler.

Conclusion and recommendations

There was a lot of enthusiasm, interest and exchange of information among the participants of the training workshops. Farmers gained knowledge and skills on self-production technology of special rice variety (*Tai Nguyen*) in traditional farming systems. The evaluation of women and men's capacity in seed revival and multiplication of Tai Nguyen variety in Tra Hat CSV showed that women play important roles in these activities. Moreover, women certainly have the potential capacity to be a team member of seed revival and multiplication. After attending the training, women's technical knowledge on seed quality increased. The evidence also showed that training makes a difference - trained women's knowledge score was higher than those of untrained women. There are no differences in knowledge scores of trained men and trained women. Women also acquired technical knowledge on the method of seed revival for Tai Nguyen variety after training although their knowledge score on this domain is lower than trained men farmers. The local managers of DARD have a high regard for women's role and indicated they will support women's participation in terms of their guidelines and policies. In this project, women's participation in the training activities was low at 20%. However, there should be a policy to increase women's participation to 30% and then hopefully to 50%.

Below are some recommendations:

- To enhance men and women farmers' technical knowledge and skills on seed revival and multiplication/production, the trainings should be repeated 2- 3 times and supplemented with "hands-on" field experiments. The training materials should be precise, short, and simple. To help women concentrate during training, activities should be conducted from 10:00 (after cooking) to 2:00 in the afternoon instead of 8:00 in the morning. .
- Local managers at different levels and extension workers should increase both women's and men's awareness of the long-run benefits of rice production from seeds of reinvigoration to obtain a trade name for Tai Nguyen variety
- There is a need to select and train active women and men under TOT (training of trainer) program. Later on, farmers can teach each other. There is a need for socialization of the training fund whereby different groups in the community will contribute to the funds.
- This project should be continued with increased representation of women farmers
- Farmers should have access to loans with low interest rates for seed production

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Appendix 9.1. Percentage of male and female farmers' response to the knowledge statement

Knowledge statement	Trained women (a) (n=7)			Untrained women (b) (n=21)			Trained men (c) (n=11)			Exact Sig. (2-sided)	
	Yes	No	Don't know	Yes	No	Don't know	Yes	No	Don't know	Compare (a) & (b)	Compare (a) & (c)
Seed quality, seed production											
Seeds of good quality must be pure and/or have very less impurities	100	-	-	91	-	9	100	-	-	1.000	
Seeds of good quality must be strong and have uniform stand in the field	100	-	-	100	-	-	100	-	-		
Seeds of good quality must have good vitality and very strong development	100	-	-	100	-	-	100	-	-		
Seeds of good quality have 100% filled grains and without seed spots	100	-	-	100	-	-	100	-	-		
Seeds of good quality must not have any physical injury	86	-	14	91	-	9	95	-	5	1.000	0.444
Seeds of good quality must not have more than 25% surface area with red color or red stripe	86	14	-	64	27	9	76	19	5	0.757	1.000
Certified seeds of good quality must be 99% but must not be less than 98% pure	100	-	-	55	-	45	100	-	-	0.101	
Certified seeds of good quality must not have more than 10 weed seeds per 1 kg rice seeds	100	-	-	64	36	-	81	10	10	0.119	1.000
Germination rate of good quality seed should be at least 80%	100	-	-	91	-	9	100	-	-	1.000	0.076
Seed moisture must be 14% or lower	29	-	71	27	-	73	71	-	29	1.000	
Need to use seeds with certificate to ensure production of good seed quality	100	-	-	55	-	45	100	-	-	0.101	
Reinvigoration of Tai Nguyen Dục											
Reinvigoration of rice variety use initial materials obtained from production field	86	-	14	18	9	73	81	14	5	0.013*	0.537
Reinvigoration of rice variety must be conducted in 4 crop seasons	43	14	43	-	9	91	81	14	5	0.020*	0.042*

In the 1st crop season, field should be well-prepared and seedlings should be transplanted with only one tiller per hill in rows	100	-	-	45	9	45	90	-	10	0.038*	1.000
The field which produces tillers with pure seeds must be separated at least 20 m from other fields	71	-	29	18	9	73	67	10	24	0.049*	1.000
The field which produces tillers with certified seeds must be separated at least 20 m from other fields	71	-	29	18	-	82	76	14	10	0.049*	0.473
Flowering time of rice grown on seed production field must be before or after flowering time (at least 15 days) of rice grown in other fields	71	14	14	27	9	64	86	14	-	0.113	0.281
Seed production field should be provided with adequate water, fertile soils and free from disease and pests for uniform maturity	100	-	-	82	-	18	100	-	-	0.497	
In 1st crop season, the rice plants with different phenotype and flowering time, weak growth, susceptibility to pest and low tolerance capacity to biotic and abiotic stresses should be removed	100	-	-	64	-	36	100	-	-	0.119	
Final evaluation should be done 1-2 days before harvesting, remove undesirable plants	100	-	-	55	-	45	100	-	-	0.101	
Before harvesting, the plants should have uniform plant height, level of mature grains per panicle and free from disease.	100	-	-	73	-	27	100	-	-	0.245	
The hills in the production field must have proper labels and serial numbers	43	-	57	9	9	82	90	-	10	0.245	0.021*
The individual hills selected from the 1st crop season are transplanted in rows in the 2nd crop season to have line selection by observation of growth situation. The sticks with labels on each line with synchronized flowering, similar phenotype, leaves, and panicle	86	-	14	27	-	73	95	5	-	0.050	0.444
In 2nd crop season, remove the plants with different flowering time, phenotype, length of panicles, and affected by insect/disease	86	-	14	45	-	55	90	10	-	0.151	0.295

In 2nd crop season, select the lines with synchronized flowering and maturity, same height, uniform flag leaves and phenotype and free from insect and disease. In each line, harvest 10 representative hills. Measure the necessary criteria to remove the lines with different characteristics, low yield and different color	86	-	14	45	-	55	95	-	5	0.151	0.444
If the number of lines selected in the 2nd crop season is more than 85% of total lines, they are mixed as pre-basic seeds	86	-	14	-	9	91	90	5	5	0.000**	0.594
If the number of lines selected in the 2nd crop season is less than 85% of total lines, they are transplanted in the 3rd crop season to continue evaluation. The distance among lines must be from 30-35cm	57	14	29	9	-	91	90	5	5	0.013*	0.111
When transplanting in the 3rd crop, 1/3-1/4 seeds of each line hould be stored to provide for all possible contingencies. The rest should be transplanted in line and compared with the field and seed propagation field. All fields must have proper distance after transplanting	57	-	43	9	-	91	76	5	19	0.047*	0.496
In the 3rd crop, perform evaluation and comparison to select suitable lines. The verification is requested to verify the seed production field. The lines which satisfied the seed criteria are mixed as pre-basic seeds	71	-	29	27	-	73	90	5	5	0.145	0.253
Need to send the seed samples for examination to obtain pre-basic seeds	71	-	29	18	-	82	95	-	5	0.049*	0.145
Pre-basic seeds are planted in 4th crop season to produce basic seeds	43	-	57	9	-	91	76	10	14	0.245	0.098

Chapter 10
Incorporating a Gender Dimension in a Participatory Community-based Project: A Case Study in Guinayangan Quezon Province, Philippines

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Introduction

The Philippines is highly vulnerable to the impacts of climate change, including sea level rise, increased frequency of extreme weather events, rising temperatures and extreme rainfall. This is due to its high exposure to natural hazards (cyclones, landslides, floods, and droughts), dependence on climate-sensitive natural resources and vast coastlines. Agriculture is the backbone of the economy in the Philippines. Cultivable crop lands are located in the lowland and uplands. The Philippine uplands are occupied and cultivated by roughly 24 million people—one-third of the country's population—with their lives and general well-being intimately linked with the forest and its resources. On these lands, a large percentage of the population suffers from extreme poverty (World Bank 2002). Farming households are engaged in diversified farming systems and mixed crop-livestock systems to spread risks due to extreme weather events, typhoons and drought in particular. Upland rice environments in general have poor infrastructure, infertile and acidic soils, and heterogenous landscapes. Farmers are mostly tenants, with little incentive to develop the land to control soil erosion (Paris et al. 2004). In the diversified upland areas in the Philippines, poor women provide unpaid labor in crop (rice, corn, rootcrops, bananas, coconut) production as well as in small animal production (Rola-Rubzen 1997; Alcober 1986; Buenavista et al. 1994) . They also earn income by working as agricultural workers in other farms. They generally, have less access to capital, extension services, inputs, and other resources related to agricultural production. Helping women gain greater access to and control over key assets e.g., small animals can increase resilience of households and communities to climate change. Participatory community-based adaptation strategies are also critical given the location-specific nature of climate change impacts and adaptive capacity. Despite the many constraints they face in ensuring food security during or after prolonged drought or strong typhoons, they continue to provide their labor and decision-making in agriculture. Moreover, due to traditional perceptions, poor women are seldom regarded as farmers and consequently have been ignored in needs assessment, planning, design, implementation and dissemination of Climate Smart Agriculture (CSA) technologies and practices.[13]

Background of the project

This participatory action research project, "Generating evidence base for upscaling local adaptation of Climate Smart Agriculture (CSA)" is being conducted by the International

[13]Climate-smart agriculture, forestry and fisheries seek to sustainably increase productivity, adapt to climate change, build resilience to shocks and variability (adaptation), reduce and remove greenhouse gases (mitigation) and enhance the achievement of national food security and development goals (FAO. 2010).

Institute of Rural Reconstruction (IIRR) based in the Philippines. This project is supported by the Climate Change, Agriculture and Food Security (CCAFS) program in Southeast Asia (SEA). This research was designed to deepen the understanding and to build upon the current knowledge base on undertaking gender-sensitive community-based adaptation (CBA) and local-level CSA upscaling, through participatory action research (PAR). This action research was undertaken in selected villages in Guinayangan, Quezon Province Philippines wherein IIRR has been developing the concept of climate-smart villages (CSVs) and processes of community-based adaptation. Its work has focused on demonstrating the value of social learning approach and ways to generate portfolios of CSA options within the context of local municipalities (CCAFS 2016.) This paper presents how the gender perspective is being incorporated into the ongoing research project.

Vulnerability to climate change is the extent to which a system, individual or group of people is susceptible to, and unable to cope with, the adverse effects of climate change; vulnerability to climate change depends on exposure to climate change, sensitivity to its effects and adaptive capacity (FAO 2012 p. 13). Participatory Vulnerability Assessment (PVAs) were undertaken to systematically generate knowledge on how development interventions in Guinayangan can facilitate community-based adaptation. Thus, they build on community perceptions and utilized participatory approaches for generating information. The PVA methods emphasized the importance of understanding the issues that surround vulnerabilities, especially those of the poor, including the gender dimensions. The PVAs were conducted in eleven villages in Guinayangan, Quezon province, Philippines by IIRR and Local Government Unit (LGU) team.

The steps in PVAs are: a) situation analysis; b) gender analysis; and c) community based participatory action research (PAR). Situation analysis of vulnerability includes examining the extent of vulnerability, how different people are able to cope and analyze present threats and/or vulnerabilities. Various participatory rural appraisal (PRA) tools were used to gather information. These include: focus group discussions, historical timeline which outlines the significant events in the community such as major disasters; seasonal calendar to map out when most vulnerabilities occur during the year; livelihood analysis and problem tree (causes of vulnerability, identification of causes and prioritization). Questions asked were: where and what climate-related hazards were experienced by the community members?; what are the differences in vulnerabilities by gender, age, social groups; what are the characteristics of the vulnerable e.g., those that are coping, declining or improving; what are the types of exposure and strategies for resilience used and their effect on livelihoods; what vulnerabilities do the livelihood options bring; and what are the causes of vulnerability (root causes and prioritization). Aside from the "theoretical" definition of vulnerability the PVAs encouraged farmer-participants to arrive at their own understanding of the concept. Farmer participants were asked: "what is their understanding of "vulnerability". The

consensus was that vulnerability "is the condition of an individual or household to be affected by a hazard. Their ability to bounce back from this was considered important". The farmer participants also characterized households that do not have the capacity to immediately bounce back following an extreme weather event. Across all villages, both men and women defined a household that is vulnerable as: a) households with only one source of livelihood; b) households with no adult men in the household; c) households that do not own land and; d) households with persons with disabilities. Situation analysis and identification of target groups (vulnerable groups with focus on poor women) offered the project with suggestions for meaningful targeting of CSA.

The case of village Arbismen will demonstrate how a better understanding of context and vulnerabilities can help in the design of CSA activities that, in turn, help local communities adapt to the risks and impacts of extreme weather. The case discussed below provides insights into how CSA can lead to better adaptation measures by communities. The case also demonstrates how issues of equity and economic empowerment of women can be addressed. Along with PVAs, the social learning process will be documented. These are: a) understanding vulnerability to generate knowledge on appropriate adaptation options for farmers; b) identifying and implementing CSA technology options and practices while integrating the gender dimension; c) identifying and implementing community-based enabling factors for sustainable implementation of PAR; d) scaling out of CSA activities.

The study area

Arbismen, is one of the 54 villages of the town of Guinayangan, Quezon which is a 3rd class municipality with a total land area of 22 800 hectares. Arbismen is near the coastal areas but with inland areas with diverse ecosystems consisting of public forestlands, upland coconut-based, and lowland rice-based farming systems. Constituents are largely smallholder farmers, half of which live below the monthly per capita poverty threshold. The coconut area villages are located in the uplands, where the dominant structure is monocropping. In the lowlands, rain-fed rice land accounts for about 950 hectares (41 villages) and the rest of the 7 villages are irrigated (106 ha). Hiwasayan River used to be the major source of irrigation, however, this river dried up during one extended dry season. In the coastal areas, mangroves were converted into commercial fishponds, most of which have now been abandoned and are lying idle. Barangay Arbismen is 11 kms from the town center. It is accessible through a paved road. The barangay can also be accessed through boat from the town's municipal port. https://en.wikipedia.org/wiki/Guinayangan

The barangay covers a total land area of 560 hectares where 34% (more than 50 ha are now developed for rice farm but a total of 150 ha has potential for expansion according to the agrarian reform office) is for rice and 63% is for coconut and banana, with the rest classified as residential lands. Majority of the residents are land owners due to the agrarian reform program. This village has infrastructures such as barangay hall, health center and day care. Most of the

households have piped water, electricity, TVs, cellphones, and motorcycles for rent and own use. Microfinance institutions (MFIs) such as Center for Agriculture and Rural Development (CARD), Tulaty sa Pagunlad, Incorporated (TSPI) which means bridge for improvement, are accessible to loan borrowers.

Climate change risks

Reflecting on the three past major typhoons, participants unanimously agreed that Typhoon *Rosing* in 1995 had the biggest impact on their livelihoods as it affected their rice, coconut and banana production. It took them a year to recover from this calamity. Typhoon Glenda destroyed houses, coconut and banana trees as it brought more wind than rain. Fortunately rice planting had not started due to longer dry season preceding the typhoon. Typhoons affected farm lands as the cascading water with mud from the uplands and the floods caused by the sea level rise flowed on the lowlands. Crops were submerged and livestock were drowned. Fishing boats and gears were damaged. As a result, food security was a major problem as their livelihood (fishing and rice farming) were affected for at least a year. From the early 1990s, until recently, the municipality has experienced an extended dry season (8-10 months), three of which were severe. Dry months that started from December 2013 lasted for 8 months. This affected rice production as farms were entirely dependent on rainfall. A long dry season more often resulted to low or no production at all. In key informant interviews and workshops conducted by IIRR in 2014, an extended dry season was felt in the past 2-3 years. Farmers reported that it only rains when there is a low pressure weather event. Villages that used to have two crops per year have adjusted their planting season; the earliest is August, and the latest is November.

These information reveal that farming communities in the uplands are exposed to late rains and strong typhoons which affect rice production and consequently, lead to food (rice) insecurity. Due to the vulnerability of these households, alternative livelihood opportunities were identified through PRAs (consultation with members of the community). The seasonal calendar showed that there is a significant change in the start of rainy season compared to the last decade. In the past (10-20 years ago), respondents indicated that rains and storm occurred between June to December. However in recent years, respondents reported that there are only occasional rains during this period and participants claim that August has constantly been hotter and generally with no rain. Rainy season now starts in the last quarter of the year, and more often these rains are associated with strong typhoons. This change in the patterns has resulted in changes in cropping pattern for rice farmers.

In recent years, the municipality has been experiencing longer dry seasons due to climate change. With climate variability, rice farmers are exposed to erratic weather changes just like what happened in 2013 and 2015. Farmers planted in November and December for second cropping knowing that there will be rains in January as this was the usual pattern. However, it did not rain starting

December 2014 and this drought lasted until early September 2014. This resulted to crop failure. Again in order to regain their loss, farmers replanted rice in October 2014 as their first crop of the year. Unfortunately, a strong storm hit Guinayangan in January that damaged the rice crop. This example provides an insight of the variability and its impacts on peoples' livelihoods.

Climate-related impacts to agricultural production in Guinayangan are purportedly brought about by increasing unpredictability of the onset of dry and wet seasons, prolonged dry spells and strong typhoons. Crop failures such as what rice farmers have experienced in 2014 were brought by the lack of soil moisture to sustain crops during its vegetative stage. Even coconut production was observed to suffer from prolonged dry spells as nuts produced during very dry months tend to be smaller. As majority of the town's farmers practice mono-cropping, food and livelihood insecurity occur during such times, forcing male members of the households to seek employment opportunities in nearby urban areas such as Laguna and Manila. Providing options for farmers to increase the diversity of agriculture-based livelihood would therefore improve their capacities to effectively address these climate variabilities.

Prolonged dry season. Prolonged dry season starting in 2000 has affected rice farmers severely. Recently there was a crop failure and 80% of the rice farmers were not able to harvest a crop. The seasonal calendar revealed that the rainy/wet season is reduced to 4 months (September- December). An extended dry season was identified to have occurred in the early 1990s. It affected rice production as water was scarce as farms were entirely dependent on rainfall. Long dry season more often resulted to low or no

Figure 10.1. Strong typhoons damaged coconut trees

Figure 10.2. Copra processing

production at all. In key informant interviews and workshops conducted by IIRR in 2014, extended dry season was felt in the past 2-3 years. Farmers reported that it only rains when there is a low pressure weather event. Before, farmers used to grow two crops in a year. Now, due to the late onset of rains, farmers grow rice only during the wet season. Rice farmers suffered from crop failures brought about by the lack of soil moisture to sustain crops during its vegetative stage. Since majority of the farmers practice mono-cropping, they suffered from food insecurity which occur during these times. Coconut production was observed to suffer from prolonged dry spells (nuts produced during very dry months tend to be smaller).

Sources of livelihood

The villagers rely on two key livelihood activities, namely coconut farming followed by rice production, backyard gardening and other non-farming jobs.

Coconut farming. Coconut production is quite important as a source of income to all farming households in this village. Instead of selling coconuts as food, farmers convert them into copra (dried coconut kernels where oil is extracted) which commands a higher price in the market. Nowadays, instead of every 45 days, the harvest time for coconut farming already takes almost two months. Farmers attribute this change in harvest dates to weather variability. The traditional process of coconut production is generally termed as "copra", named after the main product sold by the farmers to a copra market in the town. Mature coconuts are usually harvested every 45 days. Production of coconut is highest from August to December and lowest in November to May due to high temperature. However, prices of copra are very high from

April (lean month) and lowest in August. Thus, farming households are quite busy in copra production from April to November. During months of low production, farmers are directly selling de-husked coconuts instead of producing copra as it entails lesser on-farm labor. There are also few farmers who harvest and sell immature coconuts. The farm gate price of coconut during its peak is at Php 35 per kilo while Php 18 is the normal or average price of coconut.

Rice production. Rice farming is mainly dependent on the occurrence of rains. Only a few villages have access to small irrigation system. Rainfed-rice farming in the lowland and smaller parcels of land in the uplands is the primary source of livelihood of majority of families in Arbismen village. Farmers grow rice mainly for their subsistence and the rest for income. Rice planting starts from June to September depending on the onset of the rainy season. Harvesting is done from November to December as rains come on the last month of the 3rd quarter. After harvesting, the rice lands remain fallow from January to July due to low or lack of rainfall. The recent prolonged dry season affected rice farmers as some were not able grow or were not able to harvest.

Average land size for rice farming is 1 hectare. In 2010 and 2011, farmers encountered harmful pests like snails and tungro disease which affected crop yields. Farmers though used non-chemical practices to mitigate pest and disease infestation, such as placing madre de cacao (*Gliricidia sepium*) on the corners of the rice field, to prevent rice black bug (RBB) incursion. Rice black bugs feed on rice from its seedling up to the maturity stage

Banana production ranks 3rd in importance to livelihoods in Arbismen. Income from banana sales is high from September to October due to low supply/production and low from April, May and December when the production/supply is high. Farmers consider December as the month of lowest price due to competition with other fruits.

Crop diversification. Growing diverse crops is one common strategy used by farmers to spread risks as well as ensure food supply. When rains are delayed, farmers grow maize, peanut, mung bean and green leafy vegetables, i.e., pechay. Some however view this practice as risky due to the variability of weather over the past years .Aside from rice, coconuts and banana production, farming households also grow vegetables in the upland small plots. The vegetables are grown for consumption and for cash. Farmers grow eggplant, bitter gourd and string beans. Income from vegetables is higher in November when the demand is highest. Some women who are engaged in rice farming shared that they plant other crops such as maize, peanut, mungbean and pechay during times when rains are delayed. Some however see this practice as risky due to the variability of weather for the past years. Coconut farming is therefore viewed as more resilient to extreme weather relative to annual short season crop production. In fact results from FGDs suggested that those farming households who are engaged in agro-forestry based interventions are not only more resilient to extreme climate variability but also have more income sources.

Fishing. A few coastal villages are into fishpond culturing. Villagers often have one economic

Figure 10.3. Prolonged drought and unpredictable rains affect rice production

season for this system that eventually begins in December. Taking 3-4 months of growing period, marketable fish sizes will be harvested by April or May. Culturing fish is only performed when there is high precipitation rate. Usually, *chanos-chanos* (milkfish, locally referred to as *bangus*) is the most common fish species grown in the area. Usually, 20% of the harvest goes to the pond owner and 80% to the lessee. Aquaculture is very laborious in terms of water maintenance, especially when technology is not yet very sophisticated, so men supply most of the required workforce. The common pesticide used in this system is *tisid*, an organic procedure that removes undesirable foreign biota that competes with the available food in the pond.

Livestock production. Most farming households raise large livestock (carabao and cattle) and small animals (goats, pigs) and native chickens. Carabao and cattle graze on the open grassy fields. Small animals such as goats and pigs are kept in pens to prevent them from damaging other neighbors' crops. Chickens are free range. Given women's critical roles in household management, raising small animals to augment the household's income and buffer food stock are suitable for women. However, women face constraints in taking care of small animals such as lack of cash to purchase commercial feeds.

Off-farm work

Laborers or *maglulukad* are usually smallholder farmers and tenants that consider copra production as the main source of income as it provides them liquid cash. They usually work as a group and work in different coconut areas which they consider as regular employment. Many are also engaged in rice production at the subsistence level. Majority of the rice areas are rainfed and can only have one

cropping season that usually starts between June to September depending on the start of the rainy season. Those with access to small irrigation grow two cropping seasons. First season (wet season) is in June and second (dry season) is in November. Labor is not paid in cash but on share basis or the "talok-ani" system wherein 20% of the production goes to the laborer and 80% to the land owner.

Instead of receiving cash, farmers opt for share in-kind arrangements where they receive payments in the form of a fixed share of the harvest. In rice production this arrangement is referred to as "*talok ani*" (plant and harvest) system. Under this labor arrangement, the labor requirement for planting and harvesting is provided by the same people and labor is paid according to the agreed share in the harvest (e.g., the 5th sack will go to the laborer/"*ikalima*"). In the event of a crop failure, both the landowners and laborers absorb the losses. Thus both the laborer and landowner share the risks. The risks of failure are moderate to high; labor costs comprise the highest share in the cost of production for farming. Twenty percent (20%) of the population of Arbismen provide labor ("*magtatalok*"). In coconut production, the 60:40 sharing is practiced. For fishing, as many do not own motorized boats, small fishermen also are paid through shares of the catch, mostly 50:50 after the net.

Non-farm work

Male out-migration for temporary or long-term jobs: More often, at least one family member opts to go out to find a temporary job to augment their income. Usually it is the men who migrate (locally) and women have to be left behind to take care of their children and manage their farms and households. Men go to industrial zones such as Laguna, Cavite and Manila. Men mostly take factory jobs, labor contracts (e.g., construction and carpentry). Women apply as a domestic helpers or sales clerk in small businesses. They usually return when the production season starts, which is usually between June-December. However some tend to stay in their work longer if the conditions and remuneration are attractive. This situation creates labor shortage for coconut harvesting and copra production in their villages, particularly during the peak season. More often, coping mechanisms across villages where PVA was conducted revealed that people tend to go out and look for temporary jobs outside of the municipality after a disaster.

After a severe typhoon or drought which destroyed their livelihoods, men or women (depending on the opportunity) left their village and migrate. There have been cases wherein mothers have left their children and worked abroad. Men who migrate temporarily normally return to their families before planting season until harvest season (December). Others stay in the village and grow other crops such as vegetables, root crops, and bananas. Meanwhile men often resort to short-term migration to ensure that cash is available for household expenses. Traditionally, men are referred to as the major income provider. Thus after a disaster, they go out from their village and work in the nearby cities.

Making broomsticks. Aside from coconut production, farmers convert the stalks of the coconut leaves into broomsticks which are commonly used for cleaning the yard. Other women are engaged in other livelihood activities during low season for copra production such as broom production which serves as an additional income between November and December

Gender division of labor

Gender is perhaps one of the most important variables in household composition, especially as it relates to livelihood strategies. The division of labor in Arbismen and other villages in Guinayangan, Quezon province is largely structured by gender and social class. Although men are perceived to dominate the coconut, rice and fishing industry, women are actually engaged in most activities, except those which require physical strength. Through time, gender roles have changed defying deep-seated perceptions that women cannot do male traditional jobs. As mentioned earlier, poor women work as hired workers in transplanting and harvesting rice. However, due to prolonged drought, farmers could no longer grow lowland rice, thus women lost their income opportunities. This compelled poor women to join hired workers in copra production and thus the gender division of labor in copra processing became less distinct. Men welcomed women (farmers' wives) to also work as hired workers and get a share of the output. During peak copra processing, the activities of the workers could often reach until late evening. This increased women's time spent on this off-farm work but did not necessarily decrease their time to fulfill their reproductive roles (household chores, childcare, cooking, washing clothes, preparing meals, collecting water for drinking, collecting firewood, etc.) because men were rarely involved in these activities. However, to reduce their drudgery and time in off-farm remunerative work, a few women are beginning to purchase small laundry machines through their membership in microcredit associations e.g., Credit for Agriculture and Rural Development (CARD) Bank and Tulay sa Pagunland Incorporated (TSPI) or Bridge Towards Prosperity.

Rice production. Rice production is labor-intensive. In rice farming, male and female have traditional division of labor depending on the nature of work that they perform. Rice farming can be organized into different operations. These are: land preparation (non-mechanized and mechanized), crop establishment (transplanting or direct seeding), crop management (irrigating the fields, applying fertilizer, spraying chemicals, weeding), harvesting and post-harvest operations (drying and hauling). Land preparation is exclusively done by men. Preparing the seedbed and transplanting is jointly done by men and women; weeding is predominantly done by women; harvesting is jointly done by men and women while threshing (manual or mechanical) is exclusively done by men. In general, the division of labor is based on physical strength rather than cultural ascribed roles. Land preparation using a tractor or a carabao, spraying of chemicals using the heavy sprayer (16-liter solution capacity) and threshing with the use of mechanical thresher require physical strength. However, a few women claim that

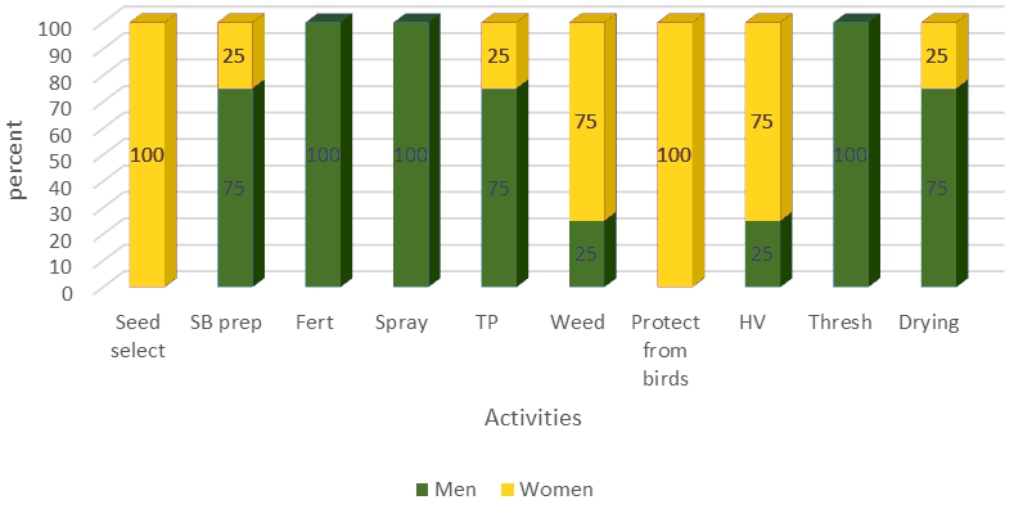

Figure 10.4. Percentage labor distribution by gender in rice production

during the absence of male family or hired labor, they are compelled to do these tasks. Although women do not provide labor in operations which require physical strength, most often, they are responsible for hiring, supervising and paying workers during peak season particularly during transplanting and harvesting seasons. Moreover, they are responsible for allocating the family's budget for household and farm expenditures as well as in purchasing farm inputs. Women earn off-farm income from March to April as unpaid family workers and hired workers.

Copra processing. Traditionally, copra processing was exclusively performed by men laborers. However, recently, more poor women workers are participating in most of the activities, except in harvesting nuts with a long pole. Women are now getting more involved in piling nuts (twice), breaking nuts (requires skills and physical strength), separating the coconut meat, preparing the kiln and smoking, selling including counting the yields and loading. Women are mainly responsible in keeping the money from share of copra sales. Based on seasonal calendar, women earn income from copra processing in March, mid Aug/Sept and Oct to Dec.

Vegetable production. Farming households grow vegetables on a subsistence and small scale production (less than 1 ha). More women provide labor in most of the vegetable production. They help in land preparation, application of fertilizer, spraying of chemicals, and watering the field. Setting of trellis is exclusively done by men, while harvesting and marketing are exclusive done by the women. In contrast, for commercial vegetable production (1 ha and above) most of the operations, including harvesting and marketing are done by men.

Livestock management. Taking care of cows and carabaos is integral in the upland farming systems. Large ruminant livestock are raised for land preparation and transporting

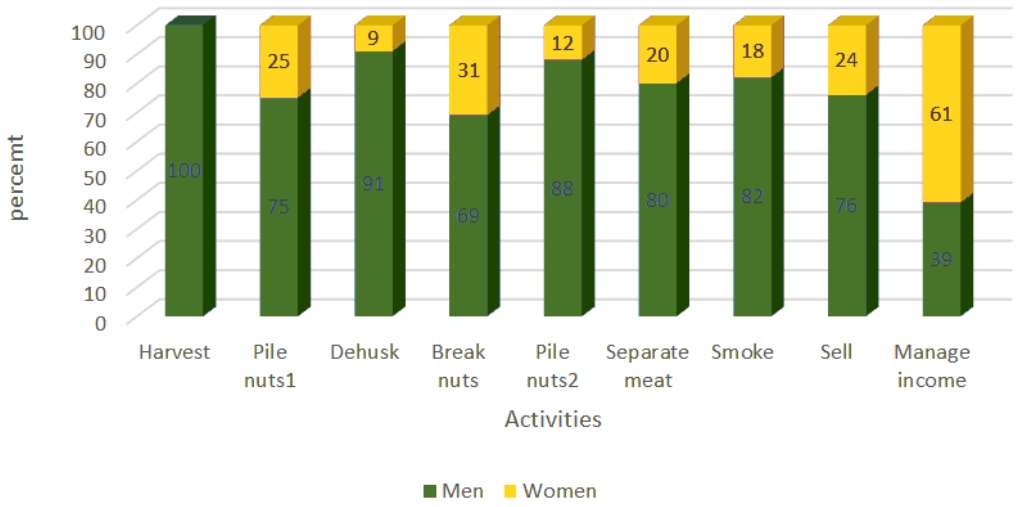

Figure 10.5. Percentage labor contribution by gender in copra processing, Guinayangan, Quezon province

farm products. Small scale swine, goat and poultry production are for sale or for food consumption.

Animal husbandry is not exclusively the domain of men. Management of large animals (carabao and cattle) are associated with men. Grazing (dependence on green fodder in open fields rather than cut-and carry practice) is traditionally men's responsibility. However, women also graze the animals in the open fields, and are involved in feeding, bathing the animals and renting out for transport when men are not around. Building animal sheds is also men's job.

Gender roles in swine production differ by scale of production. For commercial swine (white breed), men have greater roles in the preparation of housing and marketing. Women are more involved in fattening/feeding. However, when native breeds (black) were introduced, women became more involved in their management. Women are engaged in almost all operations such as selecting piglets for fattening, feeding and giving water. Small scale swine fattening is associated with women because more of the management activities (i.e., preparing the feeds, feeding, bathing, cleaning the pens) can be combined with household chores or can be considered as extension of household tasks. However, the income from pig sales can be very important particularly during times of emergency. Women's role in marketing also differ whether it is done within the village or outside the village. Women are mainly responsible for marketing piglets or sow within the village while men take care of selling piglets/sow in the larger markets.

Men and women provide labor in goat production (herding/grazing, marketing). Goat production has lower labor requirements compared with swine production. Women still have the bigger role in managing income

from livestock. Small animals (pigs, goat) and poultry often represents the only assets rural women own and control (FAO 2012).

Poor women particularly in Arbismen, Guinayangan town, however, face a number of challenges in raising small animals, including the lack of access to low maintenance breeds, lack of local supply of inexpensive animal feed resources, and livelihood security.

In general, participants confirmed that men and women share the labor in most of the activities in livestock management. The survey results also support the conventional practice that wives hold the "purse" as they contribute more in decisions related to income and make more decisions on the income from the livelihood activities. In the rural areas, traditionally, wives are the custodians of household cash and have more decision-making authority than their husbands and some control in disbursement of cash for household matters. However, the problem arises when the cash is not enough for daily household and family requirements as well as to buy farm inputs. Poor women are compelled to look for additional sources of income to pay for daily household expenses, transport expenses and school fees (Paris et al, 2004). In times of need, they are compelled to borrow loans with high interest rates from private money lenders. Thus, poor women should be given the opportunities and resources to earn income particularly to help them recover from droughts or floods.

Access to resources

According to literature citations, access and control to assets are factors in determining vulnerability of a certain sector or social group (Moser and Satterthwaite, 2008; Goh 2012). Various studies revealed that women have less access to the five livelihood capitals or assets, i.e., physical, financial, human, social and natural capital (Meinzen Dick et.al. 2011). This information was also revealed in the result of the farmer profile of the project, where basic information for the data base were collected from 290 farmers. The data provided basic profile of farmers and households, and also captured additional gender-related information such as access to land, and access to loans. Below are the results:

Access to land. The results revealed that fifty four percent (54%) of the respondents do not own the land that their house occupies while the rest own their residential lots. In terms of land ownership, results show that 54% of the males (33 respondents) while 14.7% of the females (9 respondents) have titles of the land under their names. Meanwhile, 9.8% of the respondents have joint ownership and 21.3% (6 respondents) answered that this question is not applicable to them. They are tenants.

On the other hand, coconut land owners comprised of 56.7% males (85 respondents), 18% females (27 respondents), 6.7% both male and females (10 respondents) while 18.7% said that this question is not applicable to them because they are tenants. Only seven respondents are fishpond owners and most of them are males. In terms of vegetable land ownership, 46.6% are males (10 respondents), 23.8% are females (5 respondents), 19% are both (4 respondents) while 9.5% answered not applicable (2 respondents).

In summary, men more than women have their names on the land title. However, both men and women have access to land in terms of working on the parcels/plots as unpaid family workers.

Access to Loans. Almost sixty-four percent (63.5%) of the females and almost twenty percent (19.8%) of the male respondents borrowed money. This implies that although women do not have access to land assets, they have access to loans from private money lenders (neighbors) and they even find ways to get more credit from other sources. Mothers often get loans through husbands' connections.

Men and women borrow loans from neighbors, microfinance institutions e.g., Center for Agriculture and Rural Development (CARD) bank, "Tulay sa Pag-unlad," Inc. (TSPI) which means bridge to prosperity, copra buyers and cooperatives. Most respondents have access to microfinance institutions, comprising 74% of all respondents. Microfinance institutions provide easy access to loans because they are available in the village and the loan process is simple. On the other hand, most farmers continue to borrow loans even after many months when a disaster occurred. This resulted into huge debts. However, based on this survey, farmers do not borrow loans from the rural banks and only a few of them took loans from cooperatives. One of the reasons for not borrowing is the problem of non-repayment particularly when income from crops fail due to climate hazards. Some women are worried over their own ability to repay loans, due to lack of other sources of income.

Coping mechanisms in response to climate hazards

In response to climate hazards, farming households use various coping mechanisms such as borrowing from informal money lenders, receiving government social protection programs, sale of land rights or mortgage land, and sale of land rights.

Borrowing from informal money lenders. Farmers do not only incur loans for farm inputs and repayment of debts but also in fulfilling social obligations, e.g., marriage, children's baptism, children's education, food and other household expenditure. The sources of credit are formal and informal institutions. The formal institutions are microfinance and cooperatives while the informal sources are private money lenders, friends, neighbors and copra buyers. Most (74%) of the farmer cooperators have access to microfinance institutions. This is due to the easy, simple and fast lending procedures. However loans from microfinance institutions have higher interest rates (than rural banks), thus a borrower can accumulate huge debts. Among the farm cooperators interviewed, no one borrowed money from a rural bank. Only a few have secured loans from cooperatives. Of the loan borrowers, 63.5% were women while 19.8% were men. The rest of the borrowers were joint husband and wife.

Government social protection program. Farmer participants noted that the government's social protection program (4Ps) has helped tide their family with the monetary support. For those who are not part of the 4Ps program, the available microfinance institutions are their sources of emergency funds.

Sale of land rights or mortgage of land. Land is the most valuable asset of a household or individual since land provides livelihood and income. With the Comprehensive Agrarian Reform Program (CARP) based on Republic Act RA 3844 in the Philippines, which abolished tenancy and farmers, formerly leaseholders were given the legal and full ownership of the land. However, due to lack of capital to invest in rice production, selling of agrarian land rights is widely practiced. Of the more than 100 farmer beneficiaries, 10-15% have sold their rights according to the records of the barangay. This is due to their inability to develop the land due to lack of capital. The delay in the irrigation system contributed to this practice as it affected rice production. Most land buyers are from the well- off families in the Poblacion area. In times of disasters and with needs to raise large amounts of cash for various purposes, farmers are also forced to mortgage their lands. Although CARP has succeeded in reducing patron-client relation, poor farmers remain dependent on the informal sector.

Social learning process

Social learning is important in increasing the scale of climate-smart agriculture. In this project we use social learning in their contexts as a process that engages the different partners in the upscaling and outscaling of CSA practices. Interested farmers are first trained by the researchers and technicians on the practices. Those who implement these practices form groups to share their experiences and provide support to one another. This social learning process demonstrates that women are important partners and key practitioners and disseminators of CSA.

1. Understanding vulnerability to generate knowledge on appropriate adaptation options for farmers: The Case of Arbismen

Although not so obvious, the PVAs and group discussions indicate that one of the vulnerable groups in the village are those who provide labor for rice farming (magtatalok). Majority of them are women who are from farming households with marginal lands and those who are without lands. These are farmers who live in the upland area of Arbismen and who own small parcels of coconut areas. They do not get enough income from their coconut farm. They rely on rice areas where they provide labor. Further, a number of the agricultural workers are agrarian beneficiaries who had chosen to sell their land rights and are now landless. While some belong to the younger generation and do not have their own farm lands, as their parents who are the agrarian beneficiaries still till the land. Though they provide family labor, their share is not enough for their needs. They opt to provide labor to other farmers to augment their income. If the harvest is good, these laborers can get a moderate share of rice as they are usually engage with more than one land owner and get their share from several owners. Their only land is usually their residential lot with a small backyard. These landless and near landless sections of the poor are most vulnerable to the impacts and effects of climate change.

2. Identifying CSA technology options and practices

In Arbismen and other villages in the municipality of Guinayangan, livestock production is one of the more reliable sources of income and food for households. Pigs and goats are being raised easily in the farm-households' backyards, helping diversify and reduce total reliance on crops. However, changing climate, especially the rising temperatures, directly affects the growth and reproduction rates of pigs and other livestock.

To address this problem, the International Institute of Rural Reconstruction (IIRR) introduced the low external input on small-livestock system (native pig) to communities in Guinayangan. Part of the *Developing Scalable Approaches for Community Based Adaption* project of IIRR, climate-smart agriculture (CSA) approaches, including those in livestock production, were introduced to help build farm resilience in anticipation of the impacts of climate change. Using participatory action research methods, the activity contributes to the broader goal of the project, which is to establish an evidence-base for sustainable outscaling of climate-resilient agricultural practices to enhance livelihood, resilience and adaptive capacities with gender dimensions. The project is currently supported by the CGIAR Research Program on Climate Change, Agriculture and Food Security in Southeast Asia (CCAFS SEA).

a) *Native pig production.* As prolonged dry season has been observed to occur more frequently than typhoon in the past 2-4 years, women from marginal and near landless households who work as transplanters/harvesters in rice production will continue to be vulnerable due to lack of alternative source of income. During severe droughts, men migrate on a short-term or long-term period to earn non-farm income. But this is not an option for the women since they have to take care of their children, crops, animals, and do the household chores. Women expressed their lack of assets (pigs, goats, chickens) and lack of start-up capital for a small scale pig production enterprise. Building assets are critical for the poor and vulnerable sectors because they can help them cope better with shocks, including climate shocks and the longer term impacts of climate extremes. In examining pathways out of poverty for the poor, research on asset-based approaches to development and poverty alleviation since the 1990s has shown that

Figure 10.6. Native pig production and low external input system can be climate-friendly

control over assets plays a fundamental role in increasing incomes, reducing vulnerability and empowering people to move out of poverty (Goh 2012; Bebbington 1999; Moser 2007; Sen 1997; Sherraden 1991), in reducing their vulnerability and in moving them out of extreme poverty.

The IIRR interventions with the Municipal Agriculture office in Guinayangan tested two pathways for building assets of the identified vulnerable sector in Barangay Arbismen. One was the introduction of low external input production and low carbon foot print methods for pig production. In one of the FGDs to identify possible adaptation options, one of the suggested options was for an alternative approach to livestock raising which would be climate-smart, low cost and environmentally friendly. Of the 20 farmers in that group, only four raised their hands when asked who were raising pigs as a livelihood. These were all men and all were engaged in commercial pig production. When probed why there were no women, participants said in unison that commercial pig production requires large capital to purchase commercial feeds. Traditionally, women were engaged in pig production, however, when small pig production became commercialized, the men took over.

With a purpose to integrate a gender dimension in the project in Guinayangan, IIRR decided to introduce and test climate-smart agriculture practices and technologies. In 2015, native pigs and low external input pig production were introduced to six farmers (5 women and 1 man), in the village of Arbismen. Three native breeds, i.e., Kalinga, BT Black, and Macalelon, are now being raised in the area. These were sourced from the National Swine and Poultry Research Center in Quezon. Decentralised and farmer-managed multiplication and dispersal centers have been established to further improve access to better breeds of native animals. Farmers are expected to help disseminate the idea within the community. Using pass on scheme, 47 additional farmers in four different barangays benefitted from receiving commercial pigs, and an additional 18 farmers from four barangays received native pigs. All of the original beneficiaries have shared their livestock assets with at least two other farmers, many of whom have then gone on to also share to at least one additional farmer. Each farmer was given 2 gilts and commercial feed provision enough for the first month. The suggested model was to feed the gilts with commercial feeds for just 1 month. Following that, farmers would rely on alternative feeds such as sweet potato, taro, banana, rice bran, coconut by-products etc. The purpose of the experiment was to demonstrate that swine production can be done with low cost investments. Starting with a small group of farmers engaged in action research, the program has grown within Arbismen and has now spread to neighboring villages, primarily engaging women in a livelihood that they control. The practice of low external input pig production has drawn wide interest and the number of women increased to 74 farmers and expanded to 5 more villages. As the interest in pig production has been rekindled among women, the re-introduction of the improved native breeds was also tested. Native breeds tolerate high temperatures and humidity better than modern and commercial

breeds. Another good trait of native pigs is their resiliency to diseases and harsh weather condition. They seldom get sick thus there is no need to purchase antibiotics and other medicines. All these helped this low-cost approach to pig production to qualify as climate-smart.

Livestock can be raised on low carbon footprint diets and are an asset building approach given the lesser investment outlay and potential for expansion in a short time. When raised in housing made of natural materials, the temperatures can be lowered in these pig pens (open sides permitting aeration and roofs made of natural materials.

The low external input on small-livestock system piloted in Guinayangan requires the use of locally-produced inputs, while promoting health and productivity at the same time. Because of their higher tolerance to higher temperatures and resistance to parasites, pests and diseases, the system relies on the use of native pigs. Native pigs also have higher economic (meat is considered by local communities as tastier, crispier, and leaner) and nutritional value (lower fat and cholesterol), providing more benefits to farmers. Climate-smart livestock production can also reduce the carbon footprint of livestock production by emphasizing small scale, backyard systems that rely more on locally grown alternative feed sources without chemical additives. Not to rely on commercial feeds, the farmers participating in the project are required to grow their own intensive feed garden. Crops such as taro, cassava, sweet potato, and water hyacinth are being grown, not only to provide nourishment for the livestock, but also an alternative food source for the households. However, limited quantities of commercial feed are used during the first two months of pigs.

Utilizing local materials like bamboo, housing structures were built to protect the pigs from different weather conditions and the risk of contracting diseases. Coconut husks, soils, rice hull, dried leaves, and saw dust were used to make the deep bed flooring system. Farmers observed that this practice has reduced the smell and consequently the flies, thus promoting the health of the pigs, and providing farms with a source of natural compost. Housing design promotes the free flow of air through the pens.

No antibiotics were used and vaccination was done only for major diseases. In some cases, farmers used herbal supplements which cost lower. Improved native breeds, farm raised feed and housing based on native materials are key elements of this alternative approach to livestock production.

Sharing livestock assets

Farmers are expected to help disseminate the idea within the community. Using a pass-on scheme, 47 additional farmers in four different barangays benefitted from receiving commercial pigs, and an additional 18 farmers from four barangays received native pigs. All of the original beneficiaries have shared their livestock assets with at least two other farmers, many of whom have then gone on to also share to at least one additional farmer. In this pass-on scheme, locally called "Back two which means give back two" requires

that every member should give back 2 piglets to the association's other members for every farrowing of his/her sow.

Benefits from native pig production

Income security

Growing native pigs has proven to be reliable due to their tolerance to changing climate. They have higher survival compared to commercial breeds. A litter can be sold for Php2,000 while a fully grown (3-4 months) native pig can be sold at Php 100-120 per kilo at live weight. If butchered, it can go as high as Php180.00 and if processed into lechon, it can generate Php 200 per kilo. Farmers claim that compared to other sources of income, they find this to be the most worthwhile as it generates the most income from a small investment. As their assets are supplemented and savings increased, households have more disposable income which they can use, not only to support everyday expenses, but also to purchase non-essential needs. Pigs are considered as an asset they can readily sell to address emergency expenses. Women reported that they have sold livestock to raise emergency funds. Others were able to acquire supplies and to meet other needs of their children through the sale of livestock.

Food security

Native pigs also offer safe and nutritionally-rich food with their high protein content. As native pigs are more resilient to changing climate, a pig enterprise provides reliable source of food for family. The crops in the feed gardens can also become household food in times of emergency such as sweet potato, cassava and taro. Native pig production does not entail taking loans or credit. Households and their relatives are often more likely to consume such products for family consumption especially at festive events. The potential of pigs to produce large litters at a time also provides increased assurance that families will consume at least some of this produce.

Economic empowerment to poor women

At one mid-year assessment of CSA options conducted by the IIRR field team, swine raising is now referred to as women's livelihood compared to the previous practice in the village where commercial pigs were managed mostly by men. Women are now more involved in livestock management (70% of total time in managing the livestock is done by women). As a consequence they have a say on how to spend the income from this livelihood. Research has found that women are inclined to spend the income associated with livelihoods they manage on children's education, food and medical expenses (Quisumbing 2003; Kurz and Welch 2001 any of the women claimed that now they can afford to serve roasted pig (lechon) during special occasions (usually associated with rich households), thus improving their social status in the community. Women have gained confidence and self-worth.

3) Organizing Farmer Learning Groups (FLGs)

After identifying native pig production using low external inputs, IIRR organized FLGs

to provide the beneficiaries with a platform for knowledge exchange. The FLGs are designed to bring together the beneficiaries and for them to have a sense of belonging in a community. Farmers began to approach others and demonstrated the positive impacts of adopting this livestock production method. Women's participation in the pig production learning group increased (of the 34 members in the Arbismen FLG, 20 are women). In addition, the Arbismen FLG has been able to reach out to more than 15 women in their own village and to more than 10 women in other villages. In the FLG, they discuss and overcome the challenges as a community. The platform of farmer learning group has provided voice and opportunity to share their experiences in managing their swine and collectively analyze issues in livestock management. The research support component (participatory action research) means that methods are adapted to the local conditions and farmers are producing the finest quality pigs for markets, at a lower cost and in an environmentally sound manner. The FLGs provide beneficiaries with a platform for knowledge sharing about the breakthroughs in the action research being conducted in the community. After experiencing the benefits of rearing native pigs and of using low input methods for both breeds, farmers approached others and showed them the evidence of the positive impacts of adopting this livestock production method. At present, two FLGs are focusing on low external input pig production, such as in Barangay Arbismen, with 34 members, and in Barangay Ermita, with 15 members.

4) Encouraging the FLG members to save

This offshoot of the small livestock project provided an opportunity to test and develop a savings group with the same group of women pig raisers. The community savings association or CoMSCA[14] promotes the concept of Self-Help Groups (SHGs) as a way to empower the community. CoMSCA encourages households to save and manage on their own a saving and credit component. Because many farmers do not have access to formal saving mechanisms like banks, farmers are not compelled to save. With CoMSCA, the culture of saving is encouraged. Being community-based loans (based on amount of savings), funds are more accessible without going through complicated requirements. Moreover, trusted members of the village manage the saving/loans. CoMSCA is different from micro-finance institutions. It is self-managed and independent, which means the members of the group in the community are the ones who manage the money they put in. It is considered time-bound or it follows its own financial cycle and group members share equity at least once a year in proportion to savings. The concept works best in the Philippine context for it creates local pools of capital and it provides access to useful lump sums which can be used for predictable

[14]COMSCA membership should have at least 25 members. The complete cycle is six (6) months where members are required to attend a meeting twice a month. Saving per member is pegged at a maximum of Php 400.00 and minimum of Php. 20.00. Loans are also provided to members with 3% interest payable in 6 weeks. Loan priorities are agricultural inputs, emergency situations, tuition fees and health. COMSCA started in 2015 in Arbismen and in 2016 in Sintones village. However, they stopped for a year and resumed again with improvements in the procedures. This savings scheme was developed by World Vision which is an international Christian, humanitarian, development advocacy and relief organization that is child-focused and community-based.

Voices from the beneficiaries of native pig production

Increased income and reduced cost of feeds

Juliana Belmin, a mother from Barangay Arbismen, grows native pigs despite her poor leg condition. She started in January 2014 after IIRR gave her one young suckling pig each. Together with her son Melicio, they started raising only native pigs including managing the community breeding area. Now, she and her son combines native (black) and hybrid (white) pigs. She has a total of 23 pigs (3 white sows, 4 native sows and 2 boars, 5 white fattening, 2 pure native newborn). Most of their pigs came as a payment for native boar service mostly from the adjacent barangay, CapuloanTulon, and 7 white piglets for sale. According to her, raising native pigs helped them reduce their expenses for feeds and other materials. It also helped her with her regular medication and personal expenses such as food and supplies. The meat of the native pigs also serves as food for the household.

She said that from her pigs alone, she has earned Php 40,000.00 in a year (US$800). She used some of her earnings for additional low cost housing of pigs and for payment for hired labor for land preparation of their small farm. She reiterated that native pigs are so easy to take care of. They are like trained pets as they go out of the pen when told to do so. They can adjust to climate change (extreme hot and cold). Most of all, one can start with small capital. She shared that before, she incurred Php200 (US$4) a day for commercial feed costs. These alternative feeds are composed of sweet potato tops, cassava, trigo, rice hull and yam. This ration is enough for a whole day of feeding for both white and native pigs. Meanwhile, if they use commercial feeds, it will cost them Php 100.00 (US$2) for a 3-kg commercial feeds per feeding which is not even enough for the 23 pigs they are currently raising.

Before the project, they preferred raising white breed, but now they prefer to raise native black breed because it is more profitable to raise native breeds as it is cheaper to grow. Native pigs grow better with locally available feeds like cassava, banana trunks, coconut sap, tricantera and yam. They mix these crops with commercial feeds thus reducing the cost of feeds. For example they buy a kilogram of trigo and mix it with yam as feeds during the first three months of the piglets to prevent stunting.

Income from pig raising provided cash for emergency needs

Meanwhile another woman farmer leader, Gloria Macaraig shared how pig production has helped their family during the most trying time. When her husband suffered a stroke, she sold her pigs to finance the hospital expenses which otherwise they cannot afford if they only depended on their rice farming and income from copra production. "I owe the life of my husband to my pigs" she declared.

Income from pig raising was reinvested in rice farming

This was also concurred by Nanay Leony as she had the same experience. Nanay Leony is one of the first farmers who volunteered as one of the oldest among the farmer researchers. Raising three young grandchildren together with her husband, they are tilling their small parcel of rice land as source of food. She provides labor through transplanting (magtatalok) despite her age to augment their income. So when she saw the opportunity of owning pigs as part of the research, she readily volunteered. She joined the first meeting hoping that she can solicit help from IIRR where she secretly gave a note to the facilitator asking for money to support the cost of food and schooling of her grandchildren. Instead, the team challenged her to join the research. Now she is growing both white and native pigs. She had also passed on pigs that benefitted four more women. Nanay Leony used her earning from taking care of native pigs to buy an important part of their hand tractor. Now they can use the hand tractor for preparing their land for rice cultivation.

expenses, to reduce shocks to vulnerable livelihood, to facilitate household cash-flow management, and to allow short-term investment in income-generating activities. The adoption and implementation of the CoMSCA concept in 3 municipalities has been proven to work because of the socio-economic characteristic of the communities involved which are mostly very poor. CoMSCA is flexible and simple to adopt and implement because transparency is embedded in its system. It provides a frequent opportunity to save and regular opportunity to borrow. The system itself is savings-based and not credit-based.

Conclusion

This study showed that understanding vulnerabilities through PVAs contributed to appropriate approaches and CSA practices for small livestock which address gender issues. Native pig production using low external inputs has benefitted women as it provided them with a low labor requirement and easily manageable economic asset which requires a small start-up investment. Small livestock activities can help promote women's empowerment, particularly those women from landless and near landless households. In an economy dominated by crops that are vulnerable to climate change, small livestock production presents a less risk prone livelihood venture. Production of small livestock is relevant to all ecosystems: coastal, lowland and upland in meeting food security, nutrition, livelihood and asset building objectives. Small livestock systems lend themselves to community-based dispersal mechanisms reducing the need for reliance on cash inputs. Women pay back in-kind, usually to other members of the local community. Pig production lends itself to community-managed out scaling. IIRR works to empower the most vulnerable women and men to achieve climate-resilient livelihoods and reduce disaster risks. The women vowed to continue their savings group not only to meet their basic needs but more so, to be ready when another disaster strikes. Providing women farmers with multiple benefits, the reduced external input small-livestock system piloted and membership in COMSCA in Guinayangan, Philippines is a good example of a climate-smart agriculture technological option combined with savings and micro-credit schemes for poor women.

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This book presents the gender dimensions of the relationship between agriculture and climate change. It explores whether men and women farmers experience similar or different vulnerabilities and coping mechanisms or adaptation measures in response to climate change risks. It identifies gender gaps in access to resources, information, services, technologies, training, finance, etc., which enable or constrain men and women to adopt climate-smart agriculture and practices, as well as presents examples of Participatory Vulnerability Analysis and participatory action research, which incorporate a gender dimension.

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